Natural Hazards Mitigation Plan

St. Tammany Parish, Louisiana

Prepared by

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Natural Hazards Mitigation Plan

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This *Natural Hazards Mitigation Plan* was prepared by

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Natural Hazards Mitigation Plan

Executive Summary

1. Introduction St. Tammany Parish is subject to natural hazards that threaten life and health and have caused extensive property damage. Since 1965, St. Tammany Parish received 16 Presidential Disaster Declarations, more than any other parish in the state. To better understand these hazards and their impacts on people and property, and to identify ways to reduce those impacts, the Parish's Office of Emergency Preparedness undertook this *Natural Hazards Mitigation Plan.*

Mitigation activities need funding. Under the Disaster Mitigation Act of 2000 (42 USC 5165), a mitigation plan is a requirement for Federal mitigation funds. Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from The Department of Homeland Security's Federal Emergency Management Agency (FEMA). FEMA also recognizes plans through its Community Rating System, a program that reduces flood insurance premiums in participating communities. This *Mitigation Plan* meets the criteria of all these programs.

Wind damage from Hurricane Lili

Source: cbsnews.com

This *Hazard Mitigation Plan* was developed under the guidance of a Hazard Mitigation Planning Committee, created by a resolution of the St. Tammany Parish Council on September 4, 2003. The Committee's members include representatives of Parish offices, interested municipalities, and public and private stakeholder organizations. All municipalities were invited and Folsom, Sun, Abita Springs and Pearl River passed resolutions to participate. Slidell, Covington, and Mandeville opted to prepare their own plans, but sent representatives to the Committee. It should be noted that several members had been flooded, had wind damage, or had otherwise personally been affected by natural hazards.

The Committee met monthly from September 2003 through March 2004. It reviewed the hazards and their effects on people and property, considered a variety of ways to reduce and prevent damage, and recommended the most appropriate and feasible measures for implementation. Its work was coordinated with Parish and municipal staff and a variety of State and Federal agencies and private organizations.

The sections in this Executive Summary correspond to the chapters in the full Plan. The full text of the St. Tammany Parish *Natural Hazards Mitigation Plan* can be reviewed or downloaded from www.stpgov.org.

2. Hazard Profile The Committee reviewed 13 hazards that cause the greatest threat to St. Tammany Parish. Chapter 2 reviews what causes them, their likelihood of occurring, and their impact on people and property. The following summary table was prepared.

Hazard Risk Summary				
Hazard	**Areas Exposed**	**Annual Chance**	**Threat to People**	**Property Damage**
2.1 Tropical storms/hurricanes	Entire Parish	0.83	High	High
2.2 Flooding	Floodplains	1.00	Med	High
2.3 Tornadoes	Entire Parish	1.00	High	High
2.4 Wildfires	Forests	1.00	Low	Med
2.5 Drought	Entire Parish	0.05	Low	Low
2.6 Fog	Roads, airport	1.00	Low	Low
2.7 Earthquake	Entire Parish	0.01	Low	Low
2.8 Hailstorm	Entire Parish	0.16	Low	Med
2.9 Land failure	Shoreline	1.00	Low	Low
2.10 Severe winter	Entire Parish	0.05	Med	Low
2.11 Dam failure	Downstream of dams	0.01	Low	Med
2.12 Levee failure	Leveed areas	0.005	Med	Med
2.13 Termites	Entire Parish	1.00	Low	Med

3. Vulnerability Assessment Chapter 3 reviews how vulnerable St. Tammany Parish is to property damage, threats to public health and safety, and adverse impact on the local economy. This involved an assessment of the location and likely damage to critical facilities and other structures from different scenarios of strikes by the 13 hazards.

This effort concluded that the Parish can be expected to suffer over $350 million in average annual damage from all of the hazards listed in the table above. Some hazards are more important than others. The chapter concludes:

1. Tropical storms (including hurricanes) and flooding are by far the most severe hazards facing St. Tammany Parish in terms of property damage. The combined effects of wind and water damage account for $342 million or 97% of the property damage caused by all natural hazards.
2. Fog is the most severe hazard facing St. Tammany Parish in terms of the threat to lives, safety and mental health. Tornadoes, wildfires, termites and tropical storms are also important.
3. Tropical storms (including hurricanes) and flooding have the greatest overall impact on the area's economy.
4. Special attention should be given to manufactured homes and areas that flood repeatedly.

Isidore storm surge flooding at Mandeville

Photo by Alex Brandon © 2003

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4. Goals Following the hazard analysis and a review of the Parish's "New Directions 2025" planning effort, six goals were set for the mitigation plan:

1. Protect the lives and health of the Parish's residents from the dangers of natural hazards.
2. Ensure that public services and critical facilities operate during and after a disaster.
3. Ensure that adequate evacuation routes, streets and utilities are maintained and available during and after a disaster.
4. Protect homes and businesses from damage.
5. Keep the problems caused by natural hazards from getting worse through wise management of new development.
6. Give special attention to repetitively flooded areas.

5. Property Protection Property protection measures are used to modify buildings or property subject to damage. They include acquisition, elevation, retrofitting, and insurance. These measures are implemented by the property owners, so appropriate government activities include information and financial support for protection measures. The Parish has actively helped residents implement property protection measures with FEMA funds, but could do more with information, technical assistance, and more flexible FEMA funding rules.

This St. Tammany Parish house was elevated with FEMA funding support

6. Preventive Measures The Committee reviewed a variety of mitigation measures to protect new construction from hazards and see that future development does not increase potential losses. This Plan calls for support of the plans and ordinances that will be prepared pursuant to the Parish's New Directions 2025 planning effort.

Most programs that regulate new development and preserve open space and natural areas are in good shape, providing the new International Building Code series is adopted. Improvements are needed in the Parish's floodplain management program's maps, ordinance, and administrative procedures.

7. Emergency Services Early warning, warning dissemination and response plans were all found to be effective, although a more detailed review of the program is recommended. Major concerns are with evacuation routes and procedures and post-disaster management of reconstruction and repairs.

Preventive measures are necessary to protect new development from floods and other hazards

8. Flood Control Among the advantages of levees, reservoirs, channel improvements, and other flood control projects are their ability to protect roads and buildings, minimal disruption to the protected properties, and maintenance by a government agency. Larger projects require planning at the watershed level. There are several efforts by the Corps of Engineers and the Department of Engineering to do this. Current funding levels are not sufficient to fund all needed flood control and drainage projects. Improvements would help the Parish's drainage system maintenance program and dumping regulations.

A good drainage maintenance program meant that this ditch did its job during Tropical Storm Isidore

9. Public Information There are many ways that public information can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves. The Committee identified the most important topics to cover and the most effective ways to get the messages out.

10. Action Plan Chapter 10 is the culmination of the Committee's work. Keeping the goals in mind, the Committee reviewed and discussed alternatives and set priorities with four factors in mind: addressing the greatest threats, ensuring the measures are appropriate, having the benefits exceed the costs, and pursuing affordable projects.

There are 17 action items − 10 programmatic action items, 3 public information action items, and 4 actions to administer and support the recommended mitigation program to reach the six goals. Most of these action items can be implemented as additional assignments for Parish and municipal staff and additional funding would not be needed. Some action items, particularly the first, do need outside funding support.

Action item 1. Property protection projects The Parish will continue to seek State and Federal funding support for property protection measures. Priority will be for flood protection projects for repetitive loss properties. Concurrently, staff will pursue flexible funding arrangements, with the first priority being to fund area-wide flood control or drainage improvement projects that will protect many properties at a lower cost.

Action item 2. Public property Each department and municipality will evaluate its own properties to determine if they need to be retrofitted or modified to protect them from the hazards that they are exposed to. Priority will be given to critical facilities and major roads.

Action item 3. Plans and regulations Revisions to the zoning ordinance, capital improvement plan, and other plans and regulations will incorporate the 2025 plan's recommendations and appropriate recommendations from this *Mitigation Plan*. The Parish and the municipalities will continue to administer their regulations for subdivisions, mobile homes, and drainage, coastal zone, and wetlands protection.

Action item 4. Building code The Parish will adopt the latest International series of codes, the new state Uniform Construction Code and determine if additional language is needed to better protect new buildings from damage by wind and hail.

Action item 5. Permit administration Procedures for administering and enforcing the building code and floodplain regulations will be reviewed and strengthened. This effort will include improvements to procedures for permits and inspections after a flood or other disaster and preparing two staff members to become Certified Floodplain Managers.

Action item 6. Floodplain management The Parish's floodplain regulations will be reviewed to determine where revisions would better protect new buildings. Staff will work closely with FEMA to ensure that the new Flood Insurance Rate Map will best reflect the Parish's needs. It is recommended that Sun join the National Flood Insurance Program.

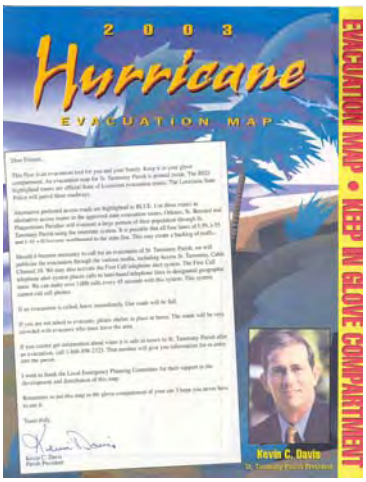
Action item 7. Tree City The Parish will implement an urban forestry program based on the criteria of the Tree City USA program. Current environmental programs will be reviewed to see how much of these criteria are already underway in the Parish. Note that Abita Spring is already a Tree City, so this action item is for the Town to maintain its eligibility.

Action item 8. Emergency operations The *St. Tammany Parish Multi-Hazard Emergency Operations Plan* will be reviewed in detail to determine where improvements can be made and how to maximize credit under the Community Rating System.

Action item 9. Flood control projects The current approach to flood control projects with watershed modeling and planning will be pursued. Priority will be given to protecting critical facilities, evacuation routes, and buildings.

Action item 10. Drainage system maintenance The Parish will continue its program of inspecting and cleaning drainage channels and retention basins. The drainage system maintenance program procedures will be revised to identify sites that need special attention more frequently than the rest of the drainage system.

Action item 11. Hazard mitigation materials As funding permits, the Parish will prepare background information, articles, and other explanations of priority hazard mitigation topics. Masters of these materials will be prepared and made available for reproduction and distribution by interested municipalities, schools, and area organizations.



The Parish's hurricane safety brochure goes out annually

Action item 12. Outreach projects As funding permits, the Parish will prepare and disseminate outreach projects based on the materials provided under action item 11. Such projects will include the hurricane preparedness and safety brochure, news releases, short programs on the public access cable channel, brochures at public places, a display, and more information on the Parish's website.

Action item 13. Flood maps The Parish will work with its watershed modeling contractors and FEMA to ensure that the next Flood Insurance Rate Map will accurately depict all flood hazards. The resulting maps will be made available to the public via the website and the Parish's map information service. Parish staff will meet with real estate agents to review hazard disclosure practices and how the Parish's map information service can help real estate agents advise purchasers of property about the flood hazard.

Action item 14. *Plan* adoption The Parish and municipal councils will adopt this *Natural Hazards Mitigation Plan.*

Action item 15. Mitigation Coordinating Committee The Natural Hazards Mitigation Planning Committee will be converted to a permanent advisory body in the Parish's resolution to adopt this *Plan*. It will act as a forum for hazard mitigation issues and report progress and recommended changes to the Parish and municipal councils.

The Hazard Mitigation Planning Committee will be converted to a permanent body

Action item 16. Financing More funds are needed for flood protection and drainage projects and for meeting the cost-share requirement for state and federal projects. New, dependable sources of funding for flood control, drainage improvements, and drainage maintenance will be sought.

Action item 17. Community Rating System St. Tammany Parish is participating in the CRS as a Class 9. Based on the recommendations in this *Mitigation Plan*, the Parish can improve to a Class 8, saving residents in the unincorporated areas over $400,000 each year in flood insurance premiums. Once the appropriate action items have been implemented, the Parish will submit a request for the class improvement. It is recommended that Abita Springs should join the CRS.

Chapter 1. Introduction

The problem: St. Tammany Parish is subject to natural hazards that threaten life and health and have caused extensive property damage. Since 1965, St. Tammany Parish received 16 Presidential Disaster Declarations, more than any other parish in the state. To better understand these hazards and their impacts on people and property, and to identify ways to reduce those impacts, the Parish's Office of Emergency Preparedness undertook this *Hazards Mitigation Plan.*

Damage from Tropical Storm Isidore, 2002

"Hazard mitigation" does not mean that all hazards are stopped or prevented. It does not suggest complete elimination of the damage or disruption caused by such incidents. Natural forces are powerful and most natural hazards are well beyond our ability to control. Mitigation does not mean quick fixes. It is a long-term approach to reduce hazard vulnerability. As defined by the Federal Emergency Management Agency (FEMA), "hazard mitigation" means any sustained action taken to reduce or eliminate the long-term risk to life and property from a hazard event.

Table 1-1 St. Tammany Disaster Declarations

Date	Hazard
9/10/65	Hurricane Betsy
8/18/69	Hurricane Camille
4/27/73	Severe storm, flood
1/31/77	Drought, flood
5/2/79	Severe storm, flood
4/9/80	Severe storm, flood
4/20/83	Severe storm, flood
11/1/85	Hurricane Juan
4/29/91	Flood
8/25/92	Hurricane Andrew
2/2/93	Severe storm, flood
5/8/95	Rainstorm, flood
9/30/98	Hurricane Georges
6/5/01	Hurricane Allison
9/22/02	Trop Storm Isidore
10/3/02	Hurricane Lili

Source: Louisiana OEP, FEMA

Why this plan? Every community faces different hazards and every community has different resources and interests to bring to bear on its problems. Because there are many ways to deal with natural hazards and many agencies that can help, there is no one solution or cookbook for managing or mitigating their effects.

Planning is one of the best ways to correct these shortcomings and produce a program of activities that will best mitigate the impact of local hazards and meet other local needs. A well-prepared plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and programs, preventing conflicts and reducing the costs of implementing each individual activity.

Mitigation activities need funding. Under the Disaster Mitigation Act of 2000 (42 USC 5165), a mitigation plan is a requirement for Federal mitigation funds. Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from FEMA. FEMA also recognizes plans through its Community Rating System, a program that reduces flood insurance premiums in participating communities. This program is described at the end of this chapter.

This *Plan:* This *Plan* identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural hazards. It fulfills the Federal mitigation planning requirements, qualifies for Community Rating System credit and provides the Parish and its municipalities with a blueprint for reducing the impacts of these natural hazards on people and property.

1.1. Planning Approach

This *Plan* is the product of a rational thought process that reviews alternatives and selects and designs those that will work best for the situation. This process is an attempt to avoid the need to make quick decisions based on inadequate information. It provides carefully considered directions to the Parish government and to the participating municipalities by studying the overall damage potential and ensuring that public funds are well spent.

Planning Committee: This *Hazard Mitigation Plan* was developed under the guidance of a Hazard Mitigation Planning Committee, created by a resolution of the St. Tammany Parish Council on September 4, 2003. All municipalities within St. Tammany Parish were invited to participate. Abita Springs, Folsom, Sun and Pearl River passed a resolution stating their commitment to the plan development. Mandeville, Covington and Slidell prepared their own plans, but still participated on the Committee.

The Committee's members include representatives of Parish offices, interested municipalities, and public and private stakeholder organizations. The member organizations and their representatives are shown in Table 1-2, on the next page. It should be noted that several members had been flooded, had wind damage, or had otherwise personally been affected by natural hazards. The Committee met monthly from September 2003 through March 2004. It reviewed the hazards and their effects on people and property, considered a variety of ways to reduce and prevent damage, and recommended the most appropriate and feasible measures for implementation.

Technical support for the planning effort was provided by the Parish Office of Emergency Preparedness, The Solutient Corporation, a database management and GIS company, and French & Associates, Ltd., a hazard mitigation consulting firm.

Planning process: The Hazard Mitigation Planning Committee followed a standard process, based on FEMA's guidance and requirements. Following a series of eight tasks (see chart), the Committee assessed the hazards facing the parish, set goals, and reviewed a wide range of activities that can mitigate the adverse affects of the hazards.

Mitigation Planning Timetable

Task	Month						
	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Task 1. Organize	M						
Task 2. Public involvement							
Task 3. Coordination							
Task 4. Hazard assessment			M	M			
Task 5. Goal setting				M			
Task 6. Mitigation activities				M	M		
Task 7. Draft plan						M	M
Task 8. Final plan							

M = Meeting of the Mitigation Planning Committee.

Table 1-2 Hazard Mitigation Planning Committee		
Participant	**Agency/Organization**	**Office**
Tom Buell	LEPC	Chair
Cynthia Sicard	New Directions 2025	Co-Chair
Larry Burch	LEPC	
Walter Haese	New Directions 2025	
Pat Brady	Greenleaves Homeowners Association	
Joe McCaffrey	Military Road Alliance	President
Liz Vollenweider	Meadowbrook Homeowners Association	
Clarence Powe	St. Tammany Parish	Emergency Preparedness
Rodney Hart	St. Tammany Parish	Emergency Preparedness
Jean Thibodeaux	St. Tammany Parish	Engineer
Larry Hess	St. Tammany Parish	Fire Services
Suzanne Parsons	St. Tammany Parish	Cultural & Governmental Affairs
Janet Pike	St. Tammany Parish	Information Services
David deGeneres	St. Tammany Parish	Public Works
Cliff Galante	St. Tammany Parish	Planning/Mitigation
Kirt Gaspard	St. Tammany Parish Schools	School Board
Clif Siverd	LEPC/City of Mandeville	
Kim Harbison	LEPC/City of Slidell	City Council
Steven Michell	City of Covington	
Cindy Murry	Town of Abita Springs	Planning & Zoning
John Mathies	Village of Folsom	Assistant to mayor
Ruby Gauley	Town of Pearl River	Mayor Pro Tempore
Hayward Jarrell	Village of Sun	
LEPC = Local Emergency Planning Committee		

Public Involvement: Task 2 of the planning process was to obtain input from the public, particularly residents and businesses that have been affected by natural hazards. The public was invited to participate through several concurrent means, including:

Planning Committee meeting

- Contact with Committee members and their organizations.
- A standing invitation to attend Committee meetings.
- Press releases.
- A special website was set up on the Parish's home page, www.stpgov.org/
- A video on mitigation planning was played periodically on the public access channel.
- A public meeting held at the end of the process to receive comments on the draft plan.

Examples of these efforts can be seen in Appendix A.

Coordination: Existing plans and programs were reviewed during the planning process. It should be underscored that this plan does not replace other planning efforts, such as the Parish's 2025 planning effort, stormwater management planning and the Local Emergency Planning Committee (LEPC) (which focuses on hazardous materials). This plan complements those efforts and, as noted in later chapters, builds on their recommendations.

During the planning process, contacts were made with regional, state, and federal agencies and organizations. On December 9, 2003, a letter was sent to a variety of stakeholder organizations as well as the following agencies to determine how their programs affect or could support the Parish's mitigation efforts.

State Agencies

- Coastal Zone Management
- Cooperative Extension Services
- Department of Wildlife & Fisheries
- Department of Transportation and Development – Dam Safety
- Dept. of Transportation and Development – National Flood Insurance Program
- Office of Emergency Preparedness
- State Geological Survey
- State Troopers

Federal Agencies

- Environmental Protection Agency
- Federal Emergency Management Agency
- National Aeronautics and Space Administration
- National Weather Service
- Natural Resources Conservation Service
- US Army Corps of Engineers
- US Fish & Wildlife Service
- US Geological Survey

Regional Agencies

- Parish School Board
- Regional Planning Commission
- Soil & Water Conservation District

Organizations

- East & West Chambers of Commerce
- Homebuilders Association
- Lake Pontchartrain Basin Foundation
- Nature Conservancy of Louisiana
- Northshore Area Board of Realtors
- Orleans Audubon Society
- Red Cross
- Sierra Club, Delta Chapter

At the end of the planning process, each of these agencies was sent a notice requesting their review of the draft *Plan.* They were advised that the draft could be reviewed on the Parish's website and they were asked to provide any comments in time for the March 11, 2004, public meeting. This notice also went to all municipalities in the Parish and the adjoining parishes of Tangipahoa, Washington, St. Bernard, and Orleans as well as Hancock County, Mississippi.

Hazard profile and vulnerability assessment: The Committee tackled Task 4 of the planning process during the months of November and December. The hazards reviewed include those locally reported and all natural hazards listed in the state's Hazard Profile. They are:

1. Tropical storms/hurricanes
2. Flooding
3. Tornadoes
4. Wildfires
5. Drought
6. Fog
7. Earthquake
8. Hailstorm
9. Land failure
10. Winter storm
11. Dam failure
12. Levee failure
13. Termites

The hazard data and the Committee's findings and conclusions are covered in Chapter 2 of this *Plan*. Chapter 2 assesses each hazard – what causes it and the likelihood of occurrence. Chapter 3 reviews the impact of these hazard on human development, i.e., how vulnerable St. Tammany Parish is to damage.

Goals: The Committee conducted a goal setting exercise at its December meeting. The goals were then drafted and revised at subsequent meetings. The results are discussed in Chapter 4 of this *Plan*.

Mitigation Strategies: The Mitigation Planning Committee considered everything that could affect the impact of the hazards and reviewed a wide range of alternatives. They are organized under five general strategies for reaching the goals. These strategies are the subject of Chapters 5 – 9 in this *Plan*.

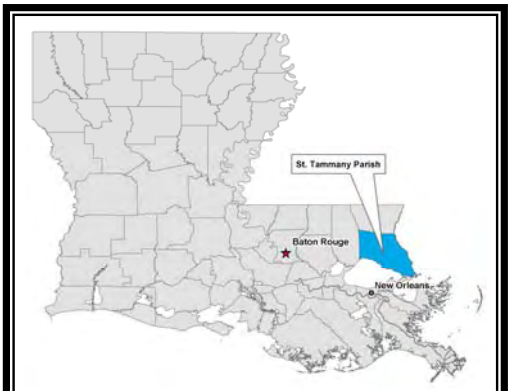
- Property protection – e.g., relocation out of harm's way, retrofitting buildings
- Preventive – e.g., zoning, building codes, and other development regulations
- Emergency services – e.g., warning, response, evacuation
- Structural projects – e.g., levees, reservoirs, channel improvements
- Public information – e.g., outreach projects, technical assistance to property owners

Action plan: After the alternatives were reviewed, the Committee drafted an "action plan" that specifies recommended projects, who is responsible for implementing them, and when they are to be done. The action plan is included as Chapter 10 of this *Hazard Mitigation Plan*.

It should be noted that this *Plan* serves only to recommend mitigation measures . Implementation of these recommendations depends on adoption of this *Plan* by the St. Tammany Parish Council and the governing boards of each participating municipality.

1.2. Topography and Land Use

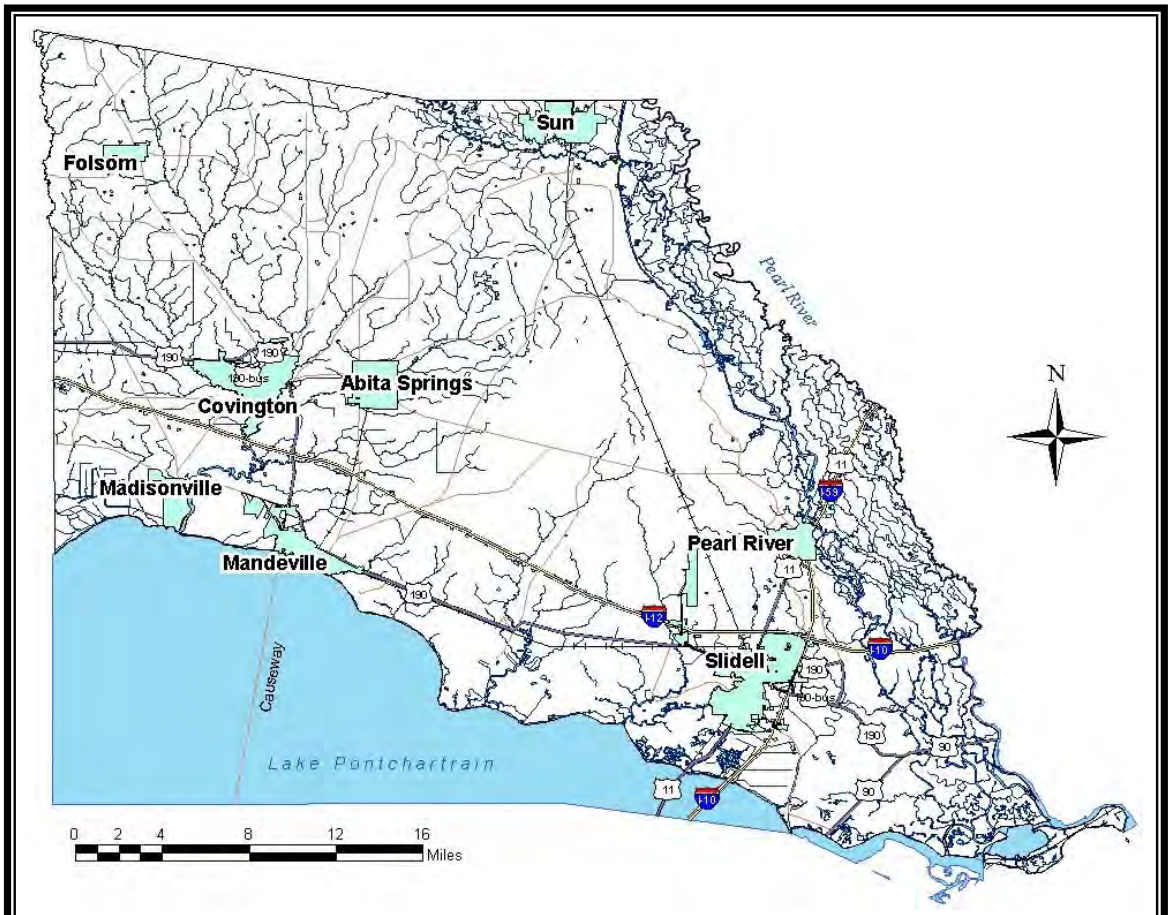
St. Tammany Parish is located in southeastern Louisiana, on the north shore of Lake Pontchartrain (see Map 1-1). The Parish measures approximately 25 miles north to south and 35 miles east to west. It covers 877 square miles and is the fifth largest parish in the state.



Map 1-1. St. Tammany Parish Location

Map 1-2 identifies the municipalities and the main features of the Parish. Lake Pontchartrain is to the south. To the east is the Pearl River, the boundary between Louisiana and Mississippi. To the southeast is the City of Slidell and US Highways 11 and 90 and Interstate 10, the main roads to the eastern entry to New Orleans.

In the western part of the Parish are the cities of Covington, Mandeville, Madisonville and Abita Springs. Crossing the Lake from Mandeville is the Causeway, the 24 mile over water link to the western suburbs of New Orleans. Folsom, Sun and Pearl River are located to the north of the two larger population centers.



Map 1-2 St. Tammany Parish

Most of St. Tammany Parish is geologically considered Easter Pleistocene Terrace and Gulf Coast Flatwood. In the northeast and east, the predominant landscape feature is the floodplain of the Bogue Chitto and Pearl Rivers. Along the Lake to the south, the land is mostly marsh. These three main features (upland, floodplain and marsh) can be seen on Map 1-3: in 1982, the terrace and flatwood is mostly forest (dark green), shrub (light brown), and farm or grass (dark brown). The larger floodplains/wetland forests to the east are orange and the marsh is light green.

Land use: The population of St. Tammany Parish has nearly tripled since 1970, making it the fastest growing parish in Louisiana. With an influx of nearly 500 people per month, the present population is over 195,000. If the current growth rate continues, the St. Tammany Economic Development Foundation predicts the population will exceed 225,000 by 2007.

The change in settlement from this growth can be seen in Maps 1-3 and 1-4 on the next page. Urban areas are shown as red. The red areas increased greatly from 1982 (Map 1-3) to 2000 (Map 1-4). There is a corresponding loss of forest and shrub land (dark green and light brown) and some marsh (light green). The Pearl River floodplain remained largely unchanged, probably because most of it is a State or Federal wildlife preserve.

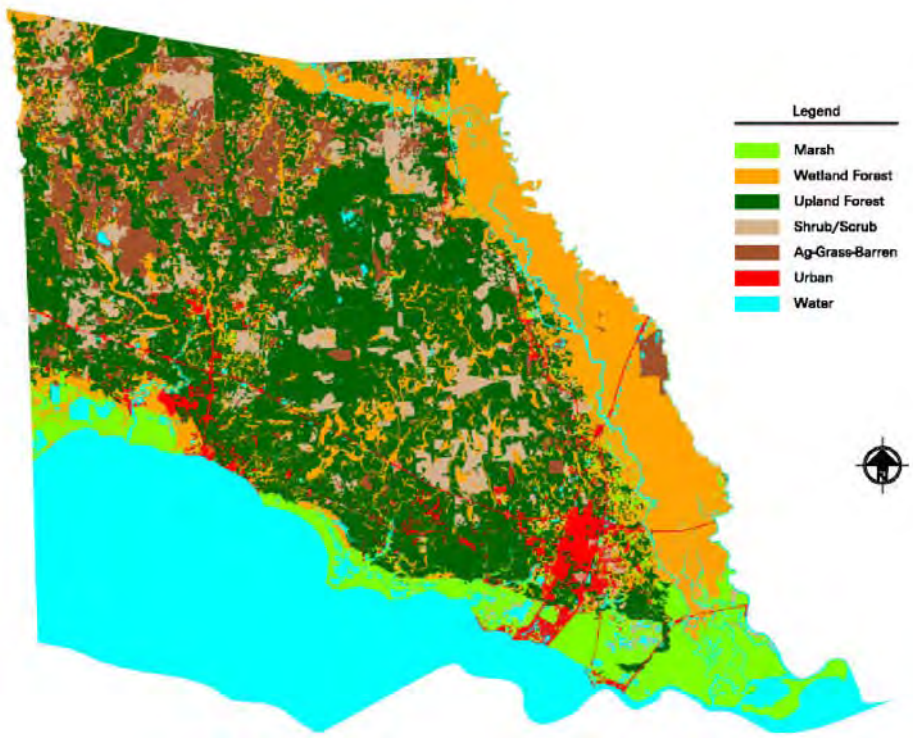
Table 1-3 Population	
1970	63,500
1980	110,800
1990	144,500
2000	190,000

Table 1-3 shows that the Parish's population tripled between 1970 and 2000. Table 1-4 provides the numbers that correspond to the areas on Maps 1-3 and 1-4. While the Parish's population increased by 73% between 1980 and 2000, the amount of land in urban development increased by 318% in the 18 years, 1982 – 2000. Most of this came from the forest and marsh areas. This reflects a national trend: land areas are urbanizing faster than the rate of population growth as new developments have larger lots and lower density than development before 1970.

Table 1-4 Habitat Classification

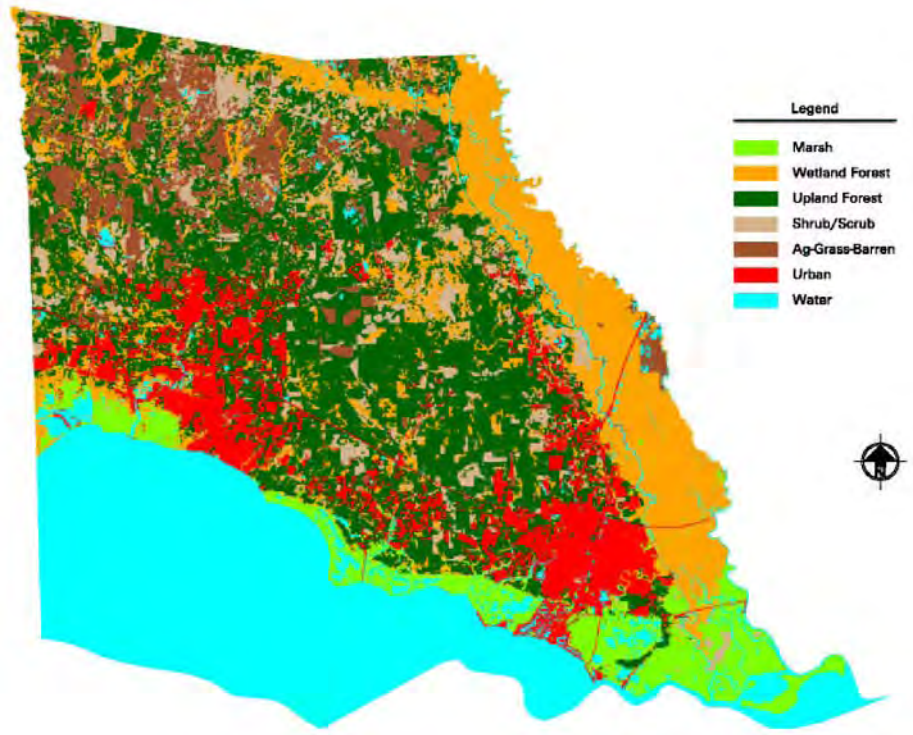
Habitat	1982 (Map 1-3)		2000 (Map 1-4)	
	Area (acres)	Percent of Parish Area	Area (acres)	Percent of Parish Area
Marsh	52,938	7.4%	41,849	5.8%
Upland Forest	126,425	17.6%	122,479	17.0%
Wetland Forest	237,232	32.9%	203,244	28.2%
Shrub/Scrub	54,909	7.6%	51,770	7.2%
Ag-Grass-Barren	47,156	6.5%	48,912	6.8%
Urban	22,238	3.1%	70,821	9.8%
Water	179,641	24.9%	181,466	25.2%
Total	720,540	100.0%	720,540	100.0%

Source: *Urbanization Effects on Habitat Change in St. Tammany Parish*



Map 1-3 Habitat Classification, 1982

Source: *Urbanization Effects on Habitat Change in St. Tammany Parish*



Map 1-4 Habitat Classification, 2000

Source: *Urbanization Effects on Habitat Change in St. Tammany Parish*

While St. Tammany Parish is faced with a variety of natural hazards and all the problems that accompany fast growth, it also has the potential to mitigate their adverse effects through current and new programs and projects. The St. Tammany Economic Development Foundation notes:

> St. Tammany has an educated and diverse work force. Over 85 percent of its residents have graduated from high school and more than 25 percent have graduated from college.
>
> The economy of St. Tammany is primarily residential, bringing an influx of retail and service establishments, corporate headquarters and shopping centers. A unique blend of residents are employed in a variety of diverse industries ranging from agriculture to space-age technology. (www.stedf.org/)

In other words, while nature has presented the Parish with a variety of hazards, the Parish has the human resources that can face those hazards and manage the impact they have on people and property.

1.3. The Community Rating System

The Federal Emergency Management Agency's National Flood Insurance Program (NFIP) administers the Community Rating System (CRS). Under the CRS, flood insurance premiums for properties in participating communities are reduced to reflect the flood protection activities that are being implemented. This program can have a major influence on the design and implementation of flood mitigation activities, so a brief summary is provided here.

1.3.1. General A community receives a CRS classification based upon the credit points it receives for its activities. It can undertake any mix of activities that reduce flood losses through better mapping, regulations, public information, flood damage reduction and/or flood warning and preparedness programs.

There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction (see Table 1-5). A community that does not apply for the CRS or that does not obtain the minimum number of credit points is a class 10 community.

Thirty-nine Louisiana communities participate, including Slidell (class 9), Mandeville (class 8), and St. Tammany Parish (class 9). Jefferson and East Baton Rouge Parishes have the best classifications in the state, Class 7.

Table 1-5 Community Rating System Premium Reductions

Class	Points	Premium Reduction In Floodplain	Premium Reduction Outside Floodplain
1	4,500+	45%	10%
2	4,000–4,499	40%	10%
3	3,500–3,999	35%	10%
4	3,000–3,499	30%	10%
5	2,500–2,999	25%	10%
6	2,000–2,499	20%	10%
7	1,500–1,999	15%	5%
8	1,000–1,499	10%	5%
9	500– 999	5%	5%
10	0 – 499	0	0

1.3.2. Program incentive The CRS provides an incentive not just to start new mitigation programs, but to keep them going. There are two requirements that "encourage" a community to implement flood mitigation activities.

First, the Parish will receive CRS credit for this *Plan* when it is adopted. To retain that credit, though, the Parish must submit an evaluation report on progress toward implementing this *Plan* to FEMA by October 1 of each year. That report must be made available to the media and the public.

Second, the Parish must annually recertify to FEMA that it is continuing to implement its CRS credited activities. Failure to maintain the same level of involvement in flood protection can result in a loss of CRS credit points and a resulting increase in flood insurance rates to residents.

It is expected that this undesirable impact of loss of CRS credit for failure to report on the plan's progress or for failure to implement flood loss reduction projects will be a strong encouragement for the Parish to continue implementing this *Plan* in dry years when there is less interest in flooding.

1.3.3. Benefits of CRS participation In addition to the direct financial reward for participating in the Community Rating System, there are many other reasons to participate in the CRS. As FEMA staff often say, "if you are only interested in saving premium dollars, you're in the CRS for the wrong reason."

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

1. The activities credited by the CRS provide direct benefits to residents, including:

   – Enhanced public safety;
   – A reduction in damage to property and public infrastructure;
   – Avoidance of economic disruption and losses;
   – Reduction of human suffering; and
   – Protection of the environment.

2. A community's flood programs will be better organized and more formal. Ad hoc activities, such as responding to drainage complaints rather than an inspection program, will be conducted on a sounder, more equitable basis.

3. A community can evaluate the effectiveness of its flood program against a nationally recognized benchmark.

4. Technical assistance in designing and implementing a number of activities is available at no charge from the Insurance Services Office.

5. The public information activities will build a knowledgeable constituency interested in supporting and improving flood protection measures.

6. A community would have an added incentive to maintain its flood programs over the years. The fact that its CRS status could be affected by the elimination of a flood-related activity or a weakening of the regulatory requirements for new developments would be taken into account by the governing board when considering such actions.

7. Every time residents pay their insurance premiums, they are reminded that the community is working to protect them from flood losses, even during dry years.

More information on the Community Rating System can be found at www.fema.gov/nfip/crs.shtm

1.4. References

1. *Community Rating System Coordinator's Manual*, FEMA, 2002
2. *Example Plans,* FEMA/Community Rating System, 2002
3. *Getting Started – Building Support for Mitigation Planning,* FEMA, FEMA-386-1, 2002
4. St. Tammany Economic Development Foundation (www.stedf.org/)
5. *State and Local Plan Interim Criteria Under the Disaster Mitigation Act of 2000,* FEMA, 2002
6. *State of Louisiana Hazard Mitigation Plan: Hazard Profiles,* Louisiana Office of Emergency Preparedness, April 18, 2003.
7. *Urbanization Effects on Habitat Change in St. Tammany Parish, 1982 – 2000,* Coastal Research Laboratory, University of New Orleans, 2001

Chapter 2. Hazard Profile

This chapter reviews the natural hazards that face St. Tammany Parish. Thirteen natural hazards were selected for this assessment. They were either listed in the State's Hazard Profile or identified by the Planning Committee as having affected St. Tammany Parish in recent history.

1. Tropical storms/hurricanes
2. Flooding
3. Tornadoes
4. Wildfires
5. Drought
6. Fog
7. Earthquake
8. Hailstorm
9. Land failure
10. Winter storm
11. Dam failure
12. Levee failure
13. Termites

This chapter has 13 sections, one for each hazard. Each section begins with a description of the hazard. This is followed by a summary of historical occurrences in the Parish, the frequency or likelihood of future occurrences and where they occur. There is then a summary of what they can do to people and structures. Chapter 3, Vulnerability Assessment, reviews the impacts of the hazards on critical facilities, properties and the communities in St. Tammany Parish.

2.1. Tropical Storms

2.1.1. The Hazard Tropical storms and hurricanes are large-scale systems of severe thunderstorms that develop over tropical or subtropical waters and have a defined, organized circulation. The larger storms generally form over the eastern Atlantic Ocean and move westward. The hurricane season runs from May through November, with the peak activity in September.

Tropical storms and hurricanes are categorized by their wind speed, as shown in Table 2-1. While best known for their winds, these storms can also bring flooding of coastal regions, heavy rains that cause inland flooding, thunderstorms, lightning, and tornadoes. Inland flooding and tornadoes are covered in later sections of this chapter. This section focuses on the storm surge and high winds caused by tropical storms and hurricanes.

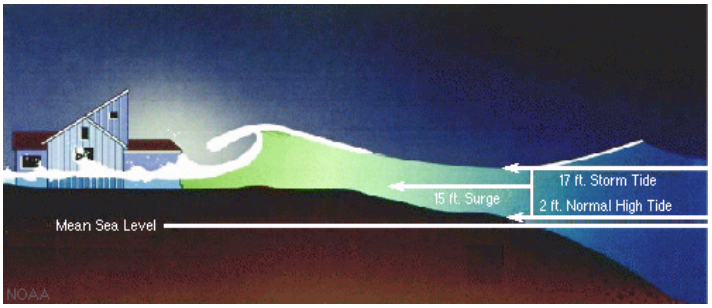
Table 2-1 Saffir-Simpson Scale

Type	Category	Winds (mph)	Surge (ft)
Depression	TD	< 39	
Tropical Storm	TS	39-73	
Hurricane	1	74-95	4-5
Hurricane	2	96-110	6-8
Hurricane	3	111-130	9-12
Hurricane	4	131-155	13-18
Hurricane	5	>155	>18

In June and October, storms are more likely to come from the Gulf, while in July – September, they generally form in the South Atlantic. The peak recorded wind speed in the parish was 125 miles per hour during Hurricane Camille in 1969.

Tropical storms and hurricanes get their energy from warm waters and lose strength as the system crosses land. However, because St. Tammany Parish is so close to the Gulf, there is not enough land for the winds to dissipate. The Parish will receive the full strength of a storm or hurricane when it makes landfall.

One byproduct of the winds and pressures created by these big storms is storm surge. This is an increase in water levels along the Gulf and Lake Pontchartrain when water is pushed toward the shore by pressure differences and the force of the storm's winds. When a storm makes landfall at high tide, the water level and wind driven waves are even higher. This combination can bring flooding up to 15 feet or more above normal sea level. In a flat area like St. Tammany Parish, 15 feet can cover large areas along the coast.



Storm Surge Source: NOAA

2.1.2. Historical Occurrences

The first recorded hurricane struck in 1711. The state has had an average of 3 or 4 each decade since detailed records have been kept. Only four hurricanes have made landfall in Louisiana as major hurricanes of category 4 or 5 intensity: unnamed hurricanes in 1909 and 1915, Hurricane Audrey in 1957, and Hurricane Camille in 1969. Camille is the only category 5 hurricane to hit Louisiana since the 1850's. Recent storms are shown in Table 2-2.

In this century, Hurricane Audrey has killed the most people in the state (556) and Hurricane Andrew caused the most property damage ($25 billion) (figures are for the entire US, not just Louisiana).

Table 2-2 Historical Average Wind Speeds

Name	Year	Tropical Storm	Hurricane Category				
			1	2	3	4	5
Audrey	1957	60	78	88		120	
Betsy	1965	40	70	93	105	120	
Camille	1969						190
Edith	1971	69		98			
Fern	1971						
Carmen	1974	52	86		121	150	
Babe	1977	57	75				
Debra	1978	57					
Bob	1979	46	75				
Claudette	1979	52					
Chris	1982	58					
Danny	1985	52	85				
Elena	1985	56			115		
Juan	1985	65	77				
Not Named	1987						
Beryl	1988	49					
Florence	1988	69	81				
Andrew	1992	57	92			132	
Danny	1997	63	78				
Hermine	1998	42					
Alison	2001	60					
Isidore	2002	60					
Lili	2002	60					
Bill	2003	50					

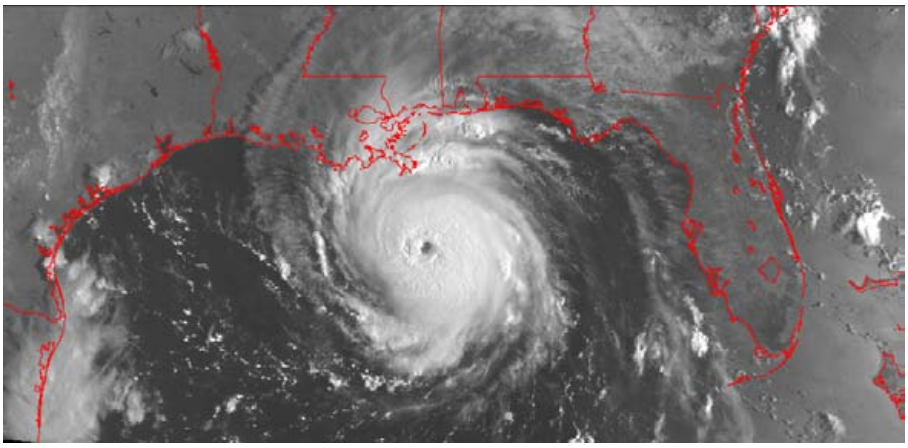
Source: State Hazard Profile and Unisys Weather

Hurricane Betsy: On September 10, 1965, Hurricane Betsy's storm surge of 10 feet overtopped levees on Lake Pontchartrain. New Orleans suffered its worst flooding since the hurricane of 1947. Flood water reaches the eves of houses in some places in the city. Hundreds of ships, tugs, and barges were sunk or driven aground as far upriver as Baton Rouge. Offshore and coastal oil installations, along with public utilities, reported unprecedented damage. Fall crops were in ruins and many livestock drowned.

Hurricane Betsy's Flooding

Even though 300,000 people went to shelters Betsy claimed 58 lives in Louisiana (81 overall). It was the first United States hurricane to produce over $1 billion damage, thus becoming known as "Billion Dollar Betsy."

In today's dollars, Betsy cost $8.4 billion. Betsy was the third costliest hurricane of the 20th Century. Hurricanes Hugo (1989 – $7 billion) and Andrew (1992 – $25 billion), exceed Betsy's devastation. Andrew also hit the state, but most of its damage was in south Florida.



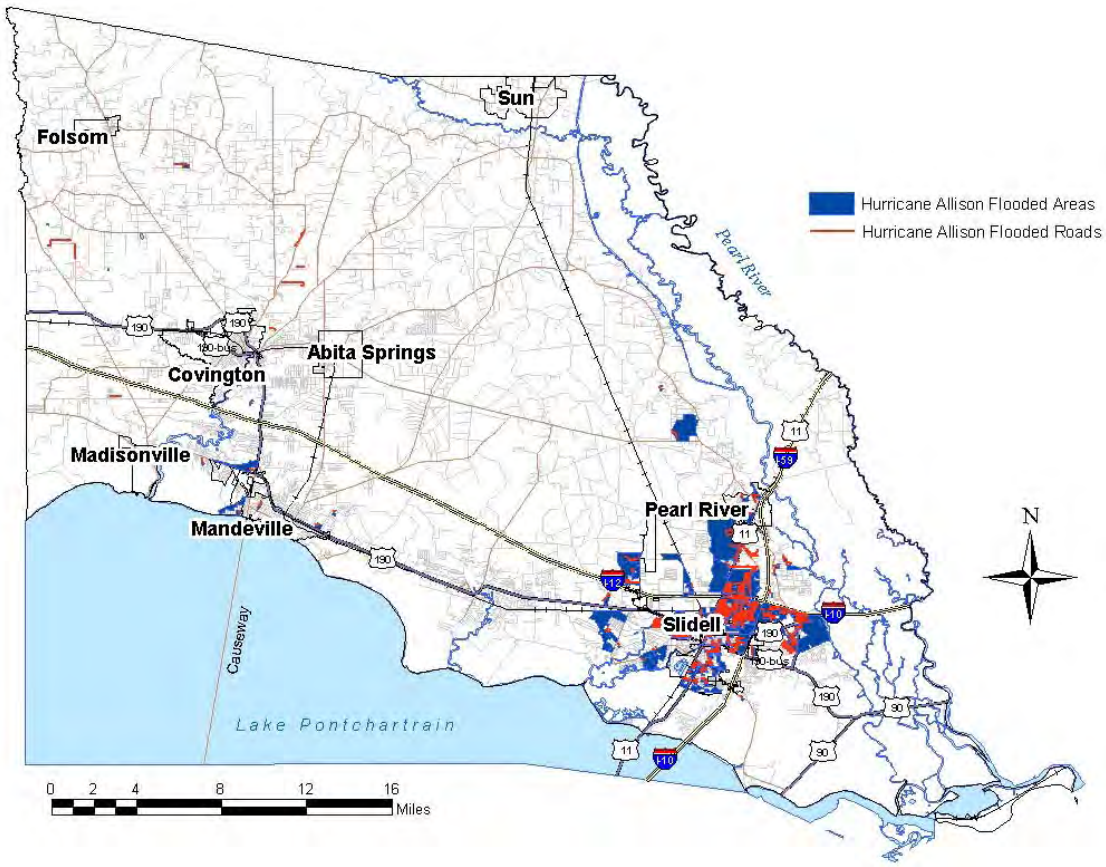
Hurricane Andrew Approaching Louisiana

Source: LSU Coastal Studies Institute

Most recently, Louisiana has received presidential disaster declarations for Tropical Storm Allison in June 2001, Hurricane Isidore in September 2001, and Hurricane Lili in October 2002. The following pages review what happened during recent storms.

Tropical Storm Allison: In June 2001, Tropical Storm Allison hit Texas. After it vented, it moved across Louisiana, causing more flooding than wind damage. Up to 30 inches of rain fell in some areas. The Bogue Falaya River at Covington exceeded flood stage for several days, cresting twice with near-record flooding, threatening levees and producing major flooding. All told, the flooding caused nearly $30 million in damage for the state and resulted in disaster declarations for 27 parishes.

Allison's flooding occurred primarily in the southeast portion of the Parish. Numerous streets were impassable. It was estimated that over 1,000 houses were flooded, primarily in the Slidell area. The areas affected by TS Allison are shown in Map 2-1.

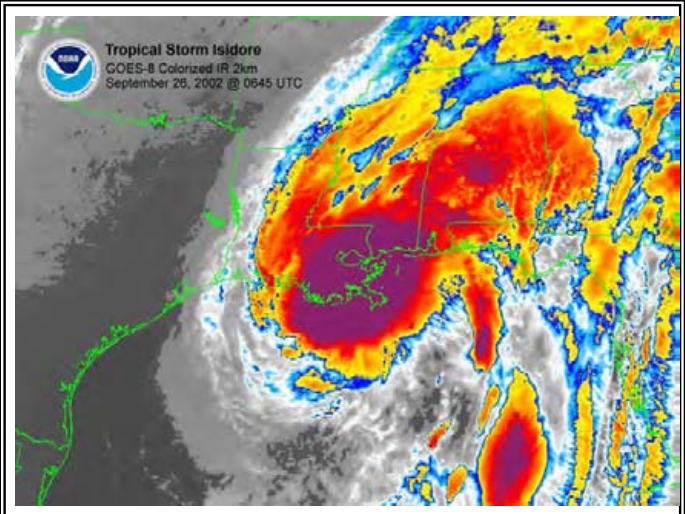


Map 2-1. Areas Affected by Hurricane Allison

Source: Unisys Weather

Tropical Storm Bertha: Bertha developed over the north central Gulf of Mexico on August 04, 2002, and moved inland over southeast Louisiana. The tropical storm was downgraded to a depression shortly after moving inland over southeast Louisiana. Some localized flash flooding from heavy rainfall developed over southeast Louisiana on August 5 and 6. Run-off from heavy rainfall caused a few rivers in St. Tammany Parish to exceed flood stage.

Tropical Storm Isidore:
Isidore had been a hurricane over Mexico. It was a tropical storm by September 26, 2002. In the morning, it made landfall at Grand Isle. By the afternoon it was over central Mississippi and downgraded to a tropical depression.



Isidore Over Louisiana, 6:45 a.m., September 26, 2002
Source: NOAA

Tropical Storm Isidore had a large circulation with high force winds extending several hundreds of miles from its center. This caused a significant storm surge over a large area. At Lake Pontchartrain, storm surges of 4 to 5 feet above normal were measured. Low lying areas, roadways and some non-elevated structures on the Lake were flooded.

Map 2-2 Areas Affected by Hurricane Isidore
Source: Unisys Weather

St. Tammany Parish was particularly hard hit with storm surge flooding when Isidore moved north and the winds shifted to a southwest direction causing water levels to rapidly increase along the north shore of Lake Pontchartrain. The storm surge overtopped or breached a small local levee system in southern portions of Slidell causing water to flood several hundred homes. Approximately 1,000 homes were flooded in the parish from either storm surge, river flooding, or from flooding from heavy rain.

Isidore Storm Surge Flooding at Mandeville

Photo by Alex Brandon © 2003
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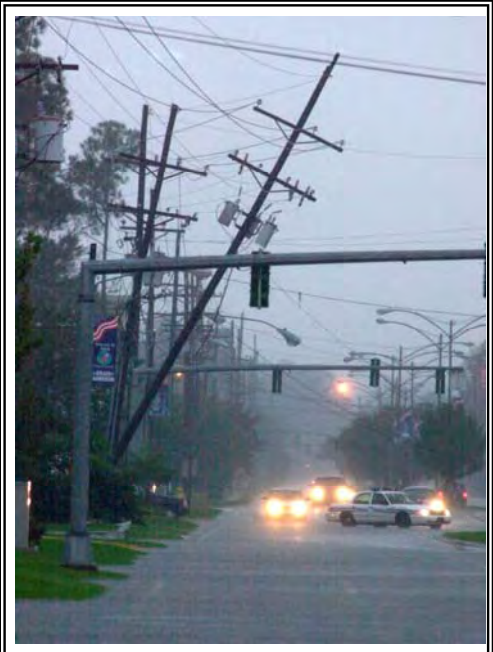
Most areas recorded sustained winds of 35 to 45 mph with some gusts to 50 mph in squalls. The highest wind speeds were observed near the coast and Lake. Approximately 2,500 people sought refuge in approximately 40 shelters in the state. Insured losses exceeded $100 million in Louisiana.

Hurricane Lili: On the heels of Isidore, Lili hit the State on October 2, 2002. It had been a category 4 storm, but dropped to a category 1 hurricane just before landfall. Lili caused 3 to 5 feet of storm surge tides across most of coastal southeast Louisiana. Along Lake Pontchartrain, the storm flooded low-lying roadways and structures. Up to 10 inches of rain fell.

Due to the rapid weakening, no sustained hurricane force winds were measured in southeast Louisiana. Highest wind gusts in New Orleans were 51 mph, in Baton Rouge, 47 mph, and at mid Lake Pontchartrain Causeway 69 mph.

Strong wind gusts downed trees and large tree branches across much of southeast Louisiana. Property damage occurred when the trees and tree limbs fell onto houses and automobiles. In St. Tammany Parish, one man was injured when a tree fell on his mobile home. Several short lived tornadoes touched down producing only minor property damage. Heavy rainfall was not widespread, in part due to the rapid movement of the hurricane away from the area. Flash flooding occurred in only a couple of areas. The areas affected are shown in Map 2-3.



Wind Damage Caused by Lili

Photo by Scott Threlkeld © 2003 The Times-Picayune Publishing Co., all rights reserved.
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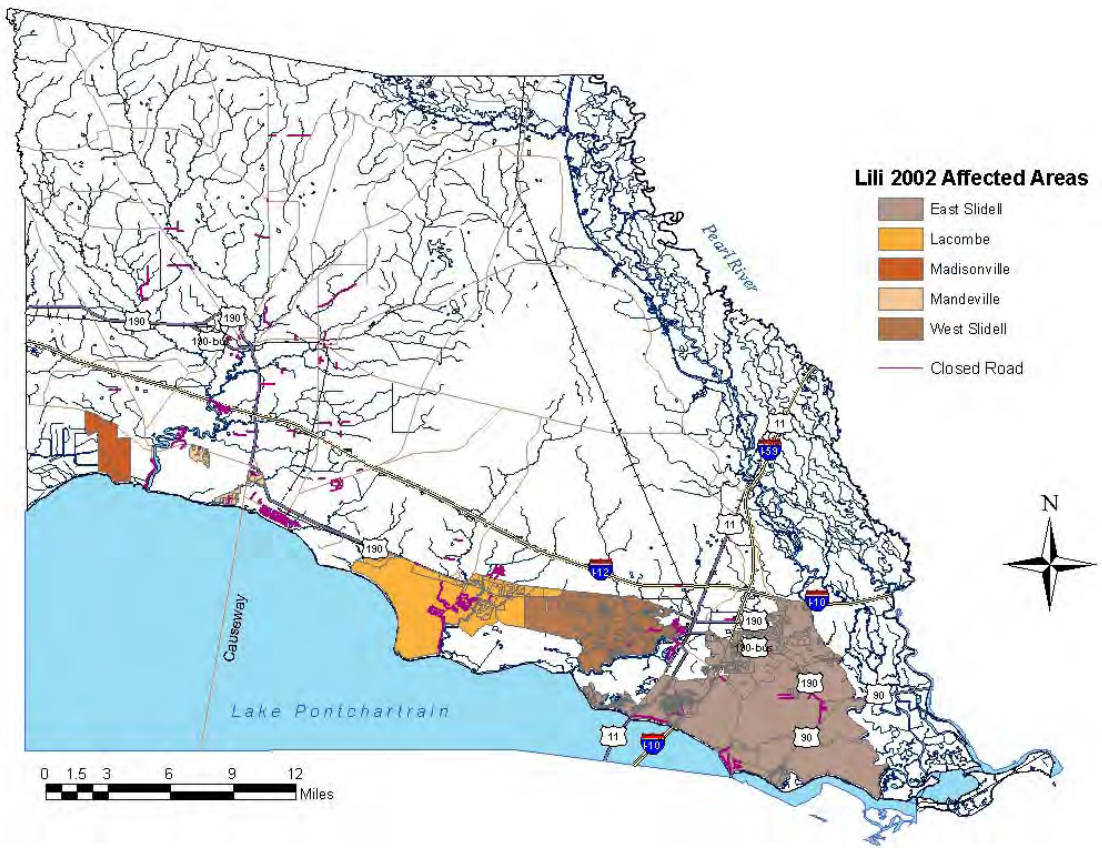


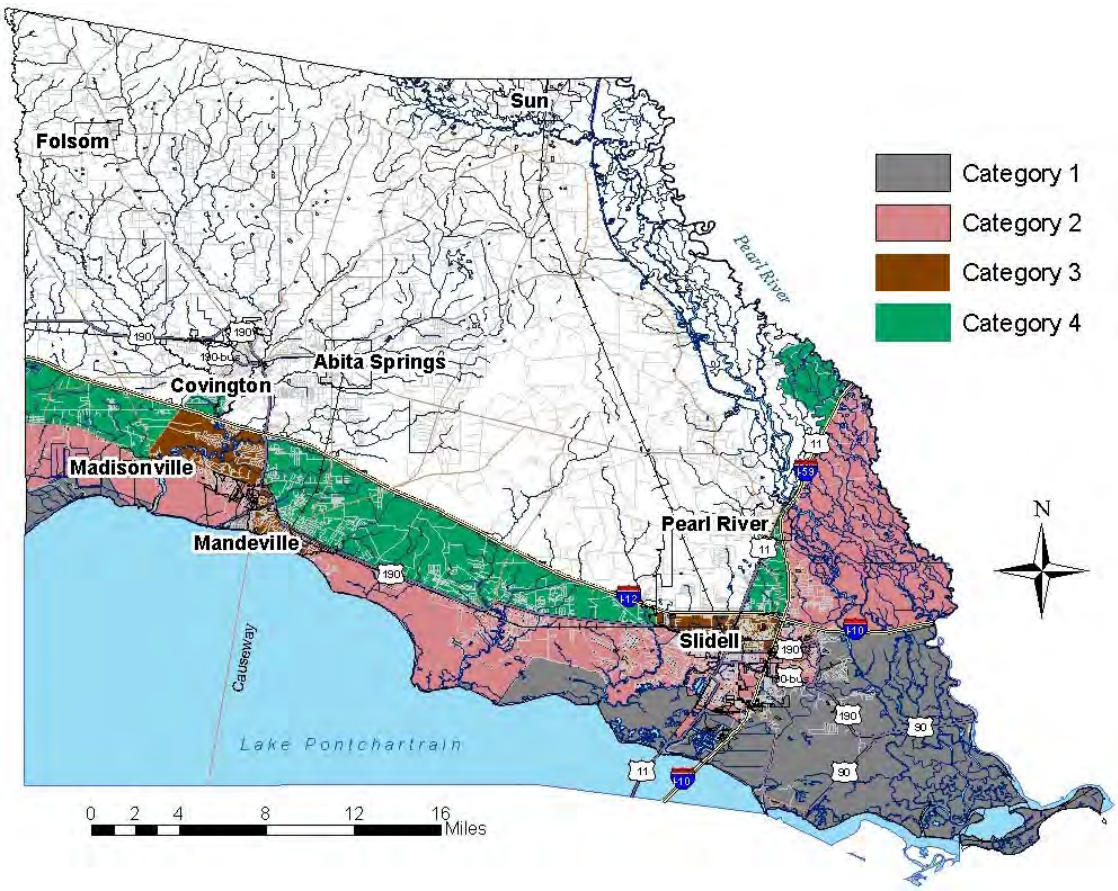
Map 2-3 Areas affected by Hurricane Lili

Source: Unisys Weather

Tropical Storm Bill: This storm moved into southeast Louisiana on Monday, June 30, 2003, and then moved north northeast across St. Tammany Parish. Here are some data:

- Storm surge of 3 to 5 feet above normal along Lake Pontchartrain
- Sustained winds of 35 to 45 mph
- Maximum gust was 62 mph at the north end of the Causeway in Mandeville
- In 48 hours, it rained 6 to 10 inches
- Maximum measured rainfall was 10.16 inches at Folsom
- Significant river flooding developed during the next five days
- Three tornadoes touched down in southeast Louisiana
- Four injuries

2.1.3. Area Affected Tropical storms and hurricanes can affect the entire parish. The satellite photos on pages 2-3 and 2-5 convey their size. Every place in the parish is susceptible to their winds, rain, and tornadoes. Map 2-4 on the next page shows the coastal areas that will be evacuated for flooding by categories 1 through 4 storms.



Map 2-4 Evacuation Areas Due to Flooding by Storm Surge

Source: St. Tammany Parish Office of Emergency Preparedness

Low lying and coastal areas south of I-12 are most subject to storm surge flooding. Maps 2-1, 2-2 and 2-3 show these areas were particularly hard hit by the three recent storms. The 100-year storm surge elevation at the Causeway and I-10 is 11.6 feet. The flood elevation drops one foot each 2.75 miles inland.

2.1.4. Frequency As seen in Table 2-3, Louisiana has had an average of 3 or 4 hurricanes each decade since detailed records have been kept. Given the size of hurricanes and the size of Louisiana, if a hurricane affects the State, it will likely affect St. Tammany Parish.

Table 2-3 Louisiana Storm History

Decade	Hurricanes	T.S.s	Total
1850's	3	1	4
1860's	7	2	9
1870's	6	3	9
1880's	7	3	10
1890's	3	6	9
1900's	2	7	9
1910's	3	2	5
1920's	3	2	5
1930's	2	8	10
1940's	3	9	12
1950's	2	7	9
1960's	4	1	5
1970's	4	3	7
1980's	4	5	9
1990's	3	2	5
Totals	57	61	118

Source: National Weather Service

Based on the historical record, a tropical storm or hurricane should be expected somewhere within the state every 1.2 years (0.83 chance). A hurricane should make landfall every 2.8 years. As noted in Table 2-4, the odds of a severe category 4 or 5 hurricane coming closer to St. Tammany Parish are lower. See section 2.2.4 for more information on relating risk and frequency.

Table 2-4 Frequency of Hurricanes Passing Within 80 Miles of New Orleans

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," in LOEP Hazard Profiles

2.1.5. Threat to People Luckily, tropical storms and hurricanes are not the killers they used to be. Table 2-5 shows that Hurricane Audrey in 1957 was the last major killer storm. The primary reasons for this development are the storm tracking and warning programs of the National Weather Service and the public information and evacuation activities of state and local emergency managers. Hurricane George in 1996 was not a direct hit, but did produce the largest evacuation in the region's recent history.

Table 2-5 Killer Storms

Fatalities	Dates
45	8/19-20/1812
218+	8/10-12/1856
47	8/11/1860
110	10/12/1886
2,000	10/1-2/1893
353	9/20/1909
275	9/29/1915
51	9/19-20/1947
526	6/27/1957
81	10/3/1964

Source: NOAA

Nine out of ten deaths during hurricanes are caused by storm surge flooding. High winds cause injuries, as noted in the descriptions of the recent storms on the previous pages. These are usually the result of falling tree limbs and flying debris. These injuries could be avoided through evacuation or sheltering in a structure built to withstand the high winds.

Because their winds, storm surge and river flooding can be so dangerous and affect such a large area, evacuation is the most important safety precaution for tropical storms and hurricanes. Evacuation procedures are reviewed in Chapter 5 and the public information programs that educate residents about those procedures are covered in Chapter 9. Safety concerns with the flooding and tornadoes that accompany tropical storms and hurricanes are reviewed later in this Chapter.

The high winds cause hazards to human health, too. Downed trees and damaged buildings are a potential health hazard due to instability, electrical system damage, broken pipelines, chemical releases, and gas leaks. Sewage and water lines may also be damaged. Salt water and fresh water intrusions from storm surge send animals, such as snakes, into areas occupied by humans.

Wind damage from Hurricane Lili

Source: cbsnews.com

2.1.6. Property Damage Property can be damaged by the various forces that accompany a tropical storm. High winds can directly impact structures in three ways: wind forces, flying debris and pressure. By itself, the force of the wind can knock over trees, break tree limbs and destroy loose items, such as television antennas and power lines (see photo, previous page). Many things can be moved by high winds.

As winds increase, so does the pressure against stationary objects. Pressure against a wall rises with the square of the wind speed, as shown in Table 2-6. For some structures, this force is enough to cause failure. The potential for damage to structures is increased when debris breaks the building "envelope" and allows the wind pressures to impact all surfaces (the building envelope includes all surfaces that make up the barrier between the indoors and the outdoors, such as the walls, foundation, doors, windows, and roof).

Table 2-6 Wind Pressures

Windspeed	Pressure
25 mph	2 lbs/ft^2
75 mph	50 lbs/ft^2
125 mph	1,250 lbs/ft^2

Pressure is measured in pounds per square foot

Buildings needing maintenance and mobile homes are most subject to wind damage. High winds mean bigger waves. Extended pounding by waves can demolish any structure not properly designed. The waves also erode sand beaches, roads, and foundations. When foundations are undermined, the building will collapse.

The resulting typical damage to structures from the different storm categories is shown in Table 2-7. The Beaufort Scale applies to high winds while the Saffir-Simpson Scale is for the five categories of hurricane winds.

Table 2-7. Beaufort and Saffir-Simpson Scales of Wind Damage

Name	Wind speed	Expected Property Damage
Strong gale	47-54 mph	Chimneys blown down, slate tiles torn from roofs
Whole gale	55-63 mph	Trees broken or uprooted
Storm	64-75 mph	Trees Uprooted, cars overturned
Category 1 Hurricane	74-95 mph	Minimal: Damage is done primarily to shrubbery and trees, unanchored mobile homes are damaged, some signs are damaged, no real damage is done to structures.
Category 2 Hurricane	96-110 mph	Moderate: Some trees are toppled, some roof coverings are damaged, major damage is done to mobile homes.
Category 3 Hurricane	111-130 mph	Extensive: Large trees are toppled, some structural damage is done to roofs, mobile homes are destroyed, structural damage is done to small homes and utility buildings.
Category 4 Hurricane	131-155 mph	Extreme: Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; some curtain walls fail.
Category 5 Hurricane	>155 mph	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.

A fast moving storm with high winds, such as Bill, will produce more wind damage. While a slow moving storm that drops a lot of rain, like Allison, creates more flooding and more flood damage. Allison caused $30 million in property damage in Louisiana, but over $1 billion in flood damage to Texas. Tropical Storm Bill caused $44 million in property damage in 11 parishes from several different forces:

Hurricane Damage in St. Tammany Parish

Photo by Scott Threlkeld © 2003
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- Winds: $31 million
- Tornadoes: $2 million
- Storm surge flooding: $4 million
- River and flash flooding: $7 million

The Louisiana Department of Insurance provided statistics on the types of insurance claims submitted after Isidore and Lili. These are shown in Table 2-8.

Table 2-8 Insurance Claims

Type of Claim	Isidore	Lili
Wind: Homeowners	$71,000,000	$400,000,000
Wind: Commercial	$10,000,000	$49,000,000
Flood	$52,000,000	$32,000,000
Auto	$24,000,000	$22,000,000
Total	$157,000,000	$503,000,000

Note: Figures are for the whole state
Source: Louisiana Department of Insurance

Following these two storms, the St. Tammany Parish President summarized their impacts. They included:

- 1 single family home destroyed
- 709 homes, mobile homes, and apartment houses with major damage
- 338 homes, mobile homes, and apartment houses with minor damage
- 70,000 power outages
- 31,000 cubic yards of debris picked up
- 331 residents stayed in one of 7 shelters

2.2. Flooding

2.2.1. The Hazard This section reviews flooding caused by heavy rains that come with tropical storms, hurricanes, thunderstorms, and prolonged rain. Coastal flooding caused by storm surges is discussed in the previous section. Flooding caused by a dam or levee failure is discussed in later sections of this chapter.

By definition, flooding is caused by more water than the drainage system can convey. Flooding is dependent on three factors: precipitation, conditions in the watershed, and conditions in the drainage channel.

Precipitation: St. Tammany Parish receives an average of 64 inches of rain each year. The rain comes from tropical storms, convective thunder-storms, and storms caused by the interaction of warm moist air with colder air from the north. As seen in Table 2-9, the parish's precipitation is not spread out evenly over the year. The amount of rain that falls varies from storm to storm and varies over an area. Where this rain goes depends on the watershed.

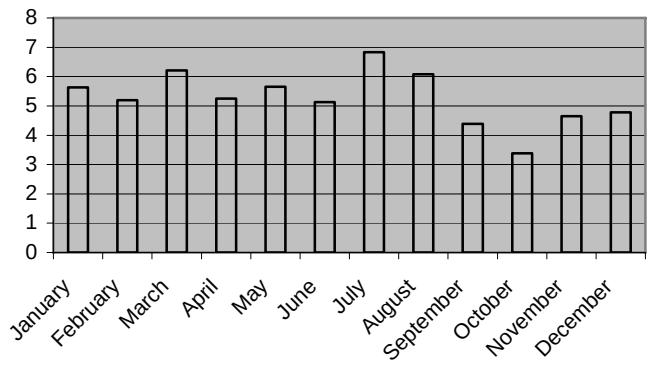
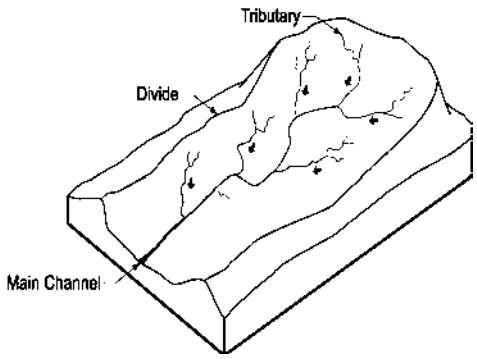


Table 2-9 Average Annual Rainfall at Covington

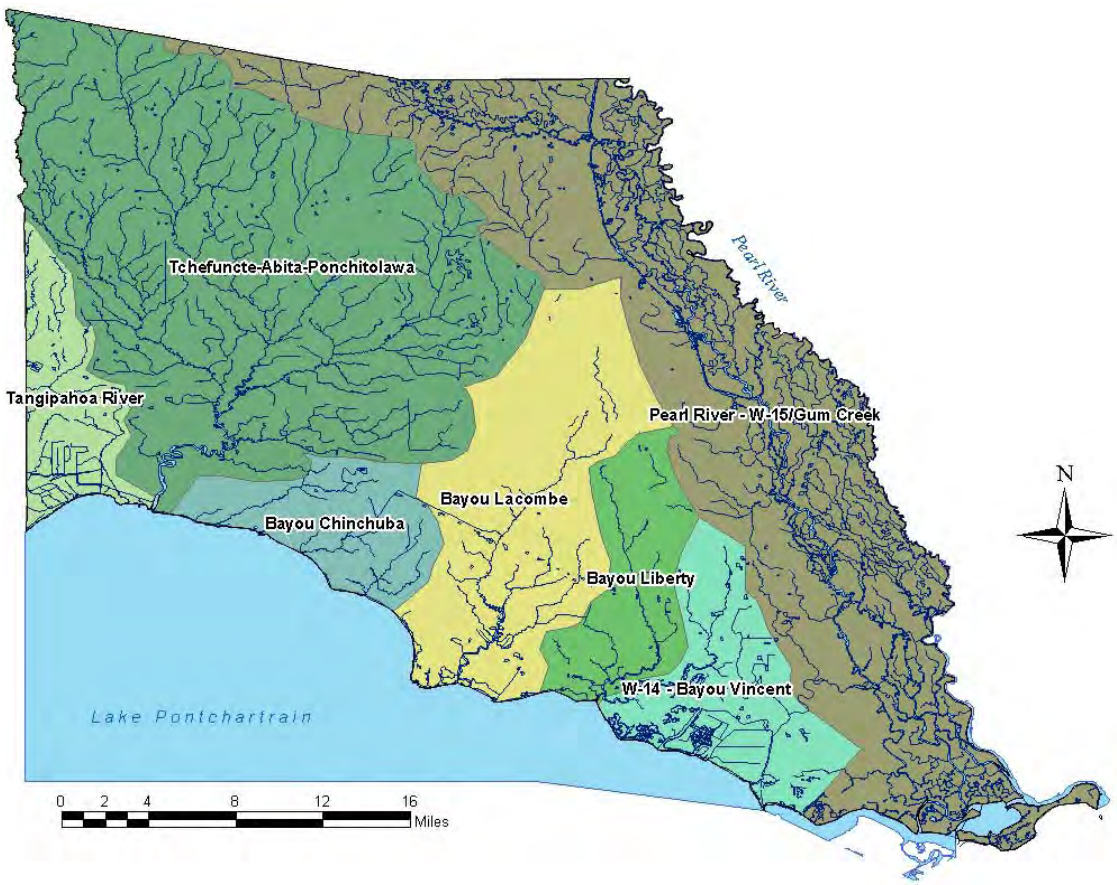
The watershed: A "watershed" is an area of land that drains into a lake, stream or other body of water. The runoff from rain is collected by ditches and sewers which send the water to small streams (tributaries), which send the water to larger channels and eventually to the lowest body of water in the watershed (the main channel, Lake Pontchartrain or the Gulf). When one of these conveyance channels receives too much water, the excess flows over its banks and into the adjacent area – causing a flood.



A watershed includes all land that drains to a common channel

St. Tammany Parish has 7 major watersheds, which are shown on Map 2-5 on the next page. Data on these watersheds are displayed in Table 2-10. Within these major watersheds are smaller subwatersheds that drain into the tributaries. All of these streams have adjacent floodplains that are inundated during a flood.

There are several watershed conditions that affect flooding. The first is the size of the watershed. Smaller watersheds will flood more quickly. The Pearl River has a much larger watershed in Mississippi upstream of St. Tammany Parish. As with most major rivers and watersheds, the Pearl River responds more slowly to rain and runoff than do the other, smaller, streams in the Parish. But when floods do occur on the Pearl River, the duration of the flooding can extend for much longer than it does for the smaller streams.



Map 2-5 St. Tammany Parish Watersheds

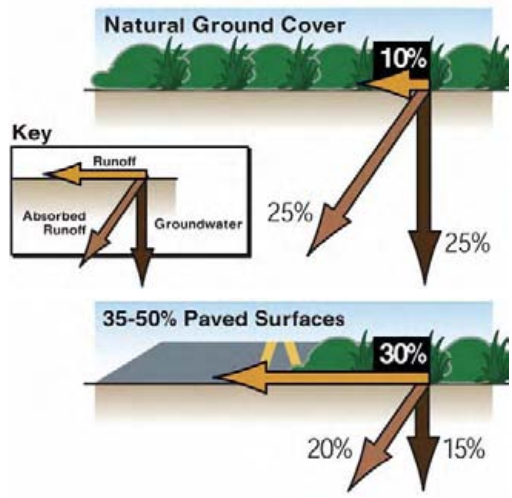
Table 2-10 Watershed and Floodplain Data

Watershed	Area of Watershed (square miles) *	Area of Floodplain (square miles)	Percent Of Watershed in Floodplain
Bayou Chinchuba	67,345	26,701	40%
Bayou Lacombe	181,755	72,821	40%
Bayou Liberty	70,980	29,725	42%
Pearl River - W-15/Gum Creek	453,655	330,200	73%
Tangipahoa River	60,162	35,390	59%
Tchefuncte-Abita-Ponchitolawa	482,611	140,084	29%
W-14 - Bayou Vincent	94,919	77,207	81%
Total:	1,411,427	712,128	50%

* Areas are for the St. Tammany Parish portions of the watersheds only

The second watershed factor that affects flooding is the slope of the land. More rain will run off the land and into the streams if the terrain is steep. Because much of St. Tammany Parish is so flat, water tends to pond where it falls and run off slowly. This results in very localized flooding conditions, before the water reaches the local drainage system.

A third factor is what development has done to the watershed and drainage system. Given the flat topography of the area, the natural drainage ways that drain runoff can be hard to discern and are often disrupted or even built on during construction. In areas that have been developed, farm fields and forests have been converted to pavements and rooftops. As a result, the amount of stormwater that runs off increases. The original natural drainage system cannot handle the increased loads and localized flooding occurs.



Stormwater runoff increases as areas are urbanized

Source: Association of State Floodplain Managers

These watershed conditions mean that St. Tammany Parish is faced with two types of flooding: longer-lasting, overbank flooding from the larger rivers and quick or "flash" stormwater flooding in areas where the runoff overloads the local drainage system. The former may be caused by rain falling upstream in the watershed while the latter is caused by rain falling on the affected area. Because overbank flooding takes longer to occur, there may be advance warning time, but there is very little warning of local stormwater flooding.

Recent Stormwater Flooding

– The News Banner, June 2003

~ COVINGTON – Heavy rains caught residents of western St. Tammany Parish off guard Sunday and caused flooding of some streets and homes.

Unlike Tropical Storm Bill, which brought heavy rains and tidal surges to the area last month, there was little warning of the deluge that quickly materialized around mid-morning…

[Mandeville Mayor Eddie] Price said the levels in Lake Pontchartrain directly affect drainage in Mandeville. Rain water would leave streets and yards quicker if the lake was low, but its current high levels hinder the flow of water through drainage channels.

Another problem Price cited was clogged drains, a situation further complicated when running water picks up trash and blocks culverts. In one case on Lakeshore Drive, he said workers found a sheet of plywood blocking one culvert.

The channel: Flooding can be aggravated by obstructions in the drainage system. There are two kinds: channel obstructions, such as small bridge or culvert openings or log jams, and floodplain obstructions, such as road embankments, fill and buildings.

Channel obstructions will aggravate smaller, more frequent floods, while floodplain obstructions impact the larger, less frequent floods where most of the flow is overbank, outside the channel. Channel obstructions can be natural (e.g., log jams or growth) or man made (e.g., broken culverts or debris). Channel obstructions can be cleared out by work crews or washed away during larger floods. Floodplain obstructions tend to be more permanent. They are discussed in Chapter 6's section on floodplain regulations.

2.2.2. Historical Occurrences

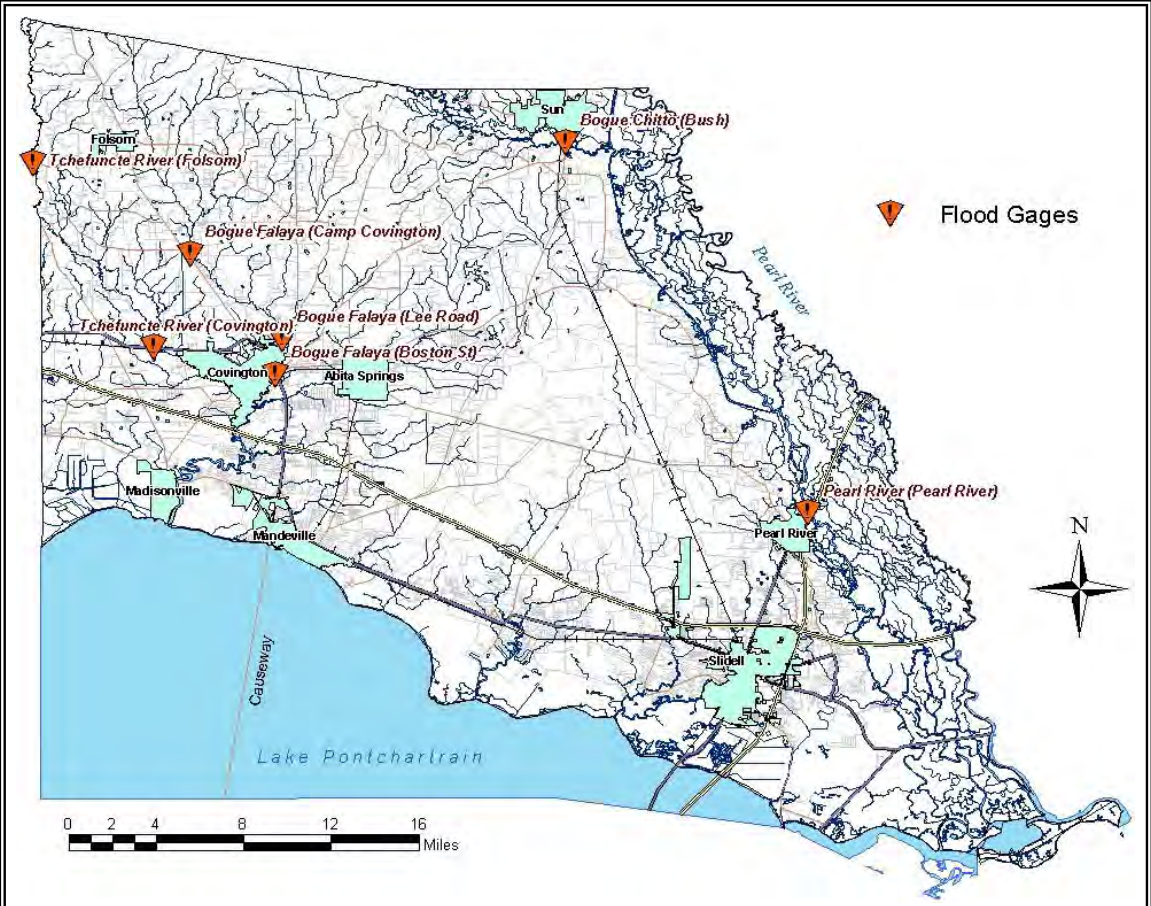
Floods have been caused by localized storms, rain over several days on saturated ground, and tropical storms. Over the last three decades, a flood great enough to have St. Tammany Parish declared a Federal disaster area has occurred on the average of every 3 – 4 years.

Table 2-11
Major Floods

April 1973
January 1977
May 1979
April 1980
April 1983
April 1991
February 1993
May 1995
June 2001

Riverine flooding: Flood heights on the larger rivers are recorded at individual river gages. There are seven reporting and recording gages in St. Tammany Parish, shown on Map 2-6. Data on recent flood events are listed in Table 2-12, on the next page.

Each gage has its own datum, or starting point for measuring stage or height. That datum can be converted to elevation above sea level, but many users are more comfortable with the gage's stage figures. Some gages have a "flood stage," which is the height when the stream goes out of banks or starts causing property damage. These figures are shown in Table 2-12, along with the five highest recorded flood crests. Some gages have been in operation for a longer time and therefore show earlier floods. Table 2-12 shows that these streams have flooded in every month of the year, except July and December. More years of records or looking at the top 10 floods would include those months. In other words, it can flood in St. Tammany Parish at any time of the year.



Map 2-6 River Gages

Table 2-12 Historical Flood Records				
Gage Name	Gage Data	Historical Floods		
		Crest	Date	Storm
Bogue Falaya near Camp Covington		54.6 ft	09/27/2002	Isidore
Elevation of Stage 0	34.40 ft	53.9 ft	03/07/1998	
Flood Stage	45.00 ft	53.6 ft	10/03/2002	Isidore/Lili
		53.0 ft	08/06/2002	
		52.3 ft	06/08/2001	Allison
Bogue Falaya at Lee Road		24.0 ft	01/21/1993	
Elevation of Stage 0	--	23.6 ft	04/08/1983	
Flood Stage	--	22.7 ft	06/11/2001	Allison
		21.8 ft	10/04/2002	Isidore/Lili
		21.4 ft	03/08/1998	
		24.0 ft	01/21/1993	
Bogue Falaya Boston St		17.1 ft	01/21/1993	
Elevation of Stage 0	0.34 ft	16.5 ft	06/11/2001	Allison
Flood Stage	6.00 ft	16.5 ft	02/22/1961	
		14.2 ft	01/07/1998	
		14.0 ft	10/04/2002	Isidore/Lili
Tchefuncte at Folsom		24.1 ft	04/06/1983	
Elevation of Stage 0	5.47 ft	22.3 ft	05/03/1953	
Flood Stage	--	22.1 ft	11/14/1961	
		22.1 ft	02/22/1961	
		21.9 ft	01/21/1993	
Tchefuncte at Covington		32.0 ft	02/03/1988	
Elevation of Stage 0	9.74 ft	31.2 ft	02/28/1987	
Flood Stage	--	29.9 ft	05/03/1953	
		29.5 ft	11/15/1961	
		29.3 ft	02/22/1961	
Bogue Chitto at Bush		21.2 ft	04/08/1983	
Elevation of Stage 0	3.33 ft	17.4 ft	01/27/1990	
Flood Stage	9.00 ft	17.3 ft	03/31/1980	
		16.3 ft	01/30/1994	
		16.0 ft	01/22/1993	
Pearl River at Pearl River		21.1 ft	04/09/1983	
Elevation of Stage 0	6.13 ft	19.8 ft	04/01/1980	
Flood Stage	14.00 ft	19.7 ft	04/19/1900	
		19.6 ft	01/30/1990	
		19.2 ft	04/26/1979	

Stormwater flooding: Stormwater flooding follows local heavy rains. There were many problems during the tropical storms and hurricanes noted in section 2.1. They are also caused by thunderstorms, which are most likely to happen in the spring and summer months and during the afternoon and evening hours, but they can occur year-round and at all hours.

Generally, local thunderstorms and their accompanying hazards do not warrant a disaster declaration or a lot of documentation. Therefore, there are few public records of their occurrences. Some of the bigger ones are listed in Table 2-13.

Table 2-13 Recent Thunderstorms and Their Impacts

Date	Severity	Reported Impact
4/11/95	5" – 7"	100 homes in Slidell flooded
5/8/95	7.7"	Widespread street flooding, several homes reported water damage.
5/9/95	9" – 16"	I-12 and US 190 flooded, hundreds evacuated, 6,000 applied to FEMA for disaster assistance
4/14/96	6" – 9"	Widespread street flooding, flooding of a few houses
8/10/96	2" – 3"	Widespread street flooding, flooding of a few houses
2/13/97	2"	Street flooding
7/8/97	"heavy"	Street flooding
1/7/98	3" – 6"	$100,000 estimated damage to homes and businesses in Slidell and Mandeville. Roads flooded in Abita Springs
1/12/98	"heavy"	Widespread street flooding, flooding of a few houses in Covington
1/22/98	2.5"	Street flooding
3/7/98	3" – 5"	Widespread street flooding, flooding of a few buildings
7/14/98	3.5"	3 buildings and numerous streets flooded in Covington
3/3/01	"heavy"	Street flooding

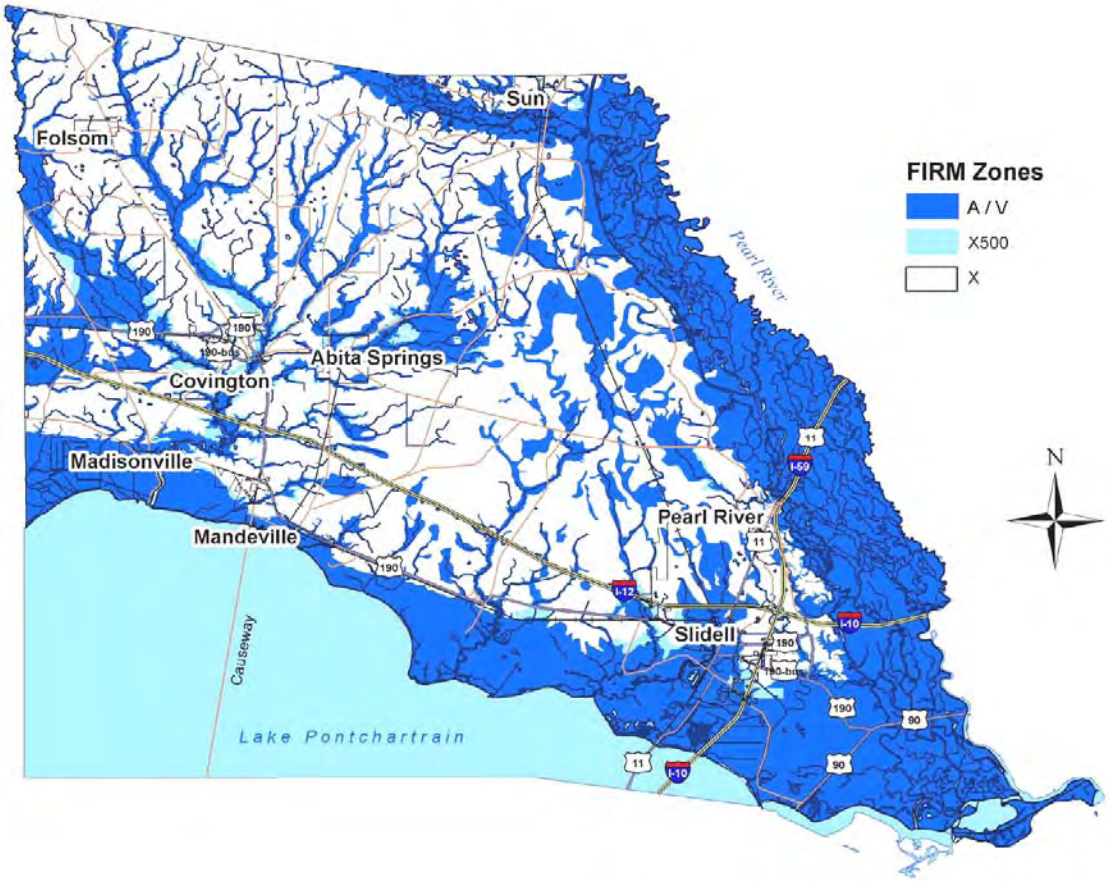
Source: National Climatic Data Center

2.2.3. Area Affected

Riverine flooding: The area affected by overbank flooding from the larger bayous and streams has been mapped as the floodplain. St. Tammany Parish has had several different flood maps. The official floodplain study for insurance and regulatory purposes is the *Flood Insurance Study* by the Federal Emergency Management Agency (FEMA). The floodplains mapped by FEMA are shown on Map 2-7. Table 2-10 shows that one-half of St. Tammany Parish is in the mapped floodplain.

FEMA uses the "base" flood as the basis for its regulatory requirements and flood insurance rate setting. This *Plan* uses the base flood, too. The base flood is the one percent chance flood, i.e., the flood that has a one percent (one out of 100 or .01) chance of occurring in any given year (see next section).

The area inundated by the base flood is called the Special Flood Hazard Area on FEMA maps (called Flood Insurance Rate Maps, or FIRMs). In riverine areas, this is noted as an A Zone. In areas subject to coastal waves, it is designated as a V Zone. St. Tammany Parish has a very narrow V Zone along the lakeshore and a larger one on the Gulf. Areas outside the mapped Special Flood Hazard Area are called X Zones.



Map 2-7 St. Tammany Parish Floodplains

Source: Flood Insurance Rate Map, St. Tammany Parish GIS

Another term used is the "500-year flood." This has a 0.2% or .002 chance of occurring in any given year. While the odds are more remote, it is the national standard used for protecting critical facilities, such as hospitals and fire stations. These areas are shown as "X 500" on Map 2-7.

Stormwater flooding: FEMA's mapping standard is for watersheds greater than one square mile. Stormwater flooding that occurs in smaller watersheds are therefore not shown on floodplain maps. Further, stormwater flooding is not limited to any area of the Parish – it occurs almost everywhere, in and out of the mapped floodplain.

One measure of the extent of the problem is the workload of the Public Works Department maintaining local drainage and roadside ditches. Between January 1 and September 30, 2003, the Department issued over 1,700 work orders to clean or remove debris from ditches. Most were based on calls from concerned residents.

2.2.4. Frequency Past floods are indications of what can happen in the future, but mitigation plans are based on the *risk* of future flooding. Flood studies extrapolate from historical records to determine the statistical potential that storms and floods of certain magnitude will recur. Such events are measured by their "recurrence interval," i.e., a 10-year storm or a 50-year flood.

What are the odds of a flood?

Chance of Flooding over a Period of Years

Time Period	Flood Size 10-year	25-year	50-year	100-year
1 year	10%	4%	2%	1%
10 years	65%	34%	18%	10%
20 years	88%	56%	33%	18%
30 years	96%	71%	45%	26%
50 years	99%	87%	64%	39%

These numbers do not convey the true flood risk because they focus on the larger, less frequent, floods. If a house is low enough, it may be subject to the 10- or 25-year flood. During the proverbial 30-year mortgage, it may have a 26% chance of being hit by the 100-year flood, but the odds are 96% (nearly guaranteed) that a 10-year flood will occur during the 30 year period. Compare those odds to the only 5% chance that the house will catch fire during the same 30-year mortgage.

These terms are often misconstrued. Commonly, people interpret the 50-year flood definition to mean "once every 50 years." This is incorrect. Statistically speaking, a 50-year flood has a 1/50 (2% or .02) chance of occurring in any given year. A 50-year flood could occur two times in the same year, two years in a row, or four times over the course of 50 years. It is possible to not have a 50-year flood over the course of 100 years.

Map 2-7 and this plan use the base or 100-year flood and the Special Flood Hazard Area shown on FEMA's Flood Insurance Rate Map to signify the riverine flood hazard faced by the Parish. Given that there were 9 flood disaster declarations in the last 27 years (Table 2-11), the chance of a major overbank riverine flood is once every three years, or 0.33.

However, the chance of stormwater flooding or a smaller overbank flood is much more frequent. Southeast Louisiana averages 100 – 110 thunderstorm events each year. They average 80 – 90 minutes in duration. Assuming the average severe storm affects 100 square miles, the odds of a severe thunderstorm hitting any particular square mile in St. Tammany Parish in any given year are 1 to 1 or 100%.

Repetitively Flooded Areas Some areas flood more frequently than others. Properties closest to the lakefront or streams and those in areas with drainage problems will be flooded more often than other properties, even more than those in the mapped 100-year floodplain.

FEMA defines a "repetitive loss" property as one which has received two flood insurance claim payments for at least $1,000 over any 10-year period since 1978. These properties are important to the National Flood Insurance Program and the Community Rating System because even though they comprise 1% of the policy base, they account for 30% of the country's flood insurance claim payments. There are several FEMA programs that encourage communities to identify the causes of their repetitive losses and develop a plan to mitigate the losses (this *Plan* meets FEMA's repetitive loss planning criteria).

There are 1,345 repetitive loss properties in St. Tammany Parish. They are plotted in map 2-8 and are listed in Table 2-14, distributed by community and FIRM Zone (as reported on the insurance policy). Table 2-14 shows that the majority of the repetitive flooding problem is in the unincorporated areas and Slidell.

Table 2-14 Repetitive Loss Properties by Community and FIRM Zone

	A	V	X 500	X	N/A	Total
Abita Springs	2	0	0	1	1	4
Covington	31	0	6	11	0	48
Folsom	0	0	0	0	0	0
Madisonville	0	1	0	0	0	1
Mandeville	16	12	1	7	0	36
Pearl River	0	0	0	1	1	2
Slidell	377	0	9	46	2	434
Sun	1	0	0	0	0	1
Unincorporated areas	551	28	21	213	6	819
Total	978	41	37	279	10	1,345

FIRM Zones: A: 100-year floodplain, riverine areas. V: 100-year floodplain, coastal areas.
B: between the 100-year and 500-year floodplain boundaries. X: Outside 100-year floodplain.

Source: FEMA flood insurance records

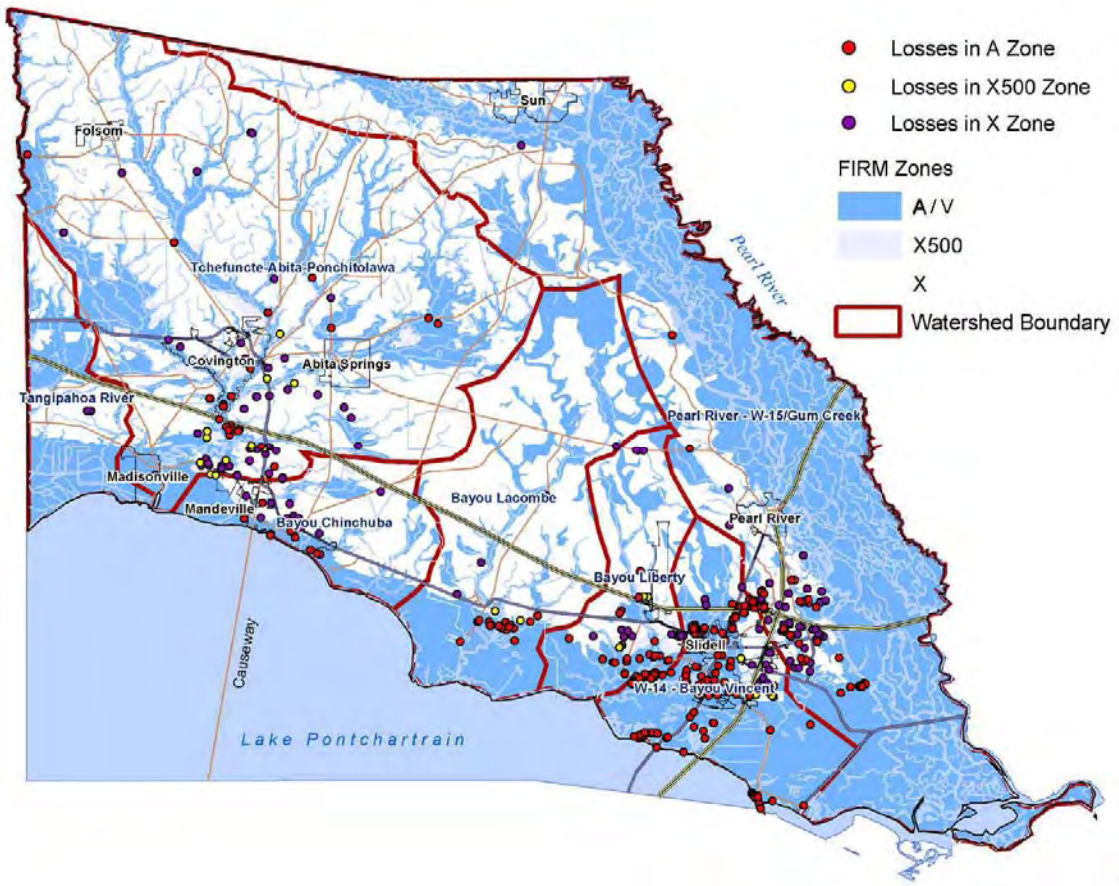
There are 827 repetitive loss properties in the planning area (i.e., outside the three cities that are preparing their own mitigation plans). The planning team was able to plot 595 of them. Many addresses cannot be plotted (e.g., post office boxes or lot numbers) and there are problems with the rest of the source data. For example, properties rated as in a city or FIRM Zone were plotted as being outside that city or in another FIRM Zone. Some work is needed to correct these problems, but conclusions can still be drawn from the aggregate data.

The 595 sites are listed in Table 2-15 and plotted on Map 2-8. It can be seen that the greatest problem areas are in the Pearl River and Bayou Vincent watersheds, to the east and south of Slidell, and the Tchefuncte watershed that drains through Covington.

Table 2-15 Distribution of Repetitive Loss Properties in the Planning Area

Watershed	FIRM Zones			Total
	A/V	X 500	X	
Bayou Chinchuba	10	4	13	27
Bayou Lacombe	21	2	4	27
Bayou Liberty	36	8	15	59
Pearl River - W-15/Gum Creek	59	1	59	119
Tangipahoa River	0	0	2	2
Tchefuncte-Abita-Ponchitolawa	34	13	53	100
W-14 – Bayou Vincent	230	12	19	361
Total	390	40	165	595

Source: FEMA, St. Tammany Parish GIS



Map 2-8 Repetitive Loss Properties in the Planning Area

Note: each dot may represent more than one property. Source: FEMA, St. Tammany Parish GIS

The flood insurance records provide the following statistics on the 827:

- 3 have been acquired or elevated, but the records show that the rest are still subject to flood damage.
- 31 have been paid a flood insurance claim six or more times, but most of them qualify by having been flooded only twice.
- 778 are single family residences.
- 364 are no longer carrying flood insurance (or are insured as a different address)
- 71% are rated as being in the mapped floodplain, indicating that 29% are subject to local drainage problems outside the mapped floodplain. Actually, this is close to the national average, although some in the X Zone may have been remapped as in the A Zone since the original policy was written.

Table 2-16 on the next page shows that Parish-wide, the average repetitive loss property has been paid 2.74 claims. There have been more claims per property in the Bayou Chinchuba watershed (3.08) and the fewest in the Tangipahoa River and Tchefuncte-Abita-Ponchitolawa watersheds. Average total payments have been highest in the Bayou Lacombe, Pearl River W15 Gum Creek, and W14 Bayou Vincent watersheds.

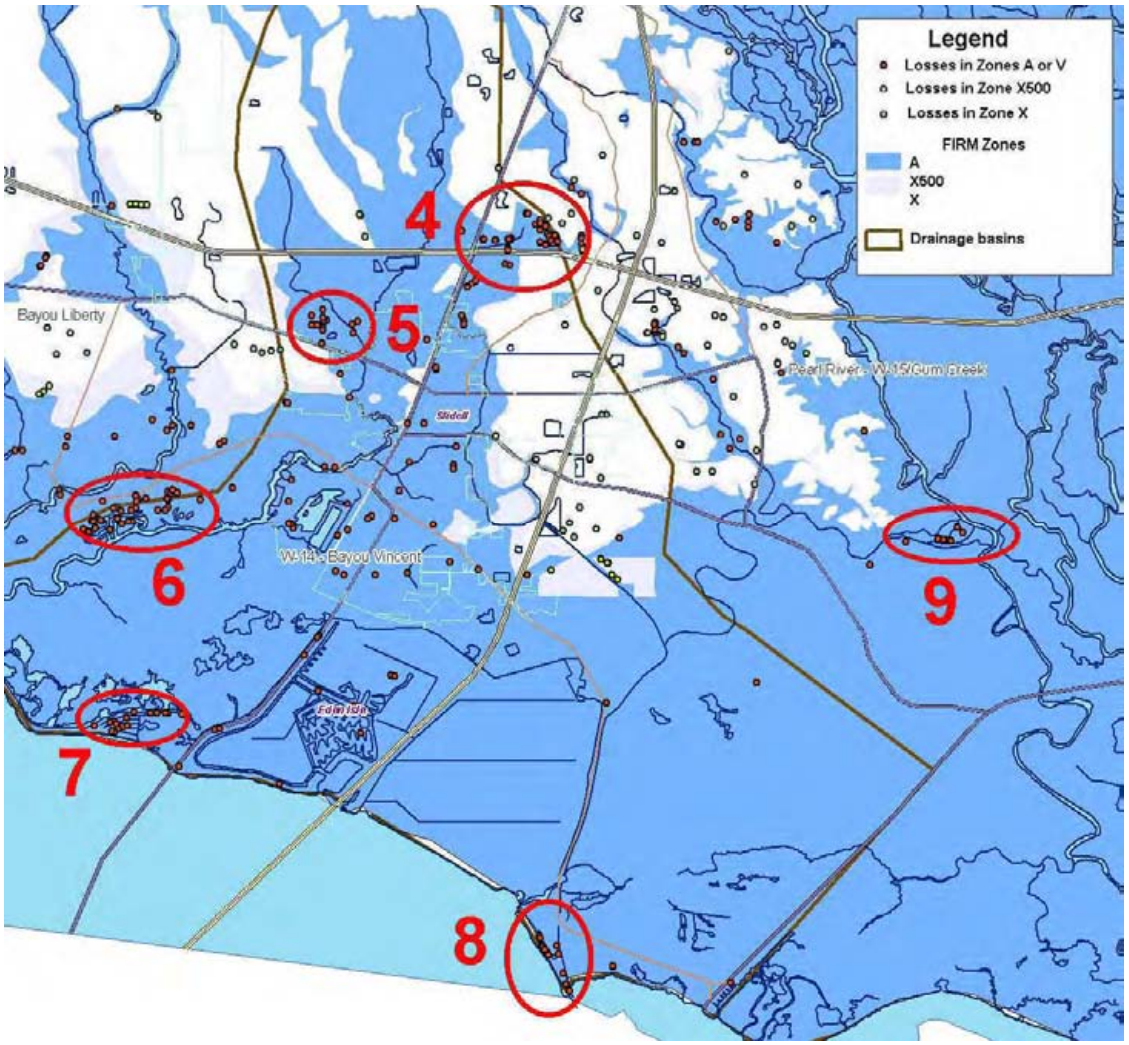
Table 2-16 Repetitive Loss Flood and Claims History by Watershed				
Watershed	Number	Average Losses	Average total payment	
			Building	Contents
Bayou Chinchuba	27	3.08	$31,788	$19,998
Bayou Lacombe	27	2.56	$45,793	$19,801
Bayou Liberty	59	2.62	$32,702	$13,953
Pearl River W15 Gum Creek	119	2.73	$45,231	$13,302
Tangipahoa River	2	2.50	$40,545	$19,812
Tchefuncte-Abita-Ponchitolawa	100	2.51	$32,915	$14,089
W14 Bayou Vincent	261	2.93	$43,670	$19,041
Not plotted	232	2.68	$32,174	$14,389
Parish	827	2.74	$38,276	$15,915
Source: FEMA, St. Tammany Parish GIS				

Many of the repetitive loss properties are scattered throughout the Parish. Most of those in the X Zone appear to be drainage flooding problems. A review of Map 2-8 helped identify nine repetitive loss areas in the floodplain, i.e., clusters of similarly situated repetitive loss properties. Six of them are around Slidell as shown on Map 2-9.

- Area 1. Approximately 20 properties along the main stem of the Tchefuncte River, between Covington and the Lake.
- Area 2. The 25 properties in the Bayou Chinchuba watershed, which are concentrated along the lakeshore.
- Area 3. The 24 properties in the Bayou Lacombe watershed, which are concentrated along Bayou Lacombe, just south of US 190.
- Area 4. Approximately 35 properties north of I-12 and east of US 11, north of Slidell.
- Area 5. 15 properties on Bayou Vincent, north of US 190, west of Slidell.
- Area 6. Approximately 35 properties in the Coin Du Lestin area along Bayou Bonfouca, southwest of Slidell.
- Area 7. Approximately 15 properties in the Northshore Beach area along the lakeshore, southwest of Slidell.
- Area 8. Approximately 12 properties in the Treasure Island area along the lakeshore, south of Slidell.
- Area 9. Six properties near the confluence of Doubloon Branch and the Pearl River, east of Slidell.

These 9 areas have 187 properties from FEMA's flood insurance records, but there are likely to be many more repetitively flooded properties in these areas. Some properties did not have flood insurance during all the floods, and not all on the FEMA list could be plotted.

These areas should have their flooding problems addressed on a neighborhood or area basis, while the other 662 properties, being scattered around the Parish, should be looked at individually.

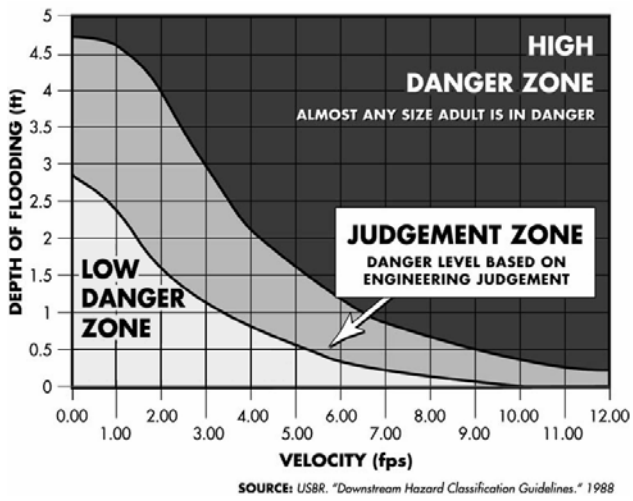


Map 2-9 Repetitive Loss Properties around Slidell

Note: each dot may represent more than one property. Source: FEMA, St. Tammany Parish GIS

Threat to People: The hazard presented by floodwaters is dependent on how deep it is and how fast it moves. The speed of moving water, or velocity, is measured in feet per second. In St. Tammany Parish, velocities are generally less than five feet per second. The relationship between depth and velocity is shown in the graph to the right.

It doesn't take much depth or velocity to be dangerous. A car will float in less than 2 feet of moving water and can be swept



Depth – Velocity danger levels for people

downstream into deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else. Victims of floods have often put themselves in perilous situations by ignoring warnings about travel or mistakenly thinking that a washed-out bridge is still there.

People die of heart attacks, especially from exertion during a flood fight. Electrocution is a cause of flood deaths, claiming lives in flooded areas that carry a live current created when power lines drop or electrical components short out. Floods also can damage gas lines, floors, and stairs, creating secondary hazards such as gas leaks, unsafe structures, and fires. Fires are particularly damaging in areas made inaccessible to fire-fighting equipment by high water or flood-related road or bridge damage.

Tropical Storm Isidore

Source: St. Tammany Parish

While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry whatever was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where cattle and hogs are kept can contribute polluted waters to the receiving streams.

Rain and floodwaters saturate the ground which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment lead to overloaded sewer lines which back up into low lying areas and some homes. Even though diluted by flood waters, raw sewage can be a breeding ground for bacteria, such as e coli, and other disease causing agents.

The second type of health problem comes after the water is gone. Stagnant pools become breeding grounds for mosquitoes, and wet areas of a building that have not been cleaned breed mold and mildew. A building that is not thoroughly and properly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced-air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If the water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

Post-flood silt, mold and mildew

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

> Van Sandt strode through her home Friday, focused on cleaning and rebuilding just hours after the water receded. Then she stopped to pick up her mother's old Bible, now sopping and blurred, from the bedroom floor.
>
> "The water pressure opened our cabinet doors and just pushed everything out," Van Sandt said, her voice starting to shake as she tried to thumb the pages. "Oh God, the videotapes of the grandchildren doing their Easter egg hunts and at Christmas. They're all gone, too."
>
> Times-Picayune, 9/28/02

2.2.5. Property Damage As with the threat to people, depth and velocity of flooding determine property damage. Flood velocity is important because the faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation.

In a few situations, deep or fast moving waters will push a building off its foundation, but this is rare and St. Tammany Parish has few riverine areas where the depths and velocities are that high. More often, structural damage is caused by the weight of standing water, known as "hydrostatic pressure."

Due to the relatively low velocities and shallow flood depths in the Parish, the most common type of damage inflicted by a flood is caused by soaking. When soaked, many materials change their composition or shape. Wet wood will swell and, if dried too quickly, will crack, split or warp. Plywood can come apart. Gypsum wallboard will fall apart if it is bumped before it dries out. The longer these materials are wet, the more moisture, sediment and pollutants they will absorb.

Soaking can cause extensive damage to household goods. Wooden furniture may become so badly warped that it cannot be used. Other furnishings such as upholstery, carpeting, mattresses, and books usually are not worth drying out and restoring. Electrical appliances and gasoline engines will not work safely until they are professionally dried and cleaned.

Proper cleaning after a flood requires stripping walls and floors and letting them dry thoroughly

In short, while a building may look sound and unharmed after a flood, the waters can cause a lot of damage. As shown in the photo on the previous page, to properly clean a flooded building, the walls and floors should be stripped, cleaned, and allowed to dry before being recovered. This can take weeks and is expensive.

Soaked Contents from Tropical Storm Isidore

Photo by Michael Democker © 2003
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Flood insurance data: Since 1978, here have been over 5,000 flood insurance claims paid in the planning area (the Parish, not including Slidell, Covington or Mandeville). 98% of the claims are in the unincorporated areas of the Parish. The rest (90 claims) are in Abita Springs, Folsom, Madisonville, and Pearl River. The claim payments range up to $220,000 for the building and $255,300 for contents.

The average claim payments for major flood events are shown in Table 2-17. These numbers show that the May 1995 storm was the worst in terms of both numbers and average dollar damage. Floods from Isidore/Lili rank second in dollar damage.

Table 2-17 Claims Data for Recent Floods

Date	Storm	Building		Contents	
		Number	Average Claim	Number	Average Claim
April 1983		477	$14,126	339	$5,854
October 1985		216	$10,355	142	$5,835
May 1995		1,313	$18,480	647	$10,380
June 2001	Allison	659	$13,791	386	$6,949
Sept/Oct. 2002	Isidore/Lili	862	$16,832	448	$10,167
All Claims		5,082	$15,983	2,701	$7,174

Source: FEMA flood insurance claims records

2.3. Tornadoes

2.3.1. The Hazard A tornado is a swirling column of air extending from a thunderstorm to the ground. Tornadoes can have wind speeds from 40 mph to over 300 mph. A majority of tornadoes have wind speeds of 112 mph or less.

Source: National Weather Service

Tornadoes can move forward at up to 70 miles per hour, pause, slow down and change directions. Most have a narrow path, less than a 100 yards wide and couple of miles long. However, damage paths can be more than 1 mile wide and 50 miles long. Summer and fall see the peak of tornado activity in southeast Louisiana. Tornadoes peak in the afternoon, when convectional heating is at a maximum.

Louisiana experiences a higher rate of tornadoes than the eastern and western parts of the country because of the recurrent collision of moist, warm air moving north from the Gulf of Mexico with colder fronts moving east from the Rocky Mountains. The state is also more subject to hurricanes that can breed tornadoes.

Table 2-18 Fujita Tornado Measurement Scale and Occurrences in Louisiana Since 1950

Category	Wind Speed	Examples of Possible Damage	Number in Louisiana
F0	Gale (40-72 mph)	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.	321
F1	Moderate (73-112 mph)	Moderate damage. Surface peeled off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.	698
F2	Significant (113-157 mph)	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.	292
F3	Severe (158-206 mph)	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.	132
F4	Devastating (207-260 mph)	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	18
F5	Incredible (261-318 mph)	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100-yards; trees debarked; incredible phenomena will occur.	2
		Total tornadoes in Louisiana, 1950-2002	1,463

Source: LOEP Hazard Profile

2.3.2. Historical Occurrences

Table 2-19 presents data on the 30 tornadoes that have hit St. Tammany Parish since 1950. These have been plotted on Map 2-10. Most caused no deaths or injuries and relatively minor property damage.

The exception is the November 1997 F2 that hit the Covington area. This twister injured 43 people and caused an estimated $3.5 million in damage.

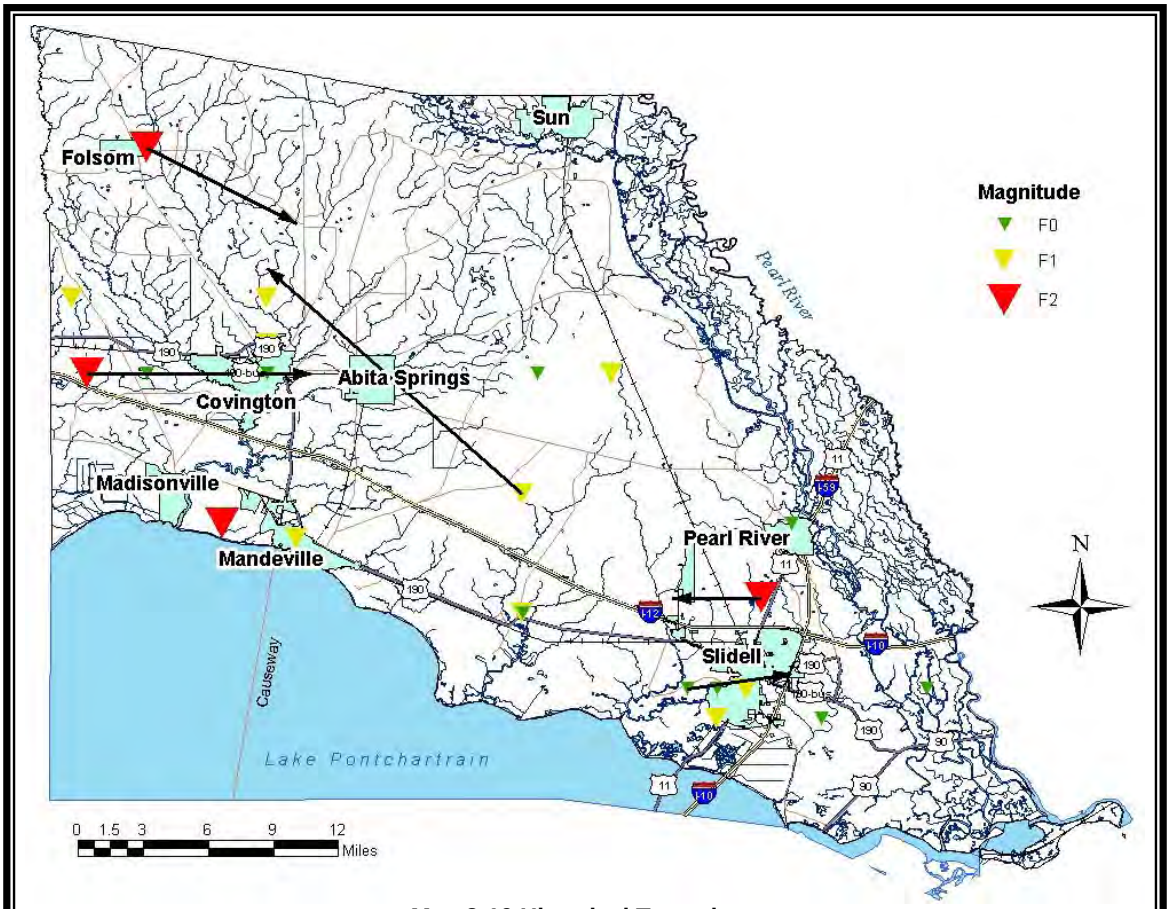
Table 2-19 Tornadoes in St. Tammany Parish

Location	Date	Magnitude	Deaths	Injuries	Damage	Width	Length
N/A	11/13/1957	F1	0	0	$250,000	100 Yards	2 Miles
N/A	9/11/1961	F2	0	2	$25,000	100 Yards	4 Miles
N/A	10/4/1964	F2	0	0	$25,000	183 Yards	1 Miles
N/A	7/8/1970	F1	0	0	$2,500	33 Yards	0 Miles
N/A	8/4/1974	F1	0	0	$2,500	33 Yards	1 Miles
N/A	11/20/1974	F2	0	0	$25,000	33 Yards	7 Miles
N/A	4/13/1980	F0	0	0	$0		0 Miles
N/A	10/7/1982	F0	0	0	$300	3 Yards	0 Miles
N/A	12/28/1983	F0	0	0	$25,000	50 Yards	3 Miles
N/A	12/11/1985	F0	0	0	$25,000	23 Yards	3 Miles
N/A	11/16/1987	F0	0	0	$25,000	10 Yards	0 Miles
N/A	4/2/1988	F1	0	0	$2,500,000	60 Yards	2 Miles
N/A	9/3/1988	F1	0	0	$25,000	20 Yards	0 Miles
N/A	9/16/1988	F0	0	0	$2,500	20 Yards	0 Miles
N/A	8/26/1992	F1	0	0	$25,000	20 Yards	14 Miles
N/A	8/26/1992	F1	0	0	$2,500	20 Yards	1 Miles
Slidell	4/14/1996	F0	0	0	$0	10 Yards	0 Miles
Slidell	6/29/1997	N/A	0	0	$0	0 Yards	0 Miles
Slidell	7/8/1997	N/A	0	0	$0	0 Yards	0 Miles
Covington	11/21/1997	F2	0	43	$3,500,000	200 Yards	9 Miles
Talisheek	11/21/1997	F1	0	0	$75,000	50 Yards	1 Miles
Slidell	1/7/1998	F0	0	0	$200	30 Yards	0 Miles
Mandeville	8/7/1998	N/A	0	0	$0	0 Yards	0 Miles
Pearl River	4/3/2000	F0	0	0	$0	30 Yards	0 Miles
Slidell	7/22/2000	F0	0	0	$0	20 Yards	0 Miles
Abita Springs	8/23/2000	F0	0	1	$10,000	30 Yards	2 Miles
Slidell	11/6/2000	F1	0	0	$65,000	30 Yards	1 Miles
Slidell	10/3/2002	F1	0	0	$25,000	30 Yards	0 Miles
Goodbee	11/11/2002	F1	0	0	$35,000	150 Yards	0 Miles
Covington	10/3/2002	F0	0	0	$25,000	25 Yards	0 Miles

Source: National Climatic Data Center

2.3.3. Area Affected Map 2-10 shows the historical tornadoes in St. Tammany Parish. The larger ones have their full path and direction plotted.

While it appears that no tornadoes have occurred in the northeastern portion of the parish, that may be a reflection of where the lower population densities are (the reported locations may be due to where the people are). Most meteorologists agree that outside of mountainous and very large urban areas, no place is safe from tornadoes. Therefore, the entire parish is considered susceptible to this hazard.



Map 2-10 Historical Tornadoes

Source: National Climatic Data Center

2.3.4. Frequency The history of tornadoes from 1950 to 2002 shows that Louisiana averages 24-29 tornadoes a year. Since 1975, the average has been more than thirty per year. Seventy percent of these have been at the F0 to F1 levels. More occur in the northern part of the state than in the south.

St. Tammany Parish has had 30 reported tornadoes since 1950 and 25 since 1972. Given the recent increase in activity (or in reports of funnel clouds), it can be concluded that the parish can experience one tornado each year.

2.3.5. Threat to People While the majority of the historical tornadoes have produced little damage and few injuries, there have been several violent ones. Between 1950 and 1994, Louisiana had 134 deaths and 2,169 injures from tornadoes, ranking it 13th and 16th in the nation, respectively.

Table 2-20 shows the variation in tornado deaths from year to year. It notes that most people killed by tornadoes are indoors. The number of people who live in mobile homes is far smaller than the number who live in permanent homes, however they have practically the same number of deaths. One of the tornadoes that were formed by Tropical Storm Bill touched down at a mobile home park and injured 4 people.

Table 2-20 Tornado Fatalities in the United States

Year	Vehicle	Permanent Home	Mobile Home	Other	Total
1995	4	15	8	3	30
1996	2	8	14	1	25
1997	3	38	15	11	67
1998	16	46	64	4	130
1999	6	39	36	13	94
2000	3	6	18	2	29
2002	3	15	17	5	40
Totals	37	167	172	39	415

Source: National Weather Service

The major health hazard from tornadoes is physical injury from flying debris or being in a collapsed building or mobile home. Based on national statistics for 1970 – 1980, for every person killed by a tornado, 25 people were injured and 1,000 people received some sort of emergency care.

Within a building, flying debris or missiles are generally stopped by interior walls. However, if a building has no partitions, any glass, brick or other debris blown into the interior is life threatening. Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged.

2.3.6. Property Damage Structures within the direct path of a tornado vortex are often reduced to rubble. The damage caused by high winds, pressure and flying debris is discussed in the section on hurricanes. Tornadoes have even greater wind forces.

Structures adjacent to the tornado's path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds. It is here, adjacent to the tornado's path where the building type and construction techniques are critical to the structure's survival. Although they strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Mobile homes,
- Homes on crawlspaces (more susceptible to lift), and
- Buildings with large spans, such as airplane hangers, gymnasiums and factories.

In 1999, FEMA conducted an extensive damage survey of residential and non-residential buildings in Oklahoma and Kansas following an outbreak of tornadoes on May 3, 1999, which killed 49 people. The assessment found

- The failure for many residential structures occurred where the framing was attached to the foundation or when nails were the primary connectors between the roofing and the walls. A home in Kansas was lifted from its foundation where the addition of nuts to the bolts anchoring the wood framing to the foundation may have been all that was needed to have kept this from happening.
- Roof geometry also played a significant role in a building's performance.
- Failure of garage doors, commercial overhead doors, residential entry doors or large windows caused a significant number of catastrophic building failures.
- Manufactured homes on permanent foundations were found to perform better than those that were not on solid walls.

Infrastructure damage is usually limited to above ground utilities, such as power lines.

2.4. Wildfires

2.4.1. The Hazard Wildfires are uncontrolled fires that spread through vegetation, such as forests or grasslands. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the area for miles around. Wildfires are a natural process, vital to restoring appropriate vegetation to an area. They are a natural hazard when they threaten built up areas.

People start more than four out of every five wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires.

Source: cnn.com

Wildfire behavior is based on three primary factors, fuel, topography, and weather. The type, and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. Topography affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels. Fire moves faster in hilly areas and up steep slopes.

Weather affects the probability of wildfire and has a significant effect on its behavior. Areas that have experienced prolonged droughts are at the highest risk of wildfires. Temperature, humidity and wind (both short and long term) affect the severity and duration of a fire.

2.4.2. Historical Occurrences The state of Louisiana has experienced more than 37,000 wildfires during the years 2000 – 2002. The year 2000 was a drier year and suffered 3 – 4 times more fires than 2001 and 2002. Table 2-21 shows when they occurred during those years. It can be seen that late summer is the time when they are most likely to occur.

Since 1980, St. Tammany Parish has experienced an average of 300 – 400 reported wildfires each year. This number has generally declined from a high of over 800 in 1981. The number of acres burned has also declined, from a high of 15,000 in 1981 to an average of 4,000 over the last 10 years.

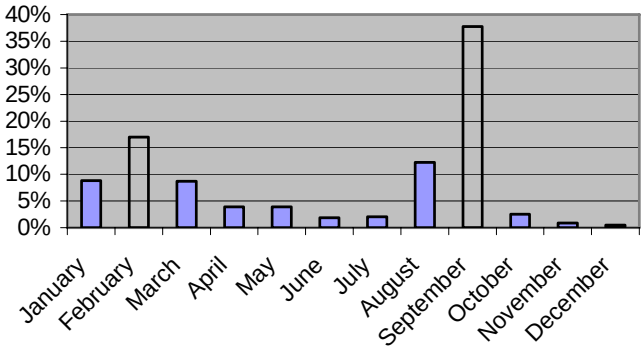
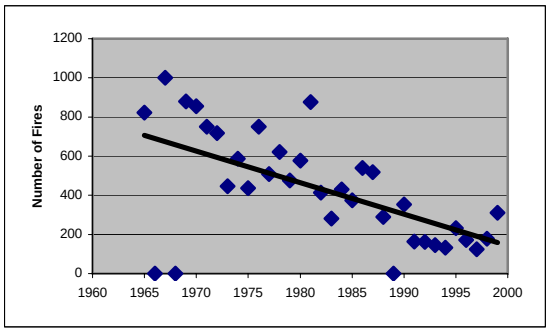
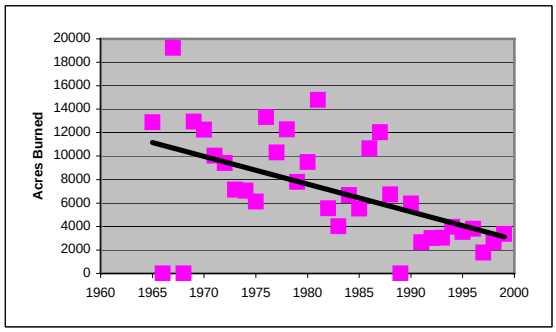


Table 2-21 Time Distribution of Wildfires, 2000 – 2002

Source: LOEP Hazard Profile

Table 2-22 Parish Wildfire History





Source: Louisiana Office of Forestry

Table 2-22 provides encouraging data: both the number of wildfires in the Parish and the size of the areas burned have gone done over the last 40 years. The trend line shows fewer than 200 fires now, down from 700 a year in the 1960's More detailed numbers are available on fires in the Big Branch Marsh National Wildlife Refuge. Their numbers show that the acreage of the prescribed burns exceeds that of the wildfires, an indication that good forestry management is being practiced.

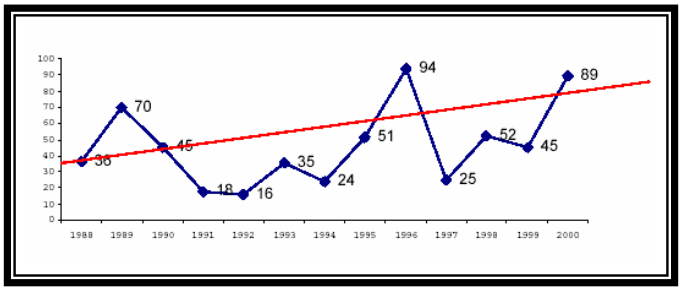
2.4.3. Area Affected The primary areas affected by wildfires are the forests. Sixty-five percent of St. Tammany Parish is covered in timber. Areas in forest and agriculture are shown in green on the existing land use map in Chapter 1, Map 1-4.

While loss of timber is a problem, the real hazard is when wildfires threaten developed areas. As more development moves into and next to forested areas, the hazards to people and property increases. The major areas exposed to the wildfire hazard are the homes and subdivisions that are located in what is called the urban-wildland interface.

2.4.4. Frequency Based on the experiences of the last 10 years, St. Tammany Parish can expect 300 – 400 wildfires each year. The majority of them should be in areas set aside as forests, such as the wildlife refuges. The minority will be in areas where fires can threaten people and buildings.

2.4.5. Threat to People Fires pose an obvious threat to life and safety. However, there have been no reported deaths or injuries from wildfires in St. Tammany Parish.

2.4.6. Property Damage While people can get out of the way of a fire, buildings can't. Even though the number of wildfires is decreasing, the number of buildings damaged by them is increasing. The red line in the chart below shows the general trend in the state since 1988. This is primarily due to the increased number of buildings located in or adjacent to rural forested areas.



2.5. Drought

2.5.1. The Hazard Drought is a period of less than usual precipitation. Its duration and severity are usually measured by deviation from norms of annual precipitation and stream flows. Although it has relatively high levels of average annual rainfall, Louisiana has had droughts, especially in the northern part of the state.

There are four classes of drought, based upon what is impacted by the shortage of water:

- Meteorological Drought: Less precipitation than an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Hydrologic Drought: Less stream flows and reservoir, lake, and groundwater levels.
- Agricultural Drought: A reduction in soil moisture enough to affect plant life, usually crops.
- Socioeconomic Drought: A reduction in water supply to the extent that demand exceeds the supply.

2.5.2. Historical Occurrences History shows a relationship between southern Louisiana precipitation and the establishment of La Niña weather patterns. La Niña, characterized by unusually cold ocean temperatures in the Pacific, can bring abnormally warm and dry weather conditions to Louisiana. During about 80% of past significant La Niña occurrences, winter and spring rainfall has been below normal.

This pattern was seen during the last dry spell in the State, 1998 to 2000. The year 2000 was the driest winter in over 100 years (and the period of the most wildfires during the last 20 years). In September 2000, the Parish was declared a disaster area by the Secretary of Agriculture in order to make farmers eligible for USDA disaster assistance.

2.5.3. Area Affected The entire parish can affected by drought.

2.5.4. Frequency There is no commonly accepted return period or frequency for defining the risk from droughts like there is for flooding and other hazards. The State's hazard profile selected the time when stream flow per square mile of drainage area is less than 2 cubic feet per second.

> "The July to January mean monthly flow with non-exceedance probability of 0.05 was selected as the threshold to characterize hydrologic drought. The July to January mean monthly stream flow will be less than this value, on average, once in 20 years."

In other words, using the state's definition, the frequency of a drought is once in 20 years, or 0.05.

2.5.5. Threat to People Unlike other hazards, droughts do not happen quickly. They evolve over time as certain conditions are met and are spread over a large geographical area. While they don't kill or injure people outright, they do have serious consequences, including:

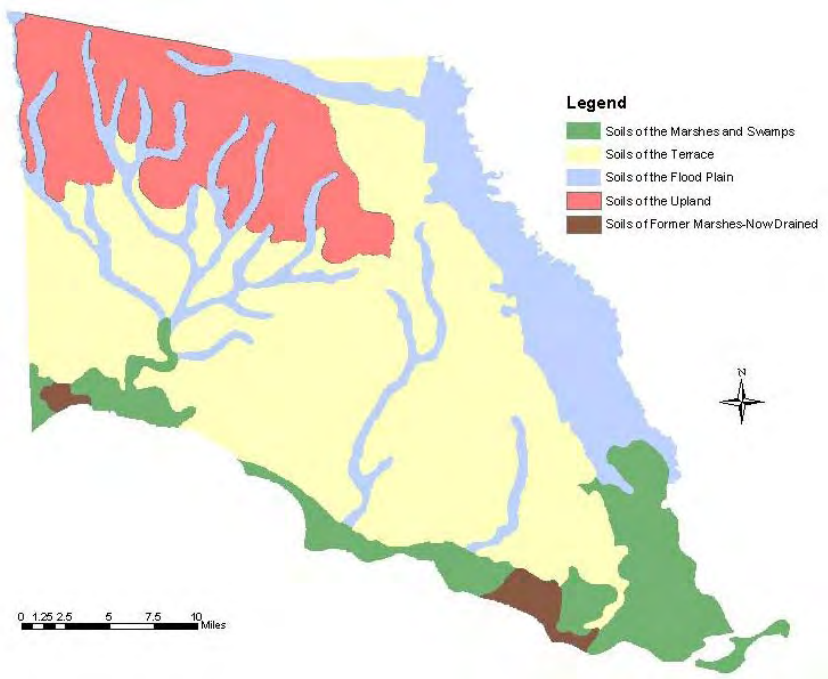
- Reduced water supply for drinking and domestic use
- Reduced water supply and pressure for fire fighting
- Reduced water for livestock and farming
- Reduced capacity of hydroelectric power generators
- Reduced stream flows for navigation and recreation
- Reduced water quality

2.5.6. Property Damage Drought does not directly damage structures and other human development. It does increase the risk of damage by fire, especially in the urban-wildland interface.

In areas with expansive soils, drought can shrink the soils under foundations. The result may crack walls and floors or even undermine supports. Out of the 250,000 homes built each year on expansive soils, 10% sustain significant damage during their useful lives, some beyond repair, and 60% sustain minor damage. Similar damage can occur to roads and bridges.

The effects of expansive soils are most prevalent when prolonged periods of drought are followed by long periods of rainfall. Houses and small buildings are impacted more by expansive soils than larger buildings. Large buildings are not as susceptible because their weight counters pressures from soil swelling. The 2000 drought caused cracks in levees. However, they were not considered threatening to the stability of the levees.

According to the Soil Survey of St. Tammany Parish, there is only one soil type where the shrink-swell potential is "high" or "very high." The Harahan soil series are located in marshes that have been drained. They are shown as the two dark brown areas on the Lakeshore in Map 2-11. These areas were drained for development. While the sites are no longer in a wetland, they are subject to the hazard of expansive soils.



Map 2-11 Major Soil Types

Source: Soil Survey of St. Tammany Parish, Louisiana

2.6. Fog

2.6.1. The Hazard Fog is a cloud that is on the ground. Fog forms once evaporation into the air results in super saturation, usually because the ground surface is very wet and the air is cooler. Fog is common in situations over water or where a daytime shower saturates the soil, vegetation and boundary layer and then skies clear in the evening into the night hours.

2.6.2. Historical Occurrences Fog is not a hazard so severe or widespread that there are Weather Service records of its occurrence. However, it can be a major problem on the Causeway. Since January 1998, fog conditions were bad enough to close the bridge to traffic 59 times. These incidents are shown in the graph in Table 2-23.

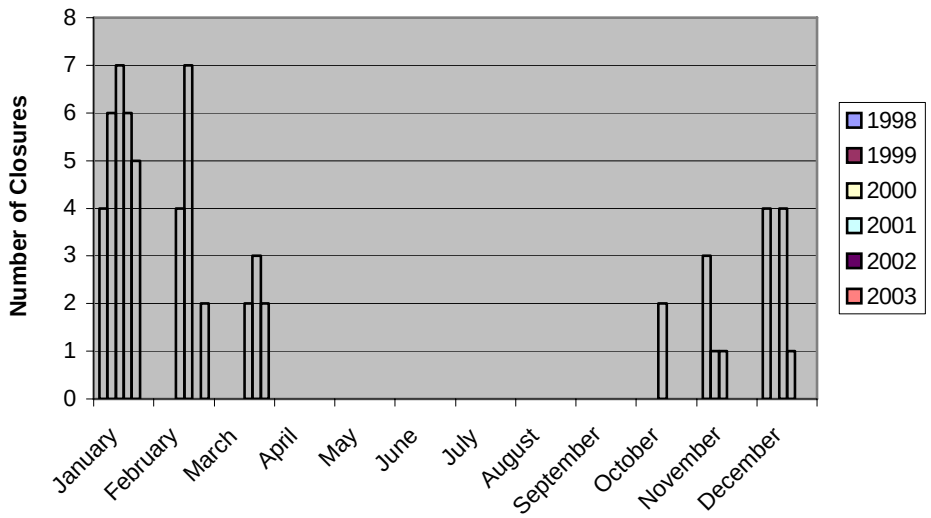


Table 2-23 Causeway Closures due to Fog

Source: Lake Pontchartrain Causeway Commission

Table 2-23 shows that fog on Lake Pontchartrain is a problem during the colder months. The most closures were in 2000. During the six year period, fog was bad enough to close the Causeway an average of 10 times. Data available for the last three years show that there were another 20 fog incidents each year that were not severe enough to close the bridge. They follow the same time pattern shown in Table 2-23.

2.6.3. Area Affected The previous section focuses on the Causeway because that is where the information is readily available. The entire parish is affected, although fog is really a hazard only on roads, airports, and other transportation routes. The Gulf Coast has a higher level of fog occasions than most of the rest of the country.

2.6.4. Frequency There are no data available for the frequency of fog days for the parish as a whole. Based on Table 2-23, fog will be bad enough to be a problem on the roads to New Orleans on the average of 30 times a year.

2.6.5. Threat to People Fog is a major nuisance to travelers. Whether driving or flying, fog results in travel delays and in some cases cancellations. Fog has had deadly consequences:

- In April 1916, a freight train ran into the rear end of another train in Slidell, killing two trainmen.
- In November 1969, a small plane ran out of fuel on its way to the Slidell airport. The pilot tried to land nearby, but did not see the trees because of the fog. The plane was totaled.
- March 21, 1987: Four people were killed and 35 were injured on the twin spans in a series of chain-reaction accidents involving 49 vehicles.
- In September 1989, another small plane hit trees as it attempted to land at the Slidell airport.
- Feb. 9, 1990: Six vehicles were damaged and four people were injured in three separate accidents on the U.S. 11 bridge.
- On December 31, 1996, fog on the Interstate 10 bridge was deemed the cause for series of accidents that involved 100 cars, trucks and buses. One woman was killed and 24 injured, two critically. The twin spans were closed for most of the day.
- On January 14, 1998, the Times-Picayune reported "A speeding pickup truck hit the rear of an 18-wheeler early Tuesday on the fog-covered Interstate 10 twin spans, causing a fiery four-vehicle smashup that left the pickup driver's passenger dead and the highway's eastbound lanes closed for almost nine hours."

In the two cases involving airplanes, the accident reports put the blame on pilot error. The 1989 report stated "Probable Cause: The pilot in command's disregard of the weather information provided during two briefings and his decision to continue VFR flight into IMC conditions."

2.6.6. Property Damage The primary threat to property is damage to vehicles caused by collisions when traveling in fog.

2.7. Earthquakes

2.7.1. The Hazard Earthquakes are one of nature's most damaging hazards. Earthquakes, and the potential damage from earthquakes, are more widespread that people realize. Earthquakes are caused by the release of strain between or within the Earth's tectonic plates. The severity of an earthquake depends on the amount of strain, or energy, that is released along a fault or at the epicenter of an earthquake. The energy released by an earthquake is sent to the earth's surface and released.

There are several common measures of earthquakes, including the Richter Scale and the Modified Mercalli Intensity (MMI) scale. The Richter Scale is a measurement of the magnitude, or the amount of energy released by an earthquake. Magnitude is measured by seismographs. The Modified Mercalli Intensity is an observed measurement of the earthquake's intensity felt at the earth's surface. The MMI varies, depending on the observer's location in relation to the earthquake's epicenter.

Table 2-24 Earthquake Measurement Scales

Richter	Mercalli	Felt Intensity
0-4.3	I	Not felt except by a very few people under special conditions. Detected mostly by instruments
	II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
	III	Felt noticeably indoors. Standing automobiles may rock slightly.
4.3-4.8	IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
	V	Felt by nearly everyone. Many People are awakened. Some dishes and windows are broken. Unstable objects are overturned.
4.8-6.2	VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
	VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction,
6.0-7.3	VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.
	IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
	X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Landslides occur on steep slopes.
7.3-8.9	XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
	XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: *Multi-Hazard Identification and Risk Assessment*

An earthquake's intensity depends on the geologic makeup of the area and the stability of underlying soils. The effects of earthquakes can be localized near its epicenter or felt significant distances away. For example, a 6.8-magnitude earthquake in the New Madrid Fault in Missouri would have a much wider impact than a comparable event on the California Coast. The thick sandstone and limestone strata of the central United States behave as "conductors" of the earthquake's energy, and tremors can be felt hundreds of

miles away. By contrast, the geology of the West Coast allows the energy to be dissipated relatively quickly which keeps the affects of the earthquake more localized.

Earthquakes can trigger other types of ground failures which could contribute to the damage. These include landslides, dam failures, and liquefaction. In the last situation, shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a special problem in floodplains where the water table is relatively high and the soils are more susceptible to liquefaction.

Although Louisiana lies in an area of low seismic risk, a number of earthquakes have occurred in the State over the last 200 years. The more severe earthquakes are related to the New Madrid seismic zone to the north of Louisiana. Most of these earthquakes were of low magnitude and occurred infrequently.

The famous 1812 New Madrid quake was felt in New Orleans. A repeat of that severe an incident is predicted to produce MMI of III or IV in southern Louisiana. The Louisiana Geological Survey reports that the "New Madrid seismic zone remains the area most likely to produce earthquakes that could affect Louisiana."

2.7.2. Historical Occurrences There are no local records of earthquakes. Here are reports of the few that have been closest to St. Tammany Parish.

The largest earthquake to have occurred in Louisiana, was centered at Donaldsonville, about 60 miles west of New Orleans at 6:17 a.m. on October 19, 1930. Maximum intensity reached MMI VI at Napoleonville, where the entire congregation rushed from a church, as the entire building rocked noticeably. Intensity V effects were noticed at Allemands, Donaldsonville, Franklin, Morgan City, and White Castle, where small objects overturned, trees and bushes were shaken, and plaster cracked. The total felt area was estimated at 15,000 square miles.

The Louisiana quake closest to St. Tammany Parish was on November 6, 1958. This MM Intensity IV earthquake was confined to an area within a five- to seven-mile radius of downtown New Orleans. The assigned MM Intensity IV is based on reports of maximum effects as windows shook and doors rattled

On November 19, 1958, a local earthquake in the Baton Rouge area shook houses and rattled windows. Scores of residents telephoned the Weather Bureau, Civil Defense, police and radio stations. The shock was also felt in Baker and Denham.

2.7.3. Area Affected The entire parish would be affected by an earthquake.

2.7.4. Frequency Based on the area's lack of experience with earthquakes, the odds of one striking St. Tammany Parish in any given year would be less than 1% (0.01).

2.7.5. Threat to People Approximately 1,600 people have been killed by earthquakes in the US since colonial times, 1,000 of them were in California and 700 of those were in the 1906 San Francisco quake. The single most common cause was collapse of a building.

Other threats to people include collapsing roads and bridges, flooding from dam breaches, fires from ruptured gas lines, and release of hazardous chemicals from broken storage tanks or trucks.

2.7.6. Property Damage All of the earthquakes that occurred in Louisiana since 1843 were of low magnitude, resulting mostly in limited property damage – i.e., broken windows, damaged chimneys, and cracked plaster.

2.8. Hailstorms

Thunderstorms can bring hail

2.8.1. The Hazard Hailstones are ice crystals that form within a severe thunderstorm. Extreme temperature differences from the ground upward produce strong updraft winds that cause ice formation. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation.

The size of hailstones is a direct function of the severity and size of the storm. High velocity updraft winds keep hail in suspension in thunderclouds. Hailstorms generally occur more frequently during the late spring and early summer. The hotter the Earth's surface, the stronger the updraft will be. Higher temperatures relative to elevation result in increased suspension time, allowing hailstones to grow in size.

2.8.2. Historical Occurrences National Weather Service records show 40 hailstorms in St. Tammany Parish over the last 20 years. Seven of them had hail as large as 1.75 inches and one (May 24, 1988) had hailstones up to 3 inches. The average was 1.1 inches in diameter. These storms are plotted on Map 2-12.

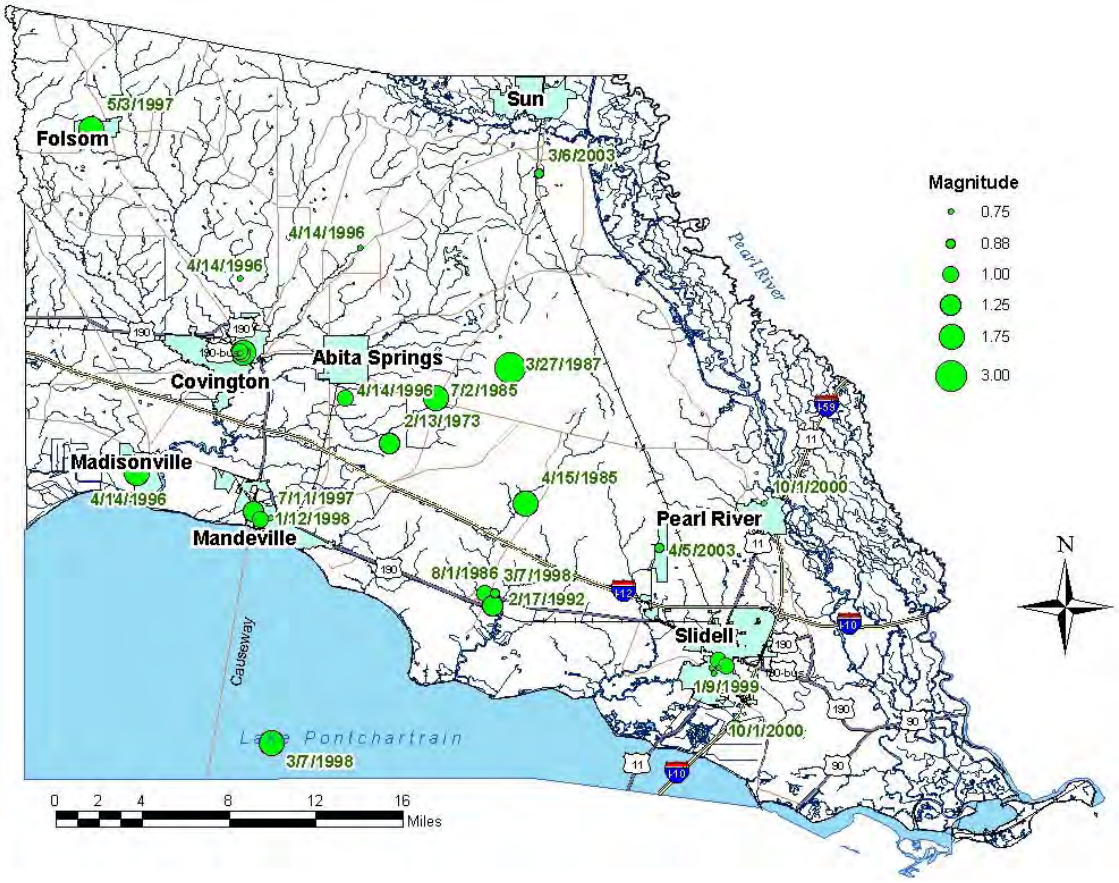
The Institute for Building and Home Safety, an insurance organization, identified the January 23, 2000, storm in New Orleans as the eighth most damaging storm in the nation in the period from 1994 to 2000. Ranging from dime to golf ball-size, the hail damaged roofs, windows, and vehicles, resulting in nearly 42,000 homeowner and 37,500 auto insurance claims at an estimated cost of $353 million.

2.8.3. Area Affected As seen in Map 2-12, hailstorms can occur anywhere in the Parish.

2.8.4. Frequency The State's Hazard Profile reports that between 1955 and 2002, Louisiana experienced 792 days with hailstorms, an average of 17 storms annually. It states that there is a 0.16% probability of hail of any size in any year in St. Tammany Parish.

2.8.5. Threat to People Hail rarely causes loss of life, although large hailstones can cause bodily injury.

2.8.6. Property Damage Significant property damage does not result until hailstones reach 1.5 inches in diameter, which occurs in less than half of all hailstorms. When hail hits, it can damage cars, shred roof coverings, and lead to water damaged ceilings, walls, floors, appliances, and personal possessions.



Map 2-12 Historical Hailstorms

Source: National Climatic Data Center

Hail can inflict severe damage to roofs, windows and siding, depending on hailstone size and winds. One study of insured losses in St. Louis found that 75% of the dollar damage was to roofing, 12% to awnings, 6% to exterior paint, 4% to glass and 3% to siding (*Hail Loss Potential in the US*, page 2).

As with tornadoes, mobile homes are at a high risk to damage from thunderstorms. Wind and water damage can result when windows are broken by flying debris or hail.

Hail can destroy long stemmed vegetation, such as wheat and corn crops. About 2% of United States crop production is damaged by hail each year. Hail from thunderstorms causes nearly $1 billion in property and crop damage each year.

Windows and cars are especially vulnerable to hail damage

Source: University of Nebraska website

2.9. Land Failure

2.9.1. The Hazard Land failure is a term that describes the combined effects of sea-level rise and land subsidence. Both of these geologic processes impact Louisiana in a similar manner, making it difficult to separate the effects of one from the other. The most prominent causes of sea-level rise are the melting of the Earth's glacial ice caps and sea floor spreading.

Subsidence refers to the gradual settling or sinking of the Earth's surface due to removal or movement of subsurface earth materials. Some principal causes of subsidence are compaction, underground mining, removal of groundwater, and sinkholes. In coastal Louisiana, large amounts of sediment are being deposited by the Mississippi River in a relatively short amount of time, causing the crust to compensate for the extra weight of the sediment.

Geology and soil types do not have much effect on subsidence rates. Other causes like human occupancy, buildings and infrastructure, oil and gas extraction, and lowering of the water due to groundwater extraction have much more of an effect. Human acceleration of natural processes through levying rivers, draining wetlands, dredging channels, and cutting canals through marshes exacerbates the subsidence problem.

Because it is difficult to separate the effects of subsidence and sea-level rise, a new approach to categorizing the hazard has been developed. A coastal vulnerability index (CVI) is determined based on rate of sea-level rise, coastal erosion, wave height, tidal characteristics, regional coastal slope, and coastal geomorphology. The CVI for the Louisiana coast is high to very high. Some portions rank very high for every factor with the exception of wave height. The main factors responsible for the high ranking, however, are geomorphology, coastal slope, and rate of relative sea-level rise.

The US Geological Survey estimates that the rate of sea-level rise in Louisiana is approximately 3.0 feet/century and the US EPA estimates that it is approximately 3.4 feet/century. There is little to suggest that these processes will cease to occur in the future, indeed rates may increase due to the naturally occurring sediment deposition. The highest rate of subsidence is occurring at the Mississippi River delta (3.5 feet/century). Subsidence rates decrease away from the delta in a northeast, northwest, and western direction.

A system of subsidence faults in southern Louisiana developed due to the extra weight from rapid sediment deposition from the Mississippi River. The system stretches across the southern portion of the State of Louisiana from Beauregard Parish in the east to St. Tammany Parish in the west, and includes every Parish to the south of this line.

There are three subsidence faults in the St. Tammany Parish area, known as the Goose Point, Causeway and Madisonville Faults. They are mostly under Lake Pontchartrain and generally parallel the lakeshore.

2.9.2. Historical Occurrences

Records show that the level of Lake Pontchartrain rose about 25 centimeters or 10 inches since 1931 (Table 2-25).

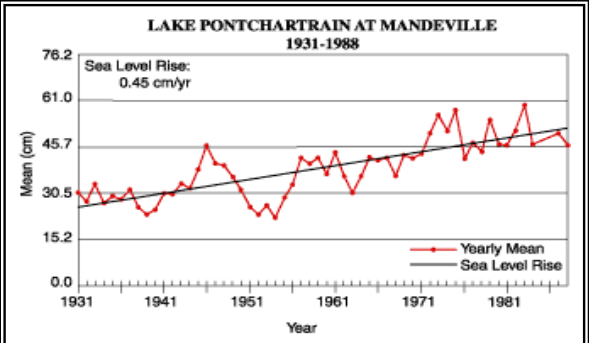


Table 2-25 Sea Level Rise at Lake Pontchartrain

Source: Lake Pontchartrain Basin Foundation

There are no single incidents or occurrences of land failure. It is a process. An acre of land along the coast disappears every 24 minutes.

Sea-level rise and land subsidence have not been identified as significant contributors to direct disaster damages in Louisiana. For the most part, sea-level rise and subsidence are two processes that are slow acting, so their effects are not as evident as sudden-occurrence hazards like earthquakes.

2.9.3. Area Affected Map 2-13 shows the Lake shoreline areas that have been lost due to erosion and/or subsidence.

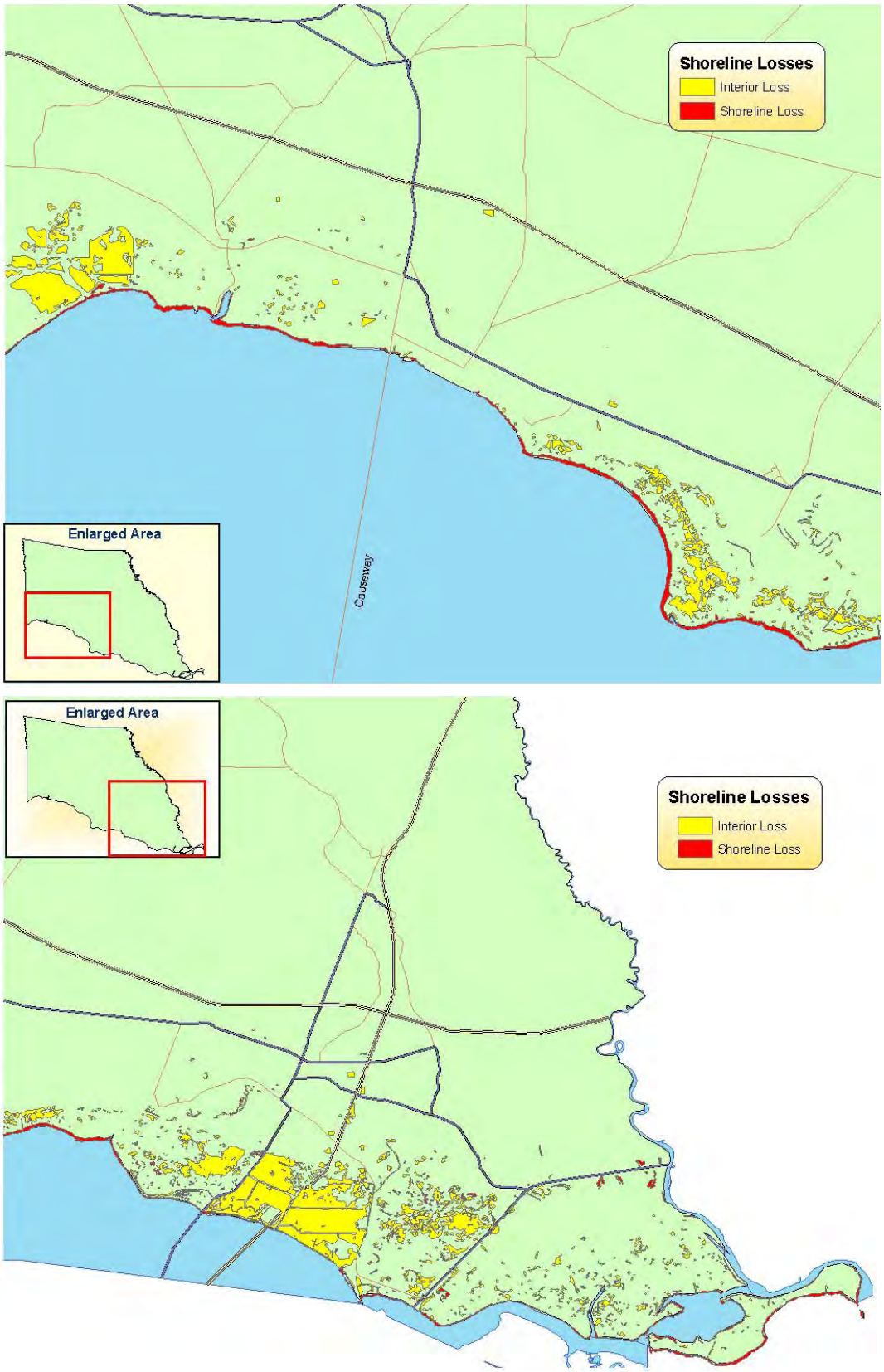
2.9.4. Frequency As noted under historical occurrences, there is no recurrence interval. Land failure is a constant process. Some shoreline loss is accelerated during tropical storms and hurricanes, which are discussed in section 2.1.

2.9.5. Threat to People Land failure does not present an immediate threat to life, safety or public health.

2.9.6. Property Damage The growth faults that affect the southern portion of the state mean very slow ground movement or fault creep. These faults pose a threat more to property than life. Over time, the land on each side of the fault line moves slowly in different directions (c. 1/10 foot per year). The results can be seen in the photo of the Goose Point Fault in chapter 3, section 3.11.

Sea level rise and subsidence along the Louisiana coast means that over time, there is less land between developed areas and water. The process means development will be more exposed to damage by storm surge and wetland vegetation will be more subject to saltwater intrusion or submergence.

Land and wetlands act as cushions during tropical storms and hurricanes. Less cushion means storm surges will reach farther inland and levees will have to be raised to maintain flood protection levels.



Map 2-13 Red Indicates Areas Lost due to Land Failure

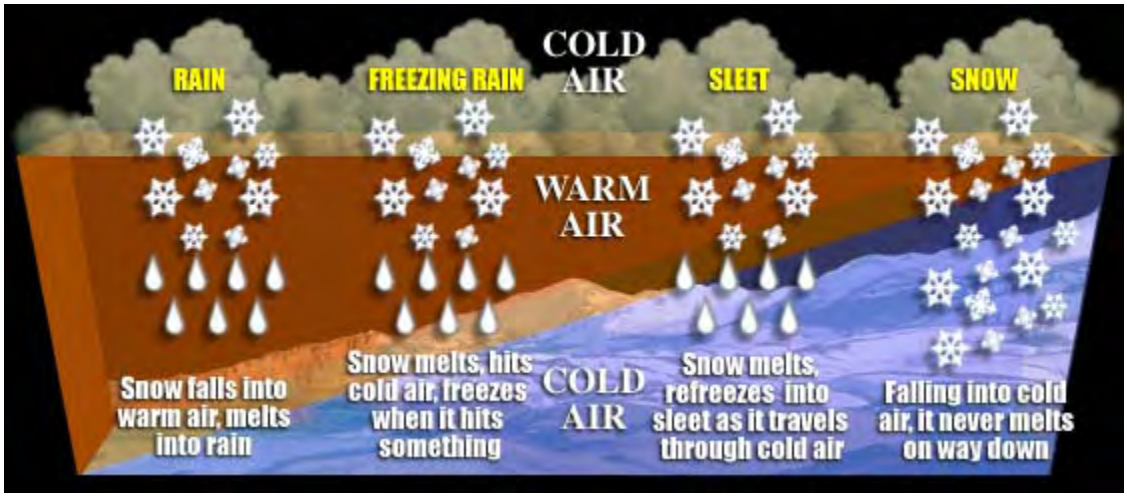
Note: Areas in yellow are loss of wetlands due to filling.
Source: University of New Orleans

2.10. Winter Storm

2.10.1. The Hazard Winter storms can occur as heavy snowfalls, ice storms or extreme cold temperatures. Winter storms can occur as a single event or they can occur in combinations which can make an event more severe. For example, a moderate snowfall could create severe conditions if it were followed by freezing rain and subsequent extremely cold temperatures.

Winter months in southern Louisiana have average seasonal temperatures in the low 50s. Normal minimum daily temperatures in Covington are 42° in December, 40° in January and 43° in February. While average temperatures remain above freezing, 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.

An ice storm occurs when freezing rain falls from clouds and freezes immediately upon impact. Freezing rain is found in between sleet and rain. It occurs when the precipitation falls into a large layer of warm air and then does not have time to refreeze in a cold layer (near or below 32°F) before it comes in contact with the surface which is also near or below 32°F, as illustrated below.



Source: University of Nebraska website, http://hpccsun.unl.edu/nebraska/icestorms.html

2.10.2. Historical Occurrences Ice storms hit northern Louisiana in February 1994 and December 2000. In 1994, ice accumulated 2 to 3 inches thick. When combined with gusty winds, it snapped power lines, power poles, and trees. Over 100,000 people were without electrical power for several days, and more than 256,000 acres of forest were damaged.

The 2000 ice storm caused similar damage. One person was killed and over 250,000 people were without power. About 30 transmission lines atop “H”-shaped steel towers were snapped due to the weight of the ice, and numerous traffic accidents occurred across

the State. With millions of dollars in damage and one death attributed to the storms, the State received a presidential disaster declaration.

Winter storms are not as severe in southeast Louisiana. The Slidell Weather Service Forecast Office reports 2 inches of snow on February 12, 1988, and March 12, 1993.

On January 1, 2002, rain, sleet and snow fell to the north and west of Lake Pontchartrain. Eventually one-half to two inches of snow accumulated, resulting in automobile accidents on icy roadways and the closing of some bridges.

2.10.3. Area Affected The entire parish is susceptible to winter storms. Their effects may be moderated in areas closest to Lake Pontchartrain.

2.10.4. Frequency "Freeze" warnings for farmers are not unusual, but they do not signify a winter storm. According to the National Climatic Data Center, the entire state of Louisiana is in the lowest category of probable snow depth – 0 to 10 inches of snow depth with a 5% chance of being equaled or exceeded in any given year. The chance of a winter storm that is considered severe (considering the area's housing conditions and lack of emergency equipment) is 5% (.05).

2.10.5. Threat to People Winter storms bring the following two types of safety hazards:

- Weather related hazards, including hazardous driving and walking conditions and heart attacks from shoveling snow.
- Extreme cold, from the low temperatures, wind chill, and loss of heat due to power outages.

About 70% of the injuries caused by snow and ice storms result from vehicle accidents and 25% occur to people caught out in the storm. Certain populations are especially vulnerable to the cold, including the elderly, the homeless, and lower income families with heating problems. House fires occur more frequently in winter due to lack of proper safety precautions when using alternate heating sources (e.g., unattended fires and improperly placed space heaters).

2.10.6. Property Damage Ice causes more property damage than snow. It can overload trees, limbs and utility lines. As a result of severe ice storms, telecommunications and power can be disrupted for days.

With today's energy consciousness, buildings are much better insulated than they were 50 years ago. Cold weather does not have a major impact on buildings.

Prolonged periods of snow and cold temperatures can be damaging to agriculture. Fruit trees can be damaged by severe cold or ice accumulation, and livestock may freeze or be more susceptible to disease.

2.11. Dam failure

2.11.1. The Hazard Dams are made to hold back large amounts of water. If they fail or are overtopped, they can produce a dangerous flood situation because of the high velocities and large volumes of water released. A break in a dam can occur with little or no warning on clear days when people are not expecting rain, much less a flood. Breaching often occurs within hours after the first visible signs of dam failure, leaving little time for evacuation.

Dam failures are usually caused by either structural problems with the dam or by hydrologic problems. Structural problems include seepage, erosion, cracking, sliding and overturning that are a result of the age of the dam or lack of maintenance. Hydrologic problems typically occur when there is excessive runoff due to heavy precipitation. A dam failure can occur if the dam has to impound (hold back) more water than it was designed to, or if the spillway capacity is inadequate for the amount of water needing to pass downstream.

A dam can suffer a partial failure or a complete failure, but the potential energy of the water stored behind even a small dam can cause loss of life and great property damage downstream. The following factors influence the impact of a dam failure:

- Level of failure (partial or complete)
- Speed of failure (sudden or gradual)
- Amount of water released
- Nature of the development or infrastructure located downstream.

Dams are classified under three levels of hazard:

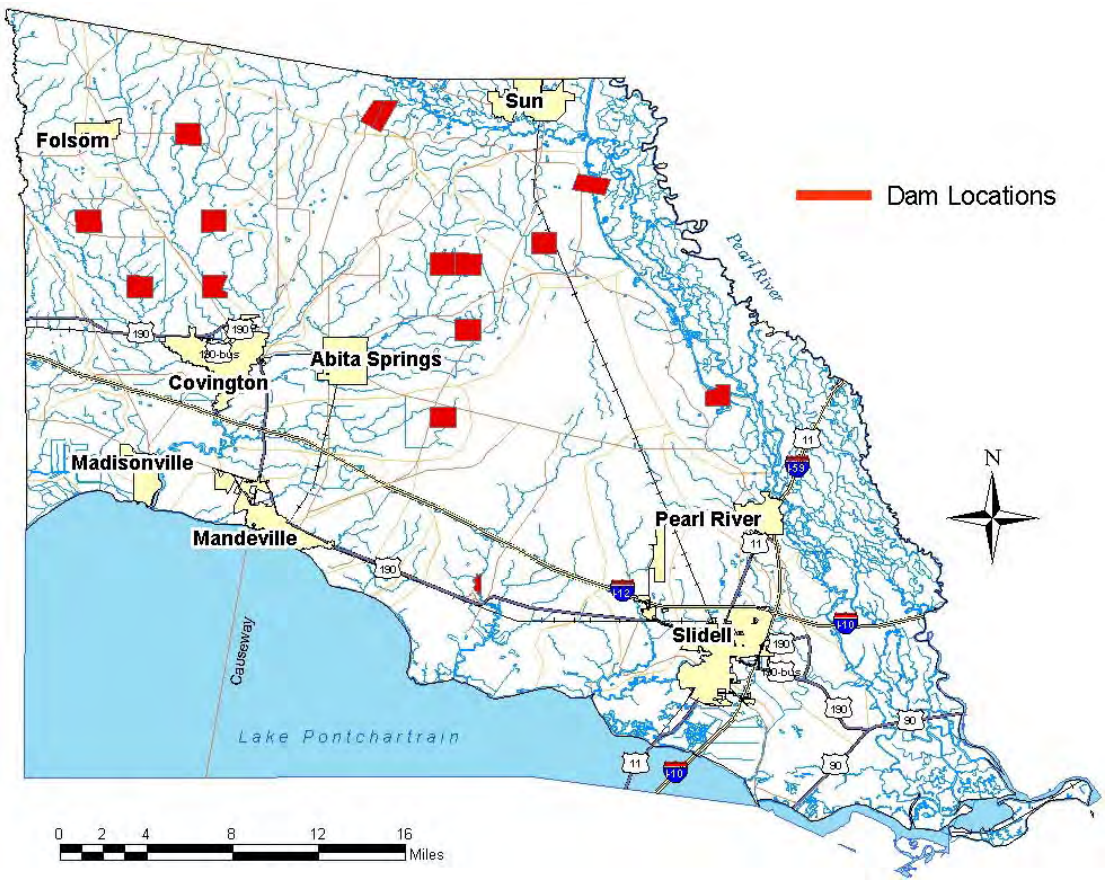
- High hazard: failure will probably cause loss of human life.
- Significant hazard: failure results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. These are usually in rural areas but could be located in areas with population and significant infrastructure.
- Low hazard: failure results in no probable loss of human life and low economic and/or environmental losses. Most losses from a failure would be limited to the owner's property.

2.11.2. Historical Occurrences There have been no significant dam failures in Louisiana. There was one incident in 1985. Park managers at the Cotile Lake Dam in Rapides Parish reported seepage due to sand and gravel deposits that displaced concrete slabs. There was no dam failure or controlled breach reported in this incident.

2.11.3. Area Affected There are 16 dams in St. Tammany Parish inventoried by the Department of Transportation and Development Dam Safety Program. All but two are considered "low hazard." The two on the Pearl River Canal are rated as "significant hazard." For security reasons, their exact sites are not provided. Their general locations are plotted on Map 2-14.

Dam ownership can be an indicator of how well they are maintained. Generally state and federal dams are larger and better maintained.

- 9 St. Tammany Parish dams are listed as owned by individuals
- 4 dams are owned by corporations or homeowners associations
- 2 locks and dams on the Pearl River Canal are owned by the US Army Corps of Engineers
- 1 dam at the Huey P. Long Fish Hatchery is owned by the state Department of Wildlife and Fisheries.



Map 2-14 St. Tammany Parish Dams

Source: Louisiana Department of Transportation and Development

2.11.4. Frequency Based on the absence of any experience with dam failure in the state, the odds of one occurring and causing damage in St. Tammany Parish would be less than 1% (0.01).

2.11.5. Threat to People Because of their sudden onset, dam failures have the potential to kill people caught unawares. Between 1960 and 1997, there have been at least 23 dam failures with one or more fatalities. There were 318 deaths as a result of these failures. However, the development downstream of the dams in St. Tammany Parish do not indicate a high level of exposure to life safety problems.

The most important factor for protecting people is a timely warning. Dams are often not very visible, so most people are not aware of the hazard and may not understand the need to evacuate on a sunny day.

2.11.6. Property Damage The effects of a dam failure on property is similar to that of a flood, discussed in section 2.2.6. The one difference is that velocities are likely to be higher in a dam failure scenario, so the potential for property damage is higher in those areas immediately downstream of a dam.

2.12. Levee Failure

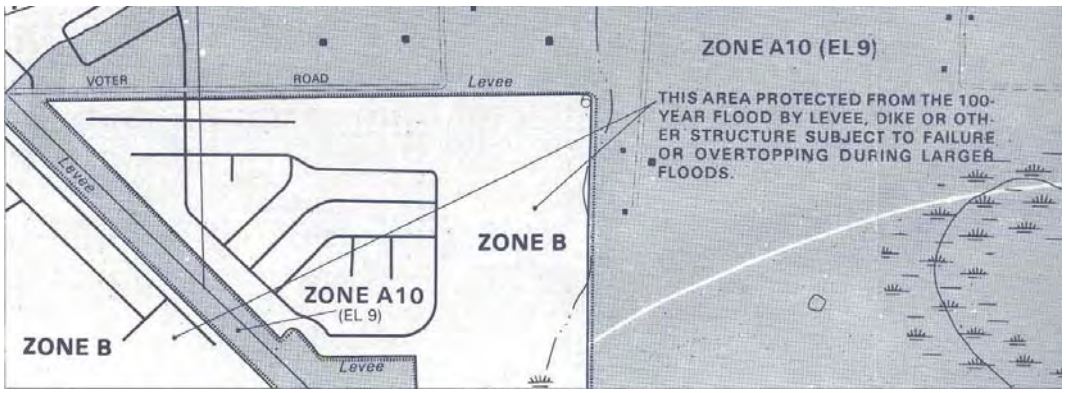
2.12.1. The Hazard For the purposes of this *Plan*, "levees" include floodwalls, seawalls and other barriers along bodies of water to protect an area from flooding. Also for the purposes of this *Plan*, levee failure includes overtopping, breach, or collapse of the levee. Technically, overtopping is not a "failure," it is simply a case of water going higher than the design protection level. However, the results are the same to the people and properties affected.

As with dam failure, the severity of levee failure depends upon the amount of development that would be affected by flooding. Some of the causes of levee failure are also similar to the causes of dam failures:

- Overtopping due to flood heights exceeding levee design protection elevation
- Flooding from upstream sources internal to the levee
- Erosion caused by embankment leaking or piping
- Erosion of the levee base caused by moving floodwaters
- Improper operation and maintenance, including failure to inspect and repair seepage problems

A levee failure may not be much of a hazard where the levee is small, people know it won't protect them from larger floods, and new construction takes the flood hazard into account. Levee failure can be a great hazard where the levee is large, people assume they will never be flooded, and no flood protection measures are taken for new construction. Examples of the damage wrought in this situation were seen during the 1993 flood on the Upper Mississippi and Missouri Rivers.

This hazardous situation is often the case where FEMA has mapped leveed areas as being outside the 100-year floodplain. Map 2-15 shows how these areas are marked on FEMA's Flood Insurance Rate Map (FIRM). Being outside the "A Zone," there are no Federal or State flood protection requirements for new construction.



Map 2-15 St. Tammany Parish Flood Insurance Rate Map showing an area protected by a 100-year flood levee.

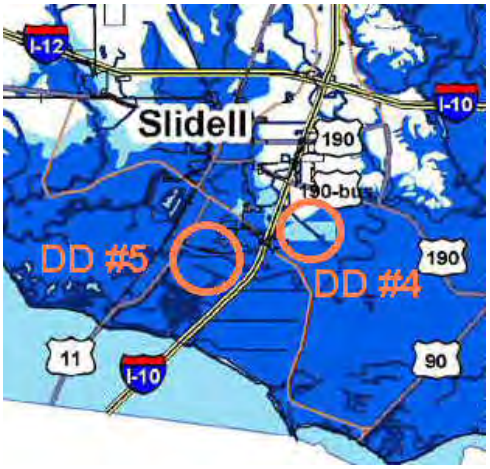
Source: Flood Insurance Rate Map, St. Tammany Parish

2.12.2. Historical Occurrences Levees have been overtopped or breached during flood events and non-flood events in Louisiana. A section of levee along the Mississippi River near Marrero, Louisiana, failed in a non-flood-related event. The failure was due to scouring and erosion of sand along the river bank.

The National Weather Service reported that during tropical storm Isidore on September 26, 2000, storm surge overtopped or breached a "small local levee system" in southern portions of Slidell causing water to flood several hundred homes.

An interesting case involves Jackson, Mississippi, upriver on the Pearl in 1982. The US Army Corps of Engineers had constructed levees in the 1960s to protect the town from flooding. The levees were overtopped in the 1979 flood, with some 40% of the damage being inflicted on buildings constructed after the levee was built.

2.12.3. Area Affected There are two subdivisions south of Slidell that are protected by substantial levees. They are located on Map 2-16. Kingspoint and Fox Hollow (the area also shown on Map 2-15) are protected by levees managed by Drainage District #4. To the southwest, Oak Harbor has a levee managed by Drainage District #5. There are approximately 1,500 homes in these two areas.



Map 2-16 Leveed areas

2.12.4. Frequency The two drainage districts' levees are sizeable. Drainage District #4's qualifies as protecting the area to the 100-year flood. It is assumed that the levees would overtop or fail during a 200-year flood. Therefore, the odds of levee failure is the same as the odds for a 200-year flood, or 0.005.

This levee is south of Slidell. It protects the Kingspoint subdivision to the right.

2.12.5. Threat to People Unlike dam failure, a levee failure should not come as a surprise. It will happen during high water when levee conditions would be monitored by the owning agency. Therefore, the area should not have a high level of exposure to life safety problems. The most important factor for protecting people is a timely warning. However, if people consider themselves safe from flooding and do not evacuate, then the results could be deadly.

2.12.6. Property Damage The effects of a levee failure on property is similar to that of a flood, discussed in section 2.2.6. The one difference is that velocities are likely to be higher where water rushes through the breach, so the potential for property damage is higher in those areas closest to the levee.

2.13. Termites

2.13.1. The Hazard Termites are small pale colored insects that live off of wood and wooden structures at or near the ground. These creatures are similar to ants as they both live in colonies, they both have workers that gather and collect food, and they both have a queen that is in charge of the colony. Queen termites can lay upwards of 10,000 eggs per year and the worker termites are responsible for maintaining and caring for these eggs.

Termites tend to live close to the ground and near areas of moisture and sources of food or wood. Their role in nature is to recycle wood. They can cause significant damage to any wooden structure if the conditions are favorable for a termite colony's development.

There are two types of termites that live in southeastern Louisiana: drywood termites and subterranean termites. Drywood termites live in the wood that they are ingesting and do not require soil and moisture.

Subterranean termites require soil and moisture in order to survive. They will bring the soil and moisture with them into the wood that they are infesting. Mud tubes are created and lead from the colony's home to the infested wood in order to supply the area with moisture and soil.

The Formosan termite is a species of the subterranean termite. Formosans are very aggressive. They have the largest colonies of any termites in North American and can cause extensive damage in a short time. To reach food and water, Formosan termites can chew through materials such as thin sheets of soft metals, rubber, stucco, and seals on water lines.

Formosan Termite

Source: LSU AgCenter

2.13.2. Historical Occurrence The Formosan termite was originally introduced into the New Orleans area and other coastal areas just after World War II. By the time it was identified in 1966, the insect was firmly entrenched into the local environment. Because this termite has no natural predators in the area, it is free to breed and spread without control.

Termite infections of structures have been devastating. The national estimates dealing with termite damage has risen from $750 million in 1988, to $2 billion by 1993. The estimate of losses for the state of Louisiana on a yearly basis is around $500 million, with $300 million of this being in the New Orleans area.

2.13.3. Area Affected The main concentration of termites occurs in southeastern Louisiana, specifically, those areas south of Interstates 10 and 12. Most of St. Tammany Parish is affected. The termite problem is expected to continue to spread throughout the parish and across the state.

2.13.4. Frequency The termite threat is a year-round issue. There is an annual peak between the months of April and June, with the heaviest concentration of swarms in May. The number of termites is dependent on the weather that occurred in the spring. Since 1989, there has been an increase in the number of swarms in the New Orleans metro area almost every year between 1989 and 1998.

2.13.5. Threat to People The greatest risk to people is safety around and in a structure or object that may have been damaged by a termite infestation. Termites can reduce the load bearing weight of support beams in houses and businesses, putting them at greater risk of having part or all of the structure collapse when force is applied. If termites have weakened a tree or pole, a slight wind could prove to be enough to push the pole over or remove a branch from the tree.

2.13.6. Threat to Property According to Louisiana State University's Agricultural Center, Formosan termites "can cause major structural damage to a home in six months and almost complete destruction in two years."

Termites, especially Formosan termites, will often infiltrate the building through a weakness in the foundation or at a location where the building comes into contact with soil. There have been recorded instances where a termite infestation has caused a house to split in half. An apartment complex was demolished 14 years after its construction due to the damage it had suffered.

Signs of subterranean termites

Indoors

- Earthen masses on door frames, edges of walls, floors, ceiling, stairs, skirting or other areas of the house
- Blistering of paint on windows, door frames and skirting
- Damp areas on walls
- Distortion of floor, window or door frames

Outdoors

- Large number of alates (winged termites) either inside or outside the house
- Mud tubes over foundation walls, piers and edges of concrete slabs
- Trees with earthen material near the base and on the bark
- Damaged fences, utility poles and landscaping timbers

Source: LSU AgCenter

2.14. Risk Summary

This chapter provides information on the 13 natural hazards that can impact St. Tammany Parish. In this chapter, data on the hazards are provided in terms of severity, historical occurrences, areas affected, frequency, and their threat to people and property.

While it is hard to compare different natural phenomena, a general summary can show their relative importance to the Parish. This is done in Table 2-26. For each hazard, the following information has been summarized from the discussions in the earlier sections of this chapter to convey the exposure presented to St. Tammany Parish for each hazard.

Areas Exposed: What part(s) of the Parish is subject to the hazard? This is discussed in the "Area Affected" section under each hazard.

Annual Chance: What are the odds of an occurrence in any given year? The chance is provided in terms of a factor between 0 (no chance) and 1.0 (100% chance of occurring in any year). More information on how the factor was derived can be found in the "Frequency" sections.

Threat to People: A relative measure of "high," "medium," or "low" based on the discussion in the section with the same name under each hazard. If more than one person was killed or 10 people were injured due to the hazard in recent years, it is rated as "high." If there were no recorded deaths or injuries lately, the threat is rated as "low."

Property Damage Potential: A relative measure of "high," "medium," or "low" based on the discussion under each hazard. This factors in the estimated damage per structure times the number of structures likely to be damaged by the hazard. For example, a tornado that will destroy 50 $100,000 homes produces $5 million in property damage, the same as a flood that causes $25,000 in damage to 200 homes.

Table 2-26 Hazard Risk Summary

Hazard	Areas Exposed	Annual Chance	Threat to People	Property Damage
2.1 Tropical storms/hurricanes	Entire Parish	0.83	High	High
2.2 Flooding	Floodplains	1.00	Med	High
2.3 Tornadoes	Entire Parish	1.00	High	High
2.4 Wildfires	Forests	1.00	Low	Med
2.5 Drought	Entire Parish	0.05	Low	Low
2.6 Fog	Roads, airport	1.00	Low	Low
2.7 Earthquake	Entire Parish	0.01	Low	Low
2.8 Hailstorm	Entire Parish	0.16	Low	Med
2.9 Land failure	Shoreline	1.00	Low	Low *
2.10 Severe winter	Entire Parish	0.05	Med	Low
2.11 Dam failure	Downstream of dams	0.01	Low	Med
2.12 Levee failure	Leveed areas	0.005	Med	Med
2.13 Termites	Entire Parish	1.00	Low	Med

* While land failure by itself does not cause much property damage in any given year, it does increase the potential for property damage by storm surge.

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Chapter 3. Vulnerability Assessment

Chapter 2 reviewed the hazards that face St. Tammany Parish. If they struck vacant land, there would not be much cause for concern. Because the parish has 200,000 residents and thousands of homes, businesses and critical facilities, the potential for damage and deaths can be high.

This chapter reviews how vulnerable St. Tammany Parish is to property damage, threats to public health and safety, and adverse impact on the local economy. The potential for property damage is measured in dollars. It accounts for how much is exposed to damage and the likelihood of damage occurring.

Except where noted, this assessment does not include Slidell, Covington or Mandeville, because those cities developed their own mitigation plans.

A four step process was followed to calculate the cost to St. Tammany Parish of the hazards reviewed in Chapter 2:

Step 1: Inventory appropriate categories of property subject to damage

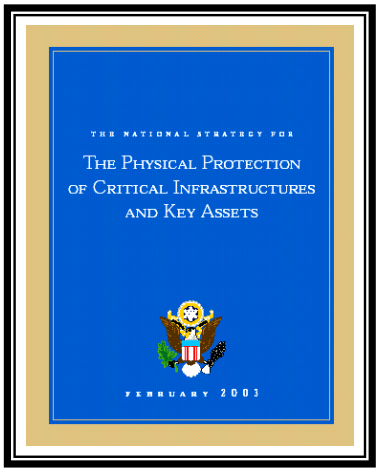
Step 2: Determine the cost of various levels of damage by the hazards

Step 3: Determine the exposure of the properties and people to hazard scenarios

Step 4: Calculate the impact, based on the exposure and the probability of occurrence

Sections 3.1 and 3.2 review the first two steps. Sections 3.3 – 3.15 describe the exposure for different scenarios for each hazard. They then and present tables with the resulting summary data for each hazard, followed by a narrative discussion of the estimated loss of life, injuries and impact on the economy from each hazard. Section 3.16 summarizes the findings.

3.1. Vulnerable Properties



In September 2003, the Parish Office of Emergency Preparedness (OEP) assembled a master list of critical infrastructure and key assets. The list was organized according to 11 categories used by the US Department of Homeland Security's 2003 publication, *The Physical Protection of Critical Infrastructures and Key Assets*. OEP added three more categories of "key assets."

A total of 568 facilities and assets in the entire Parish were identified by OEP. The categories are summarized in Table 3-1. They are oriented toward protecting the nation and its economy from terrorism. The Committee reviewed these categories and their subcategories in light of their exposure to damage and disruption by natural hazards.

For example, while banks and post offices have special roles in the national economy and can be prime targets for a terrorist, they do not have any greater exposure to damage by a natural hazard than other commercial structures. Damage to one or a few from a hurricane or tornado will not knock out the financial or shipping system they support. It was felt that if one bank or branch bank facility were damaged, people would go to another branch office.

There is a threshold where loss of a large number of these facilities, such as several hospitals or 10 or 20 fire stations, would reach a critical mass. There would be more than just a dollar loss to the community and the Parish. This impact is discussed under the threat to public health and safety and impact on the economy parts of sections 3.3 – 3.15.

As shown in Table 3-2, this review reduced the number of individual critical facilities from 568 for the entire Parish to 433 for this planning effort (plus power lines). The categories of agriculture, defense industrial base, banking, postal, and subcategories, such as libraries and museums, were dropped altogether, either because there are none in the Parish or they were not deemed critical to responding and recovering from a natural disaster (even though they may be terrorist targets).

Table 3-1 Critical Infrastructures and Key Assets

Property	Description	Parish
Agriculture and food	Centers that supply seed and feed and that handle harvested crops and food processing	0
Water	Centers for water supply, treatment and storage and wastewater treatment	56
Public health	Hospitals, health clinics, mental health facilities, nursing homes, blood-supply facilities, laboratories	25
Emergency services	Police and fire stations, emergency operations centers, and ambulance services	64
Defense industrial base	Defense industries, ports and shipping facilities	0
Telecommunications	Facilities that support telephone, television, radio and data transmission	12
Energy	Sites that generate, transmit and distribute electricity, natural gas, gasoline and other oil products	13
Transportation	Airports, railroads, major highways, and riverine and maritime shipping facilities, key bridges, bus terminals	19
Banking and finance	Banks, lending institutions, and the regulatory and support facilities that service them	66
Chemical industry and hazardous materials	Sites for research, production, storage and distribution of chemicals and hazardous materials	15
Postal and shipping	Post offices, packaging and shipping companies	34
	Key Assets	
Government	City halls, local, state and federal offices, community centers, museums, and libraries	51
Schools	Elementary and high schools, colleges, school offices and day care centers	164
Shelters	Schools that have been identified as shelters for evacuation or temporary housing of disaster victims	49
	Total	568

Note: The numbers are for the entire Parish, before the list was trimmed down.

Source: St. Tammany Parish Office of Emergency Preparedness

As noted in Chapter 2, the hazards facing St. Tammany Parish either provide plenty of warning time (e.g., tropical storms) or present a low threat to life safety (e.g., earthquakes and hailstorms). Because of these factors, it was felt that schools were not critical, unless they served as shelters. The same rationale supported not listing transportation facilities. However, telecommunications towers and electrical power lines and substations were added.

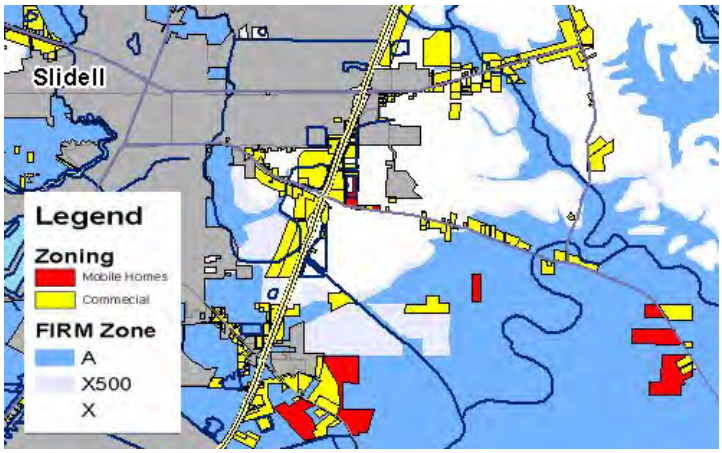
The resulting list of critical facilities and infrastructure is shown in Table 3-2. They are differentiated based on their structural characteristics as well as the service they provide. For example, both hospitals and nursing homes provide public health services, but hospitals are generally much larger structures.

In addition to the critical facilities and key assets, five types of "other structures" were identified. Because Parish tax assessment records were not available digitally, Census data and other sources were used to determine the number and value of these properties. These are listed at the end of Table 3-2.

The critical facilities from the Office of Emergency Preparedness' inventory were plotted in the Parish's GIS system. Land use maps were used to determine the distribution of the other structures. For example, businesses were concentrated in commercial districts (there are very few industries in the Parish). Mobile home parks were also plotted. An example of the GIS layers used is in Map 3-1.

Table 3-2 Vulnerable Properties in Planning Area

Property	Count
Water/wastewater	
Water plants	20
Wastewater plants	16
Wells	16
Water towers	47
Public health	
Hospitals	9
Nursing care	16
Emergency services	
Fire stations	41
Police/sheriff	19
Telecommunications	
Radio/TV towers	8
Cell towers	119
Energy	
Switching stations	55
Power lines	200
Chemical/haz mat	8
Critical government	10
Shelters	49
Total critical facilities	633
Other structures	
Single family	44,595
Mobile homes	8,170
Multi-family	500
Businesses	2,000
Government	500
Total all structures	56,398



Map 3-1 Excerpt from GIS map used for plotting property exposure to hazards

3.2. Damage Calculations

Step 2 of the vulnerability assessment was to calculate the impact of the 13 hazards reviewed in Chapter 2 in terms of property damage and loss of their use. Averages and typical situations were used. This approach cannot predict which facilities will be hit by which hazard, but it does provide a general estimate of the level of damage that would be expected, based on available data.

Step 2 started with determining the value of the property being damaged. Each type of facility can range from small to large and there is a similar range in their dollar value. Typical values of the structures were determined using data from the US Census and University of New Orleans offices. Averages were used. Outliers were not included (i.e., where the value of most properties were concentrated together, but one or two were much more expensive. In these cases, the more expensive ones were not counted toward the average value.).

For example, most general purpose government buildings in the Parish are in the $50,000 – $500,000 range. The new Parish Justice Center is much larger and estimated to be worth $40,000,000. It was not included in the calculations that concluded that the current market value of a typical government building was worth $300,000.

Contents value was calculated as a percentage of the structure's value. Table 3-3 shows the relative value of the typical contents to the typical structure type. These ratios were taken from FEMA guidance.

For each facility, two types of damage were calculated: physical damage and "downtime," a factor that represents loss of use of the facility.

Table 3-3 Contents Value as a Percentage of Structure Value

Occupancy	Value
Residential	50%
Commercial	100%
Health Care	150%
Emergency services	150%
General government	100%
Schools/shelters	100%

Source: *Understanding Your Risks*, FEMA, page 3-11

3.2.1. Physical damage

Three levels of physical damage were used:

- **Minor** damage: Many structures exposed to a storm or other hazard will suffer only moderate damage. For examples, a hurricane may just damage the roof and windows of some structures. For this calculation, 5% of the structure's value was used. Because the structure stays substantially intact, no contents losses were considered.

- **Moderate** damage: This category represents more serious damage, such as a collapsed wall or floodwater over the first floor of a building. Moderate damage is calculated as 40% of the structure's value plus 40% of the content's value.

- **Major:** This category is used when a building is demolished or heavily damaged. An example of the former is a house leveled by a tornado. An example of the latter is floodwater more than 1.5 feet over the lowest floor (i.e., over the

electrical outlets). The average dollar figure for this category is 75% of the structure's value and 75% of the contents' value.

3.2.2. Downtime Loss of use of a facility is called "downtime." Downtime is an estimate of the dollar cost to people when a facility is not available because it is damaged or not accessible. A facility could suffer no structural damage, but still have a downtime cost. An example would be a business that has lost power for a few days due to a storm. It would not be physically damaged, but it would not be able to open for business or work. A downtime cost was figured for each of the three levels of damage.

Table 3-4 lists the categories of property that were used in this vulnerability assessment effort. The category of "single family" is highlighted. Here's how the table was populated with the data for single family homes:

1. According to the records available from the Census and the University of New Orleans' Real Estate Market Date Center, the average value for a single family home (not including mobile homes) is $124,000.

2. Minor damage to a single family home is 5% of the average value of the structure, or $6,200. As noted above, it is assumed that there is no damage to the contents.

3. Downtime due to minor damage to a single family home was concluded to be negligible. The house would still be livable, so there would be no loss of use.

4. Moderate damage to a home is 40% of its structural value plus 40% of its contents value. For residential properties, contents is calculated at 50% of the structure's value (see Table 3-3). This equates to $49,600 plus $24,800 = $74,400 for the average house.

5. Moderate damage is considered to make the house uninhabitable until repairs are made. Given the widespread demand for repairs after a disaster, they won't be made quickly. The Planning Committee concluded that the building would be unusable as a home for an average of 3 months. $200 per night was used as the cost of a motel, food, and other expenses of a disposed family. Motels are assumed to represent the "true cost" of temporary housing. Three months are 90 days, for a downtime cost of $18,000 per family when a residential building has suffered moderate damage.

6. The "major damage" category is calculated at 75% of the value of the house and its contents: ($124,000 x 0.75) + ($62,000 x 0.75) = $139,500.

7. It is estimated that it will take a family 18 months to replace a house that has been destroyed or that suffered major damage. This would include reconstruction or settling an insurance claim, seeking new funds, and finding an available residence at the same time many others are seeking new housing. At $200 per day and 540 days, the downtime is valued at $108,000.

These numbers are displayed in the "single family" row in Table 3-4. The basis for the downtime for the other categories of properties are shown in Table 3-5.

Table 3-4 Physical Losses and Downtime Costs							
		Minor Damage		Moderate Damage		Major Damage	
Property	**Value**	**Physical**	**Downtime**	**Physical**	**Downtime**	**Physical**	**Downtime**
Water/wastewater							
Water plants	$500,000	$25,000	$0	$400,000	$140,000	$750,000	$600,000
Wastewater plants	$500,000	$25,000	$0	$400,000	$140,000	$750,000	$600,000
Wells	$50,000	$2,500	$0	$20,000	$0	$37,500	$35,000
Water towers	$250,000	$12,500	$0	$100,000	$140,000	$187,500	$600,000
Public health							
Hospitals	$25,000,000	$1,250,000	$0	$46,875,000	$300,000	$46,875,000	$9,125,000
Nursing care	$2,000,000	$100,000	$0	$2,000,000	$300,000	$3,750,000	$3,650,000
Emergency services							
Fire stations	$1,100,000	$55,000	$0	$1,100,000	$35,000	$2,062,500	$150,000
Police/sheriff	$1,100,000	$55,000	$0	$1,100,000	$7,000	$2,062,500	$30,000
Telecommunications							
Radio/TV towers	$1,000,000	$50,000	$0	$800,000	$56,000	$1,500,000	$720,000
Cell towers	$250,000	$12,500	$2,000	$100,000	$14,000	$187,500	$60,000
Energy							
Switching stations	$4,000,000	$200,000	$25,000	$1,600,000	$25,000	$3,000,000	$62,500
Power lines	$15,000	$750	$25,000	$6,000	$75,000	$11,250	$175,000
Chemical/haz mat	$3,000,000	$150,000	$0	$2,400,000	$25,000	$4,500,000	$50,000
Critical government	$300,000	$15,000	$0	$240,000	$7,000	$450,000	$30,000
Shelters	$3,000,000	$150,000	$0	$2,400,000	$0	$4,500,000	$0
Other structures							
Single family	$124,000	$6,200	$0	$74,400	$18,000	$139,500	$108,000
Mobile homes	$34,000	$1,700	$0	$20,400	$6,000	$38,250	$6,000
Multi-family	$400,000	$20,000	$0	$240,000	$144,000	$450,000	$144,000
Businesses	$300,000	$15,000	$8,000	$240,000	$112,000	$450,000	$2,920,000
Government	$300,000	$15,000	$0	$240,000	$14,000	$450,000	$60,000

3.2.3. Downtime calculations The costs of physical damage to a property were based directly on the value of the structure and its contents. Downtime calculations were more subjective. Table 3-5, on the next two pages, summarizes where these costs came from.

Sections 3.3 – 3.15 review the exposure of the properties described in section 3.2 to each of the 13 hazards covered in Chapter 2. Typical disaster scenarios are described . These identify an expected number of properties that will receive minor and moderate damage and/or be destroyed. The cost of the resulting property damage and downtime are presented in the tables. The impact of the scenario on people and the local economy are reviewed in narrative form.

Table 3-5 Basis for Downtime Costs	
Property	**Basis and Assumptions**
Water/wastewater	
Water and wastewater treatment plants *	Loss of drinking water for the average system: $20,000/day for people to seek other sources. Loss of wastewater treatment for the average system: $20,000/day in environmental damage. No loss of use or downtime from minor damage. 7 days for moderate damage (the facility will be repaired quickly due to its importance to the community): 7 x $20,000 = $140,000. One month loss of water/wastewater treatment if the plant is destroyed (alternative resources would be in place within a month): 30 x $20,000 = $600,000.
Wells	No losses for minor or moderate damage. The typical Parish water system has more than one well, so loss of one can be compensated for by the others while repairs are made. If the well is destroyed, it is assumed that the other wells would also be damaged, so there would be increased operating costs for 7 days at a cost of $5,000 per day.
Water towers *	Same costs as downtime for treatment plants
Public health	
Hospitals *	No downtime from minor damage – the hospital will stay in operation. Loss of use from moderate damage would cost $10,000/day in delayed treatment. Damage would be repaired sufficiently to allow full reuse in 30 days ($300,000). Loss of use from a destroyed hospital would cost $25,000/day for 1 year = $9,125,000.
Nursing care *	No downtime from minor damage – the nursing home will stay in operation. Loss of use from moderate damage would be similar to loss of use of a house: residents would have to relocate to a similar facility at a cost $100/day per person. With an average of 100 residents per home, for a total of $10,000/day. Moderate damage would be repaired in 1 month (30x $10,000 = $300,000. Loss of use of a destroyed nursing home would cost $10,000/day for 1 year = $3,650,000.
Emergency services	
Fire stations *	No downtime from minor damage – the facility will stay in operation. Moderate damage would mean loss of some equipment and would require relocation to another site, increasing response time: $5,000/day in increased loss to property due to fires. Downtime would be 7 days: $35,000. Downtime for a destroyed fire station would be 30 days, the time needed to locate an alternate site, and replace the equipment: $150,000. (Note that cost of replacing the equipment is counted as part of the physical damage to the contents.)
Police/sheriff *	No downtime from minor damage – the facility will stay in operation. Moderate damage would require relocation of the operation for 7 days while repairs are made at $1,000/day for increased travel costs, furniture rental, etc. – $7,000. Downtime for a destroyed facility would be 30 days, the time needed to locate an alternate site, and replace the equipment: $30,000. (Note that cost of replacing the equipment is counted as part of the physical damage to the contents.)
Telecommunications	
Radio/TV towers *	No downtime from minor damage – the facility will stay in operation. Loss of use is valued at $8,000/day, the same daily cost as for a business. Moderate damage will keep the facility closed for 7 days ($56,000). If the facility were destroyed, it would take 90 days to reopen a new one ($720,000).
Cell towers	One day of downtime for minor damage, 7 days for moderate damage, and 30 days for major damage. Loss of use of the tower would shut down cell phone service in a localized area. Given the prevalence of cell phones, the loss of use is more of a nuisance than a major cost. Each day a cell phone tower cannot be used is valued at $2,000.
Energy	
Switching stations	The loss of power is estimated to cost $25,000 per day in damage to properties that do not have power backup. Damage would be due to thawed food in freezers, overheating of materials that need fans or air conditioning, and closing of businesses dependent on electricity. 1 day of downtime for minor or moderate damage (either repairs would be made in one day or an alternative routing of power would be accomplished). 2.5 days of downtime for major damage.
Power lines	Loss of one mile of lines is considered as having the same dollar loss per day as for loss of one switching station. Minor damage: loss of power for one day ($25,000). Moderate damage: loss power for 3 days and loss of poles (rerouting of power will not work if there are no lines to carry it) ($75,000). Destruction of power lines: 7 days of downtime ($175,000).
Chemical/haz mat	It is assumed that hazardous materials are given enough care in storage and shipping that no release would result from minor damage to the building or site. Moderate damage would cause enough of a leak to evacuate the neighborhood, resulting in closed businesses, containment efforts, and health and safety hazards calculated to cost $25,000. Destruction would mean a release of a greater amount of the chemical(s) that would affect a larger area – $50,000. It is assumed that in either case, the problem would be neutralized in one day.
* It is assumed that these facilities have a local standby source of electricity, such as a generator, and would be able to continue operation during a power loss.	

Table 3-5 Basis for Downtime Costs	
Property	**Basis and Assumptions**
Critical gov't *	Same assumptions and costs as police stations.
Shelters	If the damage occurs before the site is to be used as a shelter, people would be directed to another shelter. Where the hazard is slower onset and where it can go is predictable (e.g., shelters in the hurricane evacuation zones), it will not be used. There is therefore, no downtime cost for shelters.
Other structures	
Single family	The basis and assumptions for downtime costs due to loss of use of a home is explained on page 3-5.
Mobile homes	Minor damage to a mobile home would have the same impact as minor damage to a single family house: it would still be livable, so there would be no downtime costs. Moderate damage would keep a family out for one month, until the home is repaired or replaced. The cost of temporary housing would be the same as for a single family home: $200/day for 30 days = $6,000. A destroyed mobile home would also put a family out for one month. After that time, a new unit would be brought in or the family would relocate.
Multi-family	Same costs due to loss of use as a single family home from minor and moderate damage. The average multi-family structure in St. Tammany Parish is estimated to have 8 units, so the dislocation costs are multiplied times 8 ($200 x 90 x 8 = $144,000 per building). A destroyed multi-family structure is estimated to take 2 years to replace. However, residents are expected to find new housing within 12 weeks, so the downtime is the same as for moderate damage.
Businesses	One day of downtime from minor damage: $8,000/day for the average business in St. Tammany Parish (from UNO Real Estate Market Data Center). Moderate damage is estimated to result in the business being closed for 14 days. This will mean either a loss in sales or a loss in wages, depending on the nature of the business, for a downtime cost of $112,000. Major damage to the structure is considered to put the typical business out of operation for one year. Some will reopen sooner (especially if they are insured) while others will close for good ($8,000 x 365 = $2,920,000).
Government	No downtime from minor damage – the facility will stay in operation. The basis for moderate damage is the same as for police/sheriff facilities: $1,000/day for increased travel costs, furniture rental, etc. However, not being critical facilities, repairs are assumed to take twice as long. Moderate damage would put the site in temporary quarters for 14 days ($14,000) and destruction for 60 days ($60,000).
* It is assumed that these facilities have a local standby source of electricity, such as a generator, and would be able to continue operation during a power loss.	

3.3. Tropical Storms

Three tropical storm scenarios are summarized here: a tropical storm, a category 2 hurricane and a category 5 hurricane. In Table 3-16 at the end of this chapter, the damage figures are adjusted to reflect the annual frequency of these storms. For example, the total cost of damage for the Category 5 hurricane is multiplied times 0.0055 to reflect the fact that one would hit the Parish every 180 years (see Section 2.1.4).

3.3.1 **Tropical storm scenario** This scenario is based on the reports of damage from tropical storms Allison, Bertha, Isidore, Lili and Bill. Winds would reach 50 – 60 miles per hour and the storm surge would be up to 5 feet along the Lake Pontchartrain shore. The damage caused by riverine and local drainage flooding is covered under those hazards.

Property: Damage from wind affects properties throughout the Parish. Mobile homes and telecommunications towers are particularly vulnerable. Damage from surge flooding is limited to properties near the Lakeshore. Under this scenario:

- Wind damage
  - 25% of the mobile homes receive minor damage
  - 10% of the mobile homes receive moderate damage
  - 5% of the properties throughout the Parish receive minor damage from wind
  - 1% of the properties throughout the Parish moderate damage from wind
  - 5 miles of power lines receive minor damage
- Water damage from storm surge (within ¼ mile of the lakeshore)
  - 25% of the properties within ¼ mile of the lakeshore receive minor damage
  - 50% of the properties within ¼ mile of the lakeshore receive moderate damage
  - 25% of the properties within ¼ mile of the lakeshore receive major damage

The cost of the physical damage and downtime to these properties is shown in Table 3-6. For each level of damage, the number of properties affected is listed in the "Count" column. For example, there are 119 cell towers in St. Tammany Parish. Under this scenario, 5% of them receive minor damage, so (119 x 0.5) = 7.2 is the count for cell towers in the minor damage column.

The "Cost" column is the dollar cost of damage to those properties. In Table 3-4, minor physical damage to a cell tower is 5% of the tower's value or $12,500. $2,000 is used as the cost of one day's downtime due to minor damage. With 7.2 towers affected, the "Cost" column shows the total cost, or ($12,500 + $2,000) x 7.2 = $104,400

People: Under the tropical storm scenario, there are no deaths and only a few minor injuries from falling limbs or flying debris. Many of the residents in the threatened areas evacuate and most of them find friends or relatives to house them. 300 families still need to be sheltered. There are no reported outbreaks of health problems.

Table 3-6 Costs from a Tropical Storm							
	Minor Damage		Moderate Damage		Destroyed		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	1.25	$31,250	0.7	$378,000	0.25	$337,500	$746,750
Wastewater plants	1.05	$26,250	0.66	$356,400	0.25	$337,500	$720,150
Wells	0.8	$2,000	0.16	$3,200	0	$0	$5,200
Water towers	2.35	$29,375	0.47	$112,800	0	$0	$142,175
Public health							
Hospitals	0.45	$562,500	0.09	$4,245,750	0	$0	$4,808,250
Nursing care	0.8	$80,000	0.16	$368,000	0	$0	$448,000
Emergency services							
Fire stations	2.05	$112,750	0.41	$465,350	0	$0	$578,100
Police/sheriff	0.95	$52,250	0.19	$210,330	0	$0	$262,580
Telecommunications							
Radio/TV towers	0.4	$20,000	0.08	$68,480	0	$0	$88,480
Cell towers	7.2	$104,400	3.69	$420,660	1.25	$309,375	$834,435
Energy							
Switching stations	2.75	$618,750	0.55	$893,750	0	$0	$1,512,500
Power lines	5	$128,750	0	$0	1.25	$232,813	$361,563
Chemical/haz mat	0.4	$60,000	0.08	$194,000	0	$0	$254,000
Critical government	0.5	$7,500	0.1	$24,700	0	$0	$32,200
Shelters	2.45	$367,500	0.49	$1,176,000	0	$0	$1,543,500
Other structures							
Single family	2442.75	$15,145,050	871.95	$80,568,180	213	$52,717,500	$148,430,730
Mobile homes	2093.5	$3,558,950	919	$24,261,600	51	$2,256,750	$30,077,300
Multi-family	25	$500,000	5	$1,920,000	0	$0	$2,420,000
Businesses	103.3	$2,375,900	25.61	$9,014,720	2.75	$9,267,500	$20,658,120
Government	25	$375,000	5	$1,270,000	0	$0	$1,645,000
Total							$215,569,033

People have a positive attitude (see box). They've been through these storms before and will likely see them again.

Life safety threat: low. Mental health impact: low.

> Ron Barrosse, who has owned a camp on Lakeview Drive since 1995, said he had never seen strong winds and tidal surges like the ones that picked up his neighbor's vacation home from its foundation about 200 feet offshore and dumped it in a parking lot Thursday about 10 a.m..
>
> Within 15 minutes of the terrifying scene, Barrosse ditched his plans to wait out Isidore in his elevated house and headed inland. But by Friday morning he was back, clearing wood and garbage from his property.
>
> "It's the price you pay for living in paradise," he said.
>
> Times-Picayune, 9/28/02

Economy: Productivity for the first few days after a tropical storm is down as people stay home from work to clean up, some roads are blocked, and some businesses are closed. Some companies, like contractors and home improvement stores, see an increase in business. Prices will rise for construction materials and oil and gas that comes from offshore rigs that were shut down. Prices are back to normal in two months.

Local governments must pay for shelters, clean up, and debris disposal. A federal disaster declaration is expected to help cover up to 75% of these costs. Due to the relatively light

level of damage, uninsured property owners will make due with partial repairs, savings or borrowed funds.

Overall economic impact: minor.

3.3.2. Category 2 hurricane This scenario extrapolates from the reports of damage from past hurricanes and the tropical storms. Winds would reach 100 miles per hour and the storm surge would be up to 8 feet along the Lake Pontchartrain shore. The damage caused by riverine and local drainage flooding is covered under those hazards.

Property: Under this scenario, the effects are similar to a tropical storm but there is more damage. Damage from wind affects more properties (especially mobile homes) throughout the Parish,. Damage from surge flooding is greater as it reaches farther inland.

- Wind damage
  - 50% of the mobile homes receive minor damage
  - 25% of the mobile homes receive moderate damage
  - 20% of the properties throughout the Parish receive minor damage from wind
  - 10% of the properties throughout the Parish moderate damage from wind
  - 5% of the properties throughout the Parish major damage from wind
  - 15 miles of power lines receive minor damage
  - 5 miles of power lines receive moderate damage
- Water damage from storm surge (within ½ mile of the lakeshore)
  - 25% of the properties within ½ mile of the lakeshore receive minor damage
  - 50% of the properties within ½ mile of the lakeshore receive moderate damage
  - 25% of the properties within ½ mile of the lakeshore receive major damage

People: Before the category 2 hurricane hits, families are advised to evacuate. Most of them do, but 25% dare to wait it out. As a result 2 people are killed when their homes are destroyed. Another 10 are injured. 1,000 families need shelter.

A boil order is issued for some areas as private wells are flooded and a wastewater treatment plant shuts down, allowing raw sewage to flow directly into the stream. Health problems are in the form of upset stomachs from lack of safe drinking water and eating spoiled food, and complications from heat and insect bites. Septic systems in repetitively flooded areas need to be replaced.

Forty-five percent of the flooded households do not have insurance Several hundred homes are more than 50% damaged and must meet the flood protection requirements as a condition of their repair permits. While mitigation funds are sought, there won't be enough for everyone. Most of the owners of substantially damaged properties will have to find the money to bring their homes up to code. Some discuss walking away from their places.

Table 3-7 Costs from a Category 2 Hurricane							
	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	1	$25,000	1	$540,000	1	$1,350,000	$1,915,000
Wastewater plants	1	$25,000	1	$540,000	1	$1,350,000	$1,915,000
Wells	1	$2,500	1	$20,000	0	$0	$22,500
Water towers	1	$12,500	1	$240,000	1	$787,500	$1,040,000
Public health							
Hospitals	0	$0	0	$0	0	$0	$0
Nursing care	0	$0	0	$0	0	$0	$0
Emergency services							
Fire stations	1	$55,000	0	$0	0	$0	$55,000
Police/sheriff	1	$55,000	1	$1,107,000	0	$0	$1,162,000
Telecommunications							
Radio/TV towers	0	$0	0	$0	0	$0	$0
Cell towers	3	$43,500	2	$228,000	1	$247,500	$519,000
Energy							
Switching stations	1	$225,000	1	$1,625,000	0	$0	$1,850,000
Power lines	15	$386,250	5	$405,000	0	$0	$791,250
Chemical/haz mat	0	$0	0	$0	0	$0	$0
Critical government	1	$15,000	1	$247,000	1	$480,000	$742,000
Shelters	1	$150,000	1	$2,400,000	0	$0	$2,550,000
Other structures							
Single family	1216	$7,539,200	1136	$104,996,400	568	$140,580,000	$253,085,600
Mobile homes	4698	$7,986,600	3268	$86,275,200	613	$27,125,250	$121,387,050
Multi-family	10	$200,000	5	$1,920,000	3	$1,782,000	$3,902,000
Businesses	47	$1,081,000	34	$11,968,000	17	$57,290,000	$70,339,000
Government	10	$150,000	5	$1,270,000	3	$1,530,000	$2,950,000
Total							$464,225,400

Attitudes are not as positive as after the tropical storm. Stress takes a toll in areas that have been flooded several times before. Homes and small businesses are put up for sale. Some are purchased and others are left vacant or are converted to rental properties. Neighbors report a decline in property values.

Life safety threat: moderate. Mental health impact: moderate.

Economy: Productivity is down for a week as people stay home from work to clean up, some roads are blocked, and some businesses are closed. A small number of marginal businesses will not reopen. Contractors and home improvement stores get a lot more business. Prices for construction related services and materials are not back to normal for six months.

Up to 75% of local governments' expenses for rescue operations, traffic control, shelters, clean up, debris disposal, and repairs to the wastewater treatment plant are covered by the federal disaster declaration. Local governments must find the 25% local share needed for these expenses and for mitigation projects in repetitively flooded areas.

Overall economic impact: moderate.

3.3.3. Category 5 hurricane This is the "worst case" hurricane scenario. Winds would exceed 150 miles per hour and the storm surge would be up to 18 feet along the Lake Pontchartrain shore. The damage caused by riverine and local drainage flooding is covered under those hazards.

Property: Wind damage is considered to be spread evenly throughout the Parish. Damage from surge flooding is the greatest hazard. It is calculated to occur everywhere within one mile of the lakeshore.

– Wind damage
  - 25% of the mobile homes receive moderate damage
  - 75% of the mobile homes receive major damage
  - 50% of the properties throughout the Parish receive minor damage from wind
  - 25% of the properties throughout the Parish moderate damage from wind
  - 25% of the properties throughout the Parish major damage from wind
  - 50 miles of power lines receive minor damage
  - 15 miles of power lines receive moderate damage

Table 3-8 Costs from a Category 5 Hurricane

	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	2	$50,000	7	$3,780,000	6	$8,100,000	$11,930,000
Wastewater plants	1	$25,000	6	$3,240,000	5	$6,750,000	$10,015,000
Wells	2	$5,000	6	$120,000	5	$362,500	$487,500
Water towers	5	$62,500	13	$3,120,000	12	$9,450,000	$12,632,500
Public health							
Hospitals	1	$1,250,000	3	$141,525,000	3	$168,000,000	$310,775,000
Nursing care	2	$200,000	5	$11,500,000	4	$29,600,000	$41,300,000
Emergency services							
Fire stations	5	$275,000	19	$21,565,000	15	$33,187,500	$55,027,500
Police/sheriff	2	$110,000	6	$6,642,000	5	$10,462,500	$17,214,500
Telecommunications							
Radio/TV towers	1	$50,000	2	$1,712,000	2	$4,440,000	$6,202,000
Cell towers	12	$174,000	31	$3,534,000	31	$7,672,500	$11,380,500
Energy							
Switching stations	6	$1,350,000	16	$26,000,000	15	$45,937,500	$73,287,500
Power lines		$0	100	$8,100,000	75	$13,968,750	$22,068,750
Chemical/haz mat	1	$150,000	2	$4,850,000	2	$9,100,000	$14,100,000
Critical government	1	$15,000	3	$741,000	3	$1,440,000	$2,196,000
Shelters	5	$750,000	14	$33,600,000	13	$58,500,000	$92,850,000
Other structures							
Single family	21623	$134,062,600	12498	$1,154,815,200	11824	$2,926,440,000	$4,215,317,800
Mobile homes	0	$0	4902	$129,412,800	7557	$334,397,250	$463,810,050
Multi-family	52	$1,040,000	130	$49,920,000	128	$76,032,000	$126,992,000
Businesses	225	$5,175,000	583	$205,216,000	543	$1,829,910,000	$2,040,301,000
Government	50	$750,000	125	$31,750,000	125	$63,750,000	$96,250,000
Total							$7,624,137,600

– Water damage from storm surge (within 1 mile of the lakeshore)
  - 25% of the properties within 1 mile of the lakeshore receive minor damage
  - 50% of the properties within 1 mile of the lakeshore receive moderate damage
  - 25% of the properties within 1 mile of the lakeshore receive major damage

It should be noted that there is a quantum jump in the cost of property damage above a Class 3 hurricane. The Tropical storm estimate is $215 million and the Category 2 is $464 million. However, the Category 5 hurricane is estimated to cost more than $7 billion in damage. This is because there is a great increase in the number of buildings damaged by wind. Most new buildings are built to be able to withstand winds up to 100 miles per hour, but few can hold up against a Category 5's winds of greater than 150 miles per hour.

People: Under the category 5 hurricane scenario, all families in the four evacuation areas are strongly advised to evacuate. Again, 25% do not leave, in part because they expect the roads to be too crowded to allow them out. Search and rescue operations are necessary to check destroyed structures. Twenty people are killed when their homes are destroyed. Another 50 are injured severely enough to be hospitalized. 5,000 families need shelter.

Under the hurricane scenarios, loss of life is likely

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Surge flooding is deep enough to destroy two treatment plants in the category 1 and 2 areas. Hundreds report health problems, such as upset stomachs, insect and snake bites, and heat problems. The latter is aggravated by a lack of power in many areas. Septic systems in repetitively flooded areas need to be replaced.

Forty-five percent of the flooded households do not have insurance. Several thousand homes are more than 50% damaged and must meet the flood protection requirements as a condition of their repair permits. While mitigation funds are sought, there won't be enough for everyone. Most of the owners of substantially damaged properties will have to find the money to bring their homes up to code. Many will abandon their homes to the mortgage holders.

Severely damaged neighborhoods are considered for acquisition. It takes a month to decide which ones should be cleared and which will be allowed to rebuild. It takes many more months to secure funding.

Delays in obtaining help to repair and rebuild keep thousands of families in temporary housing, adding greatly to commuting and travel times. Those waiting for a decision on whether they will be allowed to rebuild are particularly hard hit. The destruction, the

costs, the delays, and the uncertainty take their toll and there is an increase in divorces and reported mental health problems.

Life safety threat: high. Mental health impact: very high.

Economy: Productivity is down for several months as large areas have been devastated and people either stay home or have to relocate to other areas. Commercial areas close to the lake are destroyed and may not be rebuilt in the same location. Two hundred stores, shops and small businesses will not reopen. Contractors and home improvement stores suffer damage themselves and additional support comes in from out of state (including some unsavory people who do not perform acceptable work).

Prices for many basic commodities remain high for several months. Prices for construction related services and materials are not back to normal for two years.

Up to 75% of local governments' expenses for search and rescue operations, traffic control, shelters, clean up, debris disposal, and repairs to the treatment plants and other public properties are covered by the federal disaster declaration. However, the plants are down for several weeks and the local governments do not receive funds for all the expenses they claim. They must also finance the local cost-share. A new landfill is needed to handle the huge amounts of debris.

Local permit staff are overwhelmed with applications, inspections, and enforcement work. Several staff are more concerned over their own damaged homes than in going to work. A debate arises over whether permits and code requirements should be waived in order to let people back in their homes as quickly as possible. Local governments must find the 25% local share needed for mitigation projects in repetitively flooded areas.

Overall economic impact: high.

3.4. Flooding

Two levels of severity are used to calculate the impact of flooding: stormwater flooding from a tropical storm or heavy rains, which is assumed to damage 5% of the properties in the Parish, and the 100-year flood, which is assumed to affect all properties in the mapped 100-year floodplain to some degree plus 5% of the properties outside the mapped floodplain.

3.4.1. 5-year storm Although a single storm will not flood the entire area, over 5 years, all of the areas in the Parish would be affected. While a "typical" scenario will not affect everywhere, the frequency of floods means that the aggregate costs will accurately reflect the annual risk.

Property: The 5-year storm will be relatively shallow and will not destroy any buildings, but will get into some. It is estimated that 10% of the buildings in the Parish are subject minor flood damage from the 5-year storm and 5% would have water over the first floor (moderate damage).

Water towers and power lines are not considered to be damaged by flooding. Telecommunications towers would be damaged because they have equipment sheds at ground level.

5-year Storm Scenario

Source: Dept of Public Works

People: The 5-year storm does not kill or injure anyone. Everyone who left their homes find friends or relatives to house them and no shelters are opened. There are no reported health problems, although some septic systems need work. Because those affected are those that flood most frequently, everyone is either adequately insured or can afford to make needed repairs. Septic systems in repetitively flooded areas need to be replaced.

Life safety threat: low. Mental health impact: low.

Economy: Few businesses are flooded. Productivity is hardly affected as those flooded stay home from work to clean up. The primary cost to local governments is traffic control and clean up. There is no federal disaster declaration, so all costs are funded locally.

Overall economic impact: minor.

Table 3-9 Costs from a 5-year Storm							
	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	2	$50,000	1	$540,000	0	$0	$590,000
Wastewater plants	2	$50,000	1	$540,000	0	$0	$590,000
Wells	2	$5,000	1	$20,000	0	$0	$25,000
Water towers	0	$0	0	$0	0	$0	$0
Public health							
Hospitals	1	$1,250,000	1	$47,175,000	0	$0	$48,425,000
Nursing care	2	$200,000	1	$2,300,000	0	$0	$2,500,000
Emergency services							
Fire stations	5	$275,000	3	$3,405,000	0	$0	$3,680,000
Police/sheriff	2	$110,000	1	$1,107,000	0	$0	$1,217,000
Telecommunications							
Radio/TV towers	1	$50,000	1	$856,000	0	$0	$906,000
Cell towers	12	$174,000	6	$684,000	0	$0	$858,000
Energy							
Switching stations	6	$1,350,000	3	$4,875,000	0	$0	$6,225,000
Power lines	0	$0	0	$0	0	$0	$0
Chemical/haz mat	1	$150,000	1	$2,425,000	0	$0	$2,575,000
Critical government	1	$15,000	1	$247,000	0	$0	$262,000
Shelters	5	$750,000	3	$7,200,000	0	$0	$7,950,000
Other structures							
Single family	4460	$27,652,000	2230	$206,052,000	0	$0	$233,704,000
Mobile homes	817	$1,388,900	409	$10,797,600	0	$0	$12,186,500
Multi-family	50	$1,000,000	25	$9,600,000	0	$0	$10,600,000
Businesses	202	$4,646,000	101	$35,552,000	0	$0	$40,198,000
Government	50	$750,000	25	$6,350,000	0	$0	$7,100,000
Total							$379,591,500

3.4.2. 100-year flood As with the 5-year storm, while a single flood will not cover the entire area, over time, all of the streams in the Parish will flood their 100-year floodplains on an average of once every 100 years. This flooding will affect all of the critical facilities that have been plotted in the floodplain shown on Map 2-7 and all of the other structures estimated to be located in the floodplain.

Property: Fifty percent of St. Tammany Parish is in the 100-year floodplain as shown in Map 2-7. There are an estimated 17,900 buildings in the 100-year floodplain. Approximately 1/2 of them have been permitted in the floodplain since the Parish began enforcing the floodplain management regulations of the National Flood Insurance Program. The Parish has required that these buildings be elevated or otherwise protected from the 100-year flood. Although they are likely to be affected (especially if they have been modified since they met code), for the purposes of this analysis, 1/2 of the structures in the 100-year floodplain (8,950) are not considered to be damaged.

Of the other half of the structures in the 100-year floodplain that were built before the floodplain management regulations became effective, 1/2 will have flooding deep enough to cause major damage, and 1/2 will suffer moderate damage. Water towers and power lines are not considered to be damaged by flooding.

Table 3-10 Costs from a 100-year Flood							
	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	0	$0	2	$1,080,000	2	$2,700,000	$3,780,000
Wastewater plants	0	$0	2	$1,080,000	2	$2,700,000	$3,780,000
Wells	0	$0	2	$40,000	2	$145,000	$185,000
Water towers	0	$0	0	$0	0	$0	$0
Public health							
Hospitals	0	$0	1	$47,175,000	1	$56,000,000	$103,175,000
Nursing care	0	$0	2	$4,600,000	2	$14,800,000	$19,400,000
Emergency services							
Fire stations	0	$0	4	$4,540,000	4	$8,850,000	$13,390,000
Police/sheriff	0	$0	2	$2,214,000	2	$4,185,000	$6,399,000
Telecommunications							
Radio/TV towers	0	$0	1	$856,000	1	$2,220,000	$3,076,000
Cell towers	0	$0	10	$1,140,000	10	$2,475,000	$3,615,000
Energy							
Switching stations	0	$0	5	$8,125,000	5	$15,312,500	$23,437,500
Power lines	0	$0	0	$0	0	$0	$0
Chemical/haz mat	0	$0	1	$2,425,000	1	$4,550,000	$6,975,000
Critical government	0	$0	1	$247,000	1	$480,000	$727,000
Shelters	0	$0	4	$9,600,000	4	$18,000,000	$27,600,000
Other structures							
Single family	0	$0	3540	$327,096,000	3540	$876,150,000	$1,203,246,000
Mobile homes	0	$0	649	$17,133,600	649	$28,718,250	$45,851,850
Multi-family	0	$0	40	$15,360,000	40	$23,760,000	$39,120,000
Businesses	0	$0	160	$56,320,000	160	$539,200,000	$595,520,000
Government	0	$0	40	$10,160,000	40	$20,400,000	$30,560,000
Total							$2,129,837,350

People: As with a tropical storm, many did not evacuate. Shelters are needed for 1,000 families who were made homeless and cannot find a place to stay. Fifteen cars are washed into the flooded streams, most of them having ignored warnings or barricades. Three people are killed. Injuries are minor, most due to accidents during evacuation or clean up and repairs to damaged structures.

A boil order is issued for some areas as private wells and septic systems are flooded and most wastewater treatment plants shut down, allowing raw sewage to flow directly into the stream. Unlike coastal surge, overbank floodwaters are full of sediment, farm chemicals and sewage. Health problems are in the form of upset stomachs from lack of safe drinking water and eating spoiled food. Respiratory problems are reported when people turn on their furnaces or air conditioners and sediment filled air is circulated throughout. Septic systems in repetitively flooded areas need to be replaced.

Forty-five percent of the flooded households do not have insurance. Nearly 5,000 homes are more than 50% damaged and must meet the flood protection requirements as a condition of their repair permits. While mitigation funds are sought, there won't be enough for everyone. Most of the owners of substantially damaged properties will have to find the money to bring their homes up to code. Some discuss walking away from their places.

Stress takes a toll in the repetitively flooded areas. Homes and small businesses are put up for sale. Some are purchased and others are left vacant or are converted to rental properties. Neighbors report a decline in property values.

Life safety threat: moderate. Mental health impact: moderate.

Economy: Productivity is down for a week as people stay home from work to clean up and some businesses are closed. Many had minor damage to their structures, but lost their inventories that were stored on lower shelves, keeping them closed longer. A small number of marginal businesses will not reopen. Contractors and home improvement stores get a lot more business. Prices for construction related services and materials are not back to normal for six months.

Some roads and three bridges are washed out. Up to 75% of local governments' expenses for road and bridge repairs, rescue operations, traffic control, shelters, clean up, debris disposal, and repairs to the wastewater treatment plants and other public properties are covered by the federal disaster declaration. Local governments must find the 25% local share needed for this work and for mitigation projects in repetitively flooded areas.

Overall economic impact: high.

3.5. Tornadoes

Section 2.3 and Table 2-18 note the relatively low risk of St. Tammany Parish to tornado damage. On an average of once each year, an F0 or F1 tornado would hit somewhere.

Property: The average property damage caused by these tornadoes was $220,000. Adjusting for inflation and incorporating downtime produces a figure of $300,000 for the annual average tornado damage.

People: The tornado strikes with only a few minutes' warning. No one is killed, but a few are injured from flying debris. Several families need new homes, but they have property insurance, so there is disruption, but no long term financial hardship.

Life safety threat: low. Mental health impact: low.

Economy: The odds are that an "average" tornado will not hit a major employer or critical facility. The tornado touch down is very local, so there is no impact on the area's economy, such as an increase in prices for construction materials.

Local government expenses are limited to clean up and debris disposal. A federal disaster declaration is unlikely, so all costs are funded locally.

Overall economic impact: nil.

Tornadoes are not likely to cause much property damage in St. Tammany Parish.

3.6. Wildfires

Property: With an average of 200 fires a year, calculating costs of wildfires is done by the annual impact, rather than on the basis of a typical fire. To date, wildfires have not destroyed any primary structures, although a few outbuildings and trailers have burned. As noted in section 2.4.6, with more rural development, the trend across the state is for more buildings being damaged.

Because most development in the urban-wildland interface is of single family homes, the primary type of structure exposed to wildfire damage is a single family home. For this cost estimate, it is assumed that in the future one single family home will be burned by wildfires every fourth year (or 0.25 every year).

Given the nature of wildfires and the limits of fire fighting capabilities during a forest fire, a building that catches fire is considered destroyed. There would be no structures suffering partial damage.

Table 3-11 Annual Costs from Wildfires

	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	0	$0	0	$0	0	$0	$0
Wastewater plants	0	$0	0	$0	0	$0	$0
Wells	0	$0	0	$0	0	$0	$0
Water towers	0	$0	0	$0	0	$0	$0
Public health							
Hospitals	0	$0	0	$0	0	$0	$0
Nursing care	0	$0	0	$0	0	$0	$0
Emergency services							
Fire stations	0	$0	0	$0	0	$0	$0
Police/sheriff	0	$0	0	$0	0	$0	$0
Telecommunications							
Radio/TV towers	0	$0	0	$0	0	$0	$0
Cell towers	0	$0	0	$0	0	$0	$0
Energy							
Switching stations	0	$0	0	$0	0	$0	$0
Power lines	0	$0	0	$0	0	$0	$0
Chemical/haz mat	0	$0	0	$0	0	$0	$0
Critical government	0	$0	0	$0	0	$0	$0
Shelters	0	$0	0	$0	0	$0	$0
Other structures							
Single family	0	$0	0	$0	0.25	$61,875	$61,875
Mobile homes	0	$0	0	$0	0	$0	$0
Multi-family	0	$0	0	$0	0	$0	$0
Businesses	0	$0	0	$0	0	$0	$0
Government	0	$0	0	$0	0	$0	$0
Total							$61,875

People: Wildfires in St. Tammany Parish have not killed or injured anyone (so far), so the life safety threat is low. Fires are hazardous to residents and fire fighters, though. To date, no one has been made homeless.

Life safety threat: low. Mental health impact: low.

Economy: There is little or no economic impact of wildfires to development, such as homes and businesses. There is an impact to the forestry industry. According to the State Forestry Division, the forest products industry is Louisiana's second largest manufacturing employer. Loss of their raw material could result in closures or cutbacks of local operations.

Forests provide other benefits, including wildlife habitat, recreational opportunities and scenic beauty (these adverse affects are factored in the mental health impact). Unlike houses and businesses, forests cannot be replaced quickly. Burned out areas will not be attractive for development.

Local government expenses are limited to fire fighting, traffic control, and clean up. A federal disaster declaration is unlikely, so all costs are funded locally.

Overall economic impact: minor.

3.7. Drought

Property: Section 2.5.6 notes that, by itself, a drought does not damage developed property. However, over the long run, certain soils expand and contract, resulting in damage to buildings. 10% of buildings in areas with such soils suffer minor damage "during their useful lives." Assuming the "useful life" of a building to be 75 years, the *annual* impact of drought in areas with such soils is considered to affect 1/75 of 10% of the buildings present.

The areas with expansive soils are shown on Map 2-9. Other areas, especially in floodplains, may have such soils, but they are not rated high enough by the Parish's *Soil Survey* to cause property damage. A review of development in those areas produced the following estimated number of properties:

- 2,000 single family homes
- 300 multi-family homes
- 40 businesses

Each year, 1/75 of 10% of them will suffer minor damage. The resulting numbers are shown in Table 3-12. Even though, by definition, a drought occurs on the average of once every 20 years, these figures are an annual cost of the expansion and contraction of soils in sensitive areas. It is assumed that there is no damage to contents.

People: The effects of drought are not likely to be threatening to human health or safety. However, if one occurs during a heat wave, reduced water supplies limit ways to escape from the heat.

Life safety threat: nil. Mental health impact: nil.

Economy: Drought can have an impact on the area's economy. It hits the agricultural sector most severely. Both crops and livestock suffer. However, only 2% of St. Tammany Parish's employment comes from agriculture and forestry, so the impact on the Parish as a whole would be minor.

Lack of water results in lower stream and lake levels, which reduces boating opportunities and loss of income for the recreation sector. Again, this is not a major source of income for the Parish.

The major economic impact of drought is to crops and livestock.

Table 3-12 Costs from Drought							
	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	0.00	$0	0	$0	0	$0	$0
Wastewater plants	0.00	$0	0	$0	0	$0	$0
Wells	0.00	$0	0	$0	0	$0	$0
Water towers	0.00	$0	0	$0	0	$0	$0
Public health							
Hospitals	0.00	$0	0	$0	0	$0	$0
Nursing care	0.00	$0	0	$0	0	$0	$0
Emergency services							
Fire stations	0.00	$0	0	$0	0	$0	$0
Police/sheriff	0.00	$0	0	$0	0	$0	$0
Telecommunications							
Radio/TV towers	0.00	$0	0	$0	0	$0	$0
Cell towers	0.00	$0	0	$0	0	$0	$0
Energy							
Switching stations	0.00	$0	0	$0	0	$0	$0
Power lines	0.00	$0	0	$0	0	$0	$0
Chemical/haz mat	0.00	$0	0	$0	0	$0	$0
Critical government	0.00	$0	0	$0	0	$0	$0
Shelters	0.00	$0	0	$0	0	$0	$0
Other structures							
Single family	2.67	$16,533	0	$0	0	$0	$16,533
Mobile homes	0.00	$0	0	$0	0	$0	$0
Multi-family	0.40	$8,000	0	$0	0	$0	$8,000
Businesses	0.05	$800	0	$0	0	$0	$800
Government	0.00	$0	0	$0	0	$0	$0
Total							$25,333

Local government expenses are limited to providing water for drinking and fire fighting. Such supplies should not be threatened, but watering bans or encouraging reduced use may be needed. In any case, there would be no direct dollar cost to local governments.

Overall economic impact: nil.

3.8. Fog

Property: The primary threat to property is damage to vehicles caused by collisions when traveling in fog. It is assumed that the Causeway implements precautions sufficient to prevent damaging accidents.

However, as noted in section 2.6.5, there have been some bad accidents on inland highways and roads. Over the last 15 years, there were four major accidents on Parish highways that damaged 159 vehicles, or an average of 10 each year. Assuming that there are twice that many minor accidents that don't make the newspapers, it is estimated that an average of 10 cars will be destroyed due to accidents caused by fog each year. Twenty more cars and trucks will be damaged to a level equal to 50% of their value. At a value of $20,000 per vehicle, the annual cost of fog damage would $400,000.

People: The major accidents over the last 15 years killed 6 people and injured 63. It is assumed that the non-reported accidents injured a at least that many. This results in an average of one people killed and 10 injured each year. Because vehicle accidents are commonplace and can be avoided relatively easily, there is no long-term mental health impact on the affected population (drivers).

Life safety threat: moderate. Mental health impact: moderate.

Economy: Downtime due to accidents caused by fog can be significant when they block commuters' expressways for hours. Otherwise, no particular businesses or industry is considered to be affected.

Local government expenses relate to policing the areas during a fog and after accidents. These would not exceed the normal costs of daily operations.

Overall economic impact: nil.

3.9. Earthquakes

Property: The level of damage expected from an earthquake in southern Louisiana is quite low. It would be no worse than a Modified Mercali Intensity level of V, where some dishes and widows are broken.

Table 3-13 varies from the system used for the other hazards. For the other hazards, "minor damage" is considered to be 5% of the building's value. The expected earthquake damage is more like 1% of the value of the contents. No downtime is expected.

It is expected that the quake would impact 1% of each property category. The "count" column is therefore 1% of the number of such properties in the Parish, as noted in Table 3-2.

Table 3-13 Costs from Earthquakes

	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	0.2	$1,000	0	$0	0	$0	$1,000
Wastewater plants	0.16	$800	0	$0	0	$0	$800
Wells	0.16	$80	0	$0	0	$0	$80
Water towers	0.47	$1,175	0	$0	0	$0	$1,175
Public health							
Hospitals	0.09	$22,500	0	$0	0	$0	$22,500
Nursing care	0.16	$3,200	0	$0	0	$0	$3,200
Emergency services							
Fire stations	0.41	$4,510	0	$0	0	$0	$4,510
Police/sheriff	0.19	$2,090	0	$0	0	$0	$2,090
Telecommunications							
Radio/TV towers	0.08	$800	0	$0	0	$0	$800
Cell towers	1.19	$2,975	0	$0	0	$0	$2,975
Energy							
Switching stations	0.55	$22,000	0	$0	0	$0	$22,000
Power lines	2	$300	0	$0	0	$0	$300
Chemical/haz mat	0.08	$2,400	0	$0	0	$0	$2,400
Critical government	0.1	$300	0	$0	0	$0	$300
Shelters	0.49	$14,700	0	$0	0	$0	$14,700
Other structures							
Single family	445.95	$552,978	0	$0	0	$0	$552,978
Mobile homes	81.7	$27,778	0	$0	0	$0	$27,778
Multi-family	5	$20,000	0	$0	0	$0	$20,000
Businesses	20.11	$60,330	0	$0	0	$0	$60,330
Government	5	$15,000	0	$0	0	$0	$15,000
Total							$754,916

People: The level of an expected earthquake is not considered life threatening. Some minor injuries may result from falling objects. Because the likelihood of an earthquake occurring or reoccurring is low, no long-term mental health affects are expected.

Life safety threat: low. Mental health impact: low.

Economy: Because of the very limited property damage expected from a Modified Mercali Intensity level of V, the impact of the earthquake on the local economy and government expenditures is considered to be nil.

Overall economic impact: nil.

3.10. Hailstorms

Property: Hail damage is limited to roofs, windows and vehicles. All of it is considered to fit in the "minor damage" (5%) level. However, a hail storm can affect a large area and many structures. One storm is estimated to impact 1,000 properties. The impact is calculated to be evenly distributed among the types of properties. There are 56,000 primary structures in the planning area, so 1,000/56,000 = 0.018. This ratio, 0.018 is used to calculate the number of properties affected by each category.

Hail damage to hospitals, towers, wells and power lines, is considered negligible. No damage to contents are expected.

Hail damage to vehicles can be severe. Based on insurance company claims reports, the average hail claim is for $2,000. Assuming one vehicle in the open for each structure, 1,000 vehicles would be affected, for a total cost of $2,000,000.

Table 3-14 Costs from Hailstorm

	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	0.36	$9,000	0	$0	0	$0	$9,000
Wastewater plants	0.288	$7,200	0	$0	0	$0	$7,200
Wells	0	$0	0	$0	0	$0	$0
Water towers	0.846	$10,575	0	$0	0	$0	$10,575
Public health							
Hospitals	0.162	$202,500	0	$0	0	$0	$202,500
Nursing care	0.288	$28,800	0	$0	0	$0	$28,800
Emergency services							
Fire stations	0.738	$40,590	0	$0	0	$0	$40,590
Police/sheriff	0.342	$18,810	0	$0	0	$0	$18,810
Telecommunications							
Radio/TV towers	0.144	$7,200	0	$0	0	$0	$7,200
Cell towers	2.142	$26,775	0	$0	0	$0	$26,775
Energy							
Switching stations	0.99	$198,000	0	$0	0	$0	$198,000
Power lines	3.6	$2,700	0	$0	0	$0	$2,700
Chemical/haz mat	0.144	$21,600	0	$0	0	$0	$21,600
Critical government	0.18	$2,700	0	$0	0	$0	$2,700
Shelters	0.882	$132,300	0	$0	0	$0	$132,300
Other structures							
Single family	802.71	$4,976,802	0	$0	0	$0	$4,976,802
Mobile homes	147.06	$250,002	0	$0	0	$0	$250,002
Multi-family	9	$180,000	0	$0	0	$0	$180,000
Businesses	36.198	$542,970	0	$0	0	$0	$542,970
Government	9	$135,000	0	$0	0	$0	$135,000
Total						Total	$6,793,524
Vehicle losses	1000	$2,000,000					$2,000,000
Total							$8,793,524

People: Hail is not considered a threat to life and limb. Once a storm begins, people can quickly seek shelter.

Life safety threat: nil. Mental health impact: nil.

Economy: As with drought, the major economic sector affected by hail is agriculture, particularly long stemmed crops. This is such a small part of St. Tammany Parish's economy that the overall impact is minor. Given the high percentage of affected buildings and vehicles that are insured for hail damage, the impact on the economy is negligible.

Overall economic impact: nil.

3.11. Land Failure

Property: Section 2.9 describes this hazard and notes that, by itself, land failure does not damage structures. The damage to buildings is done by other hazards, particularly storm surge from tropical storms. Land failure accelerates exposure to those hazards.

The exception to this is road damage, where the gradual differential settling over time does damage property, as seen in the photograph. There are only a handful of locations where this occurs and where the cost of the repairs cannot be included in the normal maintenance and replacement schedule. An annual outlay of $100,000 is estimated for repairs and reconstruction specifically attributed to land failure.

Evidence of a Subsidence Fault on Highway 11 Bridge

Source: Lake Pontchartrain Basin Foundation

People: Life safety threat: zero. Mental health impact: zero.

Economy: Overall economic impact: nil.

3.12. Winter Storm

Property: Winter storms bring cold temperatures, snow and ice. Of these, ice causes the most problems to property. Freezing rain that accumulates on tree branches and utility lines can create a very heavy weight. When the overloaded tree branches come down, they damage roofs and vehicles. When utility lines are lost, so is the utility service.

Under the winter storm scenario, an estimated 1,000 buildings suffer minor damage from trees and tree limbs and broken water pipes. There are 56,000 primary structures in the planning area, so 100/56,000 = 0.0018. This ratio is used to calculate the number of properties affected by each category.

The scenario also assumes that 10 miles of power lines are downed.

Table 3-15 Costs from Winter Storm

	Minor Damage		Moderate Damage		Major Damage		Total
Property	**Count**	**Cost**	**Count**	**Cost**	**Count**	**Cost**	**Cost**
Water/wastewater							
Water plants	0.36	$9,000	0	$0	0	$0	$9,000
Wastewater plants	0.288	$7,200	0	$0	0	$0	$7,200
Wells	0.288	$720	0	$0	0	$0	$720
Water towers	0.846	$10,575	0	$0	0	$0	$10,575
Public health							
Hospitals	0.162	$202,500	0	$0	0	$0	$202,500
Nursing care	0.288	$28,800	0	$0	0	$0	$28,800
Emergency services							
Fire stations	0.738	$40,590	0	$0	0	$0	$40,590
Police/sheriff	0.342	$18,810	0	$0	0	$0	$18,810
Telecommunications							
Radio/TV towers	0.144	$7,200	0	$0	0	$0	$7,200
Cell towers	2.142	$31,059	0	$0	0	$0	$31,059
Energy							
Switching stations	0.99	$222,750	0	$0	0	$0	$222,750
Power lines	10	$150,000	0	$0	0	$0	$150,000
Chemical/haz mat	0.144	$21,600	0	$0	0	$0	$21,600
Critical government	0.18	$2,700	0	$0	0	$0	$2,700
Shelters	0.882	$132,300	0	$0	0	$0	$132,300
Other structures							
Single family	802.71	$4,976,802	0	$0	0	$0	$4,976,802
Mobile homes	147.06	$250,002	0	$0	0	$0	$250,002
Multi-family	9	$180,000	0	$0	0	$0	$180,000
Businesses	36.198	$832,554	0	$0	0	$0	$832,554
Government	9	$135,000	0	$0	0	$0	$135,000
Total							$7,260,162

People: In the last 10 years, eight people have been killed and 21 injured by snow, ice and extreme cold events in Louisiana. None of these were in St. Tammany Parish. In fact, the National Weather Service lists only has one snow/ice event for the Parish since 1950. It was in January 2002.

Life safety threat: nil. Mental health impact: nil.

Economy: As seen in Table 3-15, the cost of repairs and damage due to loss of electricity accounts for more than ¼ of the property damage. This would have a minor affect on the economy.

Local government expenditures would be limited to traffic control and helping people without heat. This would be covered under normal operating costs.

Overall economic impact: minor.

3.13. Dam Failure

Property: The 16 dams in St. Tammany Parish are of two levels of hazard. Fourteen are "low hazard," meaning little or no property damage is expected if they breach. The other two are "significant hazard." This category means there is a potential for economic damage or environmental disruption.

The two "significant hazard" dams are both located on the Pearl River Canal in the Bogue Chitto National Wildlife Refuge. There is the potential for environmental disruption, but there is little development exposed.

There are some hunting/fishing camps downstream of the dams, so there is a possibility of a safety hazard and building damage. Assuming each camp is valued at $25,000 and 20 camps receive moderate damage, the total estimated physical damage cost is $25,000 x 0.4 x 20 = $200,000.

Because the camps are not permanently occupied, there is no downtime cost if they are damaged.

People: Life safety threat: low. Mental health impact: nil.

Economy: Overall economic impact: nil.

3.14. Levee Failure

Property: A levee will fail during a flood, when high waters put pressure on the structure or overtop it. The levees in St. Tammany Parish are substantial, as seen in the photograph on page 2-52. These levees are assumed to hold during a small flood, such as the 5-year storm scenario used in section 3.4. No property damage is expected.

Should one of the levees protecting the Kingspoint, Fox Hollow or Oak Harbor subdivisions fail from a larger flood, every building in the area would suffer substantial damage. The flood depths would be up to five feet and none of the buildings have been elevated or other otherwise incorporate flood protection features. Each house would suffer damage to 75% of their value.

All of the buildings exposed to levee failure flooding are single family homes. Damage would be an average of $124,000 x 0.75 = $93,000 plus 50% for the value of the contents. Each would suffer $139,500 in damage. There are 1,500 homes in all the leveed areas, for a total damage cost of $209,250,000 in property damage.

People: When a levee fails, it can be sudden. It is expected that when flood levels reach a height where there is a potential for failure, the levee district will ensure that the area is evacuated and that patrols will monitor and respond to any threat. Therefore, the life safety threat is considered to be minor.

This photograph from the 1950's conveys the danger of a levee failure

People who think they are safe from flooding will be aggrieved when they see their homes substantially damaged. They are unlikely to have flood insurance because they are not in the mapped floodplain. The mental health impact on these residents is considered to be moderate.

Life safety threat: low. Mental health impact: moderate.

Economy: The area exposed to levee failure is entirely residential, so there would be little impact on local businesses. However, a flood large enough to cause the levee to fail would affect a large part of the Parish. The economic impact of such a flood is considered to be included in the discussion of the 100-year flood.

Overall economic impact: nil.

3.15. Termites

Property: Termites are one of the few natural hazards that can be controlled. Effective preventive measures and extermination work. While that keeps the property damage down, the cost of preventing the problem has been estimated to be $1,000 - $1,500 for a typical house (initial chemical barrier or bait treatment). Annual maintenance fees can run $75 – $250.

Any structure can have a termite problem, even brick structures on slab foundations. If there's wood in the building, termites can find it. Therefore, every building in the Parish is subject to damage. While the above figures are for an average house, commercial and multi-family structures must be factored in. Accordingly, the mid-range figures are used for this estimate: $1,250 for the initial treatment and $300 for the annual fees.

Although every type of building is potentially subject to damage, not every building needs treatment. For planning purposes, each year it is assumed that 4,000 properties receive the initial treatment (3,000 of them are the new buildings built each year) and 40,000 properties pay an annual fee.

This approach provides an annual cost of termite damage prevention at

(4,000 x $1,250) + (40,000 x $300) = $5,000,000 + $12,000,000 = $17,000,000.

Not all damage is prevented. A figure of $500,000 is used to represent the cost of actual damage to treated and untreated buildings in the Parish. Therefore, $17,500,000 is used as the total annual cost to protect property from and repair damage caused by termites.

People: Life safety threat: low. Mental health impact: low.

Economy: Overall economic impact: minor. There is no major economic impact caused by termites, just an additional cost of owning property in southeastern Louisiana.

3.16. Vulnerability Summary

This chapter provides information on how natural hazards affect St. Tammany Parish in terms of property damage, the threat to people, and impact on the area's economy. Property damage is measured in dollars while the impacts on people and the economy are summarized in subjective terms of "low," "moderate," and "high."

These impacts vary from nil to widespread destruction and death from a category 5 hurricane. However, the severity of these impacts need to be tempered with their likelihood of occurrence. The odds of an occurrence in any given year, i.e.,. the annual chance, can be found in the "Frequency" sections of Chapter 2. In some cases, such as tornadoes and drought, the damage figures already reflect the average annual damage, so 1.0 is used for the annual chance.

3.16.1. Property damage Table 3-16 displays the impacts of the hazards on property. The property damage figures are multiplied times the annual chance of occurrence to produce a dollar figure that represents average annual damage from that hazard.

Table 3-16 Property Damage Summary

Hazard	Property Damage from Single Occurrence	Annual Chance	Average Annual Damage
Tropical storm	$215,569,033	0.8300	$178,922,297
Category 2 hurricane	$464,225,400	0.0526	$24,418,256
Category 5 hurricane	$7,624,137,600	0.0055	$41,932,757
5-year stormwater flood	$379,591,500	0.2000	$75,918,300
100-year flood	$2,129,837,350	0.0100	$21,298,374
Tornadoes	$300,000	1.0000	$300,000
Wildfires	$61,875	1.0000	$61,875
Drought	$25,333	0.0500	$1,267
Fog	$400,000	1.0000	$400,000
Earthquake	$754,916	0.0100	$7,549
Hailstorm	$6,793,524	0.1600	$1,086,964
Land failure	$100,000	1.0000	$100,000
Severe winter	$7,260,162	0.0500	$363,008
Dam failure	$25,000	0.0100	$250
Levee failure	$118,575,000	0.0050	$592,875
Termites	$17,500,000	1.0000	$17,500,000
Total			$362,903,772

Table 3-16 shows that, based on the assumptions and calculations presented in this chapter, natural hazards cost St. Tammany Parish property owners and their insurers over $350 million each year. Tropical storms account for roughly half that figure. The tropical storm figure comes from wind damage and storm surge damage along the lakeshore. Inland flooding caused by a storm is counted as stormwater flooding. The combined effects of wind and water damage from tropical storms, hurricanes and rain account for $342 million or 97% of the property damage caused by all natural hazards.

3.16.2. Impact on people Lives and economic impacts have been given subjective ratings in the previous sections. In Tables 3-17 and 3-18, these are given a numerical value. “High” is 100, “moderate” is 40, “low” is 10, and “nil” is 1. The mental health impact score is multiplied times 0.25 and added to the life safety score to produce a relative score for the threat to people.

The resulting “people score” is a numerical representation of the relative impact each hazard has on safety, health and mental health. Unlike the dollars used in the previous table, these numbers have no discrete meaning. They are used to compare the values of “high,” “moderate,” “low,” and “nil” between hazards.

The different columns cannot be compared between the tables, but the impact of the different hazards can be compared by reviewing the scores in each table. For example a “people score” of 10.38 for tropical storms can be compared to the people scores for the other hazards, but not to the economic impact scores.

Table 3-17 Summary of the Impact on People

Hazard	Life Safety		Mental Health		Annual Chance	People Score
Tropical storm	Low	10	Low	2.5	0.8300	10.38
Category 2 hurricane	Mod	40	Mod	10	0.0526	2.63
Category 5 hurricane	High	100	High	25	0.0055	0.69
5-year stormwater flood	Nil	1	Low	2.5	0.2000	0.35
100-year flood	Mod	40	Mod	10	0.0100	0.50
Tornadoes	Low	10	Low	2.5	1.0000	12.50
Wildfires	Low	10	Low	2.5	1.0000	12.50
Drought	Nil	1	Nil	1	0.0500	0.10
Fog	Mod	40	Nil	1	1.0000	41.00
Earthquake	Low	10	Low	2.5	0.0100	0.13
Hailstorm	Nil	1	Nil	1	0.1600	0.32
Land failure	Nil	0	Nil	0	1.0000	0.00
Severe winter	Nil	1	Nil	1	0.0500	0.10
Dam failure	Low	10	Low	2.5	0.0100	0.13
Levee failure	Low	10	Mod	10	0.0050	0.10
Termites	Low	10	Low	2.5	1.0000	12.50

Table 3-17 shows a different emphasis than Table 3-16’s property damage figures. The greatest threat to people is fog. More people are killed each year due to fog than due to any of the other hazards. More frequent hazards, such as tornadoes, wildfires, termites and tropical storms also score high.

3.16.3. Economic impact In Table 3-18, the subjective economic impact scores are also given numerical values of 100, 40, 10, and 1. These are multiplied times the property damage cost and divided by 1,000,000. The result is multiplied times the annual chance of occurrence to produce a score that reflects the likelihood of a dollar impact. As with Table 3-17, the resulting “economic score” is a numerical representation of the relative impact each hazard has the economy of St. Tammany Parish. These numbers can only be used to compare the values of “high,” “moderate,” “minor,” and “nil” between hazards.

Table 3-18 Summary of the Economic Impact					
Hazard	**Overall Impact**		**Property Damage**	**Annual Chance**	**Economic Score**
Tropical storm	Minor	10	$215,569,033	0.8300	1789.22
Category 2 hurricane	Mod	40	$464,225,400	0.0526	976.73
Category 5 hurricane	High	100	$7,624,137,600	0.0055	4193.28
5-year stormwater flood	Minor	10	$379,591,500	0.2000	759.18
100-year flood	High	100	$2,129,837,350	0.0100	2129.84
Tornadoes	Nil	1	$300,000	1.0000	0.30
Wildfires	Nil	1	$61,875	1.0000	0.06
Drought	Minor	10	$25,333	0.0500	0.01
Fog	Nil	1	$400,000	1.0000	0.40
Earthquake	Nil	1	$754,916	0.0100	0.01
Hailstorm	Nil	1	$6,793,524	0.1600	1.09
Land failure	Nil	1	$100,000	1.0000	0.10
Severe winter	Minor	10	$7,260,162	0.0500	3.63
Dam failure	Nil	1	$25,000	0.0100	0.00
Levee failure	Nil	1	$118,575,000	0.0050	0.59
Termites	Minor	10	$17,500,000	1.0000	175.00

The numbers in Table 3-18 show a pattern similar to Table 3-16's property damage. The hazards of tropical storms/hurricanes/flooding have the greatest impact. However, termites are a greater factor here, primarily because they are so widespread and the hazard is present every year.

3.16.4. Conclusions The three tables and the earlier facts and figures in this chapter help prioritize the relative severity of the natural hazards on property and people in St. Tammany Parish. The Committee concluded the following:

1. Tropical storms (including hurricanes) and flooding are by far the most severe hazards facing St. Tammany Parish in terms of property damage. Termites and hailstorms are the next most severe.

2. Fog is the most severe hazard facing St. Tammany Parish in terms of the threat to lives, safety and mental health. Other, more frequent, hazards, such as tornadoes, wildfires, termites and tropical storms are also important.

3. Tropical storms (including hurricanes) and flooding have the greatest overall impact on the area's economy. Termites are an added cost of living in the area.

4. Some types of property and areas are more vulnerable than others. Special emphasis should be placed on protecting manufactured homes and repeatedly flooded properties.

3.17. Municipal Data

The data presented in the previous pages of this Chapter are for the entire Parish planning area, that is the unincorporated areas of the Parish and the four participating municipalities. Table 3-2 provides a count of each type of property analyzed for the entire area. It is important that each local government recognize how the 13 hazards affect their individual jurisdictions.

3.17.1. Vulnerable properties Table 3-19 provides the property data totals broken down for the five different participants. The far right column has the same numbers as Table 3-2. It should be noted that some sources of data, such as cell towers and power lines, did not include locational information. Available data only allowed estimates of the "other structures" based on extrapolation.

However, the data are sufficient for general conclusions. For example, this work concluded that nearly 94% of the property values in the planning area are in the unincorporated areas of the Parish.

Table 3-19 Vulnerable Properties in Planning Area by Jurisdiction

Property	Uninc. Parish	Abita Springs	Folsom	Sun	Pearl River	Total
Water/wastewater						
Water plants	17	1	1	0	1	20
Wastewater plants	13	1	1	0	1	16
Wells	7	5	2	1	1	16
Water towers	46	1	0	0	0	47
Public health						
Hospitals	9	0	0	0	0	9
Nursing care	16	0	0	0	0	16
Emergency services						
Fire stations	37	2	1	1	0	41
Police/sheriff	14	1	1	1	2	19
Telecommunications						
Radio/TV towers	7	0	0	0	1	8
Cell towers						119
Energy						
Switching stations	53	2	0	0	0	55
Power lines						200
Chemical/haz mat	8	0	0	0	0	8
Critical government	10	0	0	0	0	10
Shelters	44	2	1	0	2	49
Total critical facilities	400	15	7	3	8	633
Other structures						
Single family	41,992	808	474	300	1,021	44,595
Mobile homes	7,693	148	87	55	187	8,170
Multi-family	473	9	4	3	11	500
Businesses	1,884	36	21	13	46	2,000
Government	491	3	3	1	2	500
Total all structures	52,814	1,018	596	375	1,275	56,398

3.17.2. Hazard location As noted in the "Area Affected" sections of Chapter 2, all but six of the 13 hazards affect all areas of the Parish and all the municipalities somewhat equally. For example, in Section 2.3.3 on tornadoes, it was concluded, "the entire parish is considered susceptible to this hazard." This means that the relative vulnerability of each jurisdiction is proportionally the same.

Two of the hazards are more site specific:

- Tropical storms/hurricanes: While the wind impacts are Parish-wide, the lakeshore storm surge and flooding do not reach the four cities (Map 2-7). Tables 3-20 − 3-23 use only property damage caused by wind for the tropical storm and hurricane damage figures.
- Flooding: As noted in Section 3.4.1, the 5-year stormwater floods are assumed to affect the entire community. However, the 100-year flood damage estimates are based on the structures in the mapped 100-year floodplain. The data in Tables 3-20 − 3-23 are based on available GIS floodplain maps and building counts.

Four of the hazards do not affect the four inland municipalities

- Drought: The property damage impact is in two lakeshore areas (Map 2-11)
- Land failure: This is a lakeshore hazard (Map 2-13).
- Dam failure: Only the two dams on the Pearl River are calculated to cause any property damage if they failed. These are expected to affect unincorporated areas only (Map 2-14).
- Levee failure: Only two levee systems are affected, and they are both in the unincorporated areas south and east of Slidell (Map 2-16).

3.17.3. Conclusions

Property damage: Tables 3-20 − 3-23 on the following pages show the property damage expected from the nine hazards relevant to the four participating municipalities. These tables can be compared to Table 3-16, which is for the entire planning area, i.e., the four cities plus the unincorporated areas of the Parish. With the exception of Folsom, which has a very small floodplain, the relative distribution of damage is similar to the Parish as a whole − tropical storms, hurricanes and flooding are the most severe hazards.

Impact on people: It is expected that the impact of the hazards on life safety and mental health would have similar distributions, with one exception. Fog is primarily a problem along the lakeshore, especially on the bridges. All four cities are inland. Accordingly, the greatest life safety and mental health hazards to the residents of Abita Springs, Folsom, Sun and Pearl River are from tornadoes, wildfires, tropical storms, and termites.

Economic impact: Each municipality has its own economic base and business district. It is concluded that the relative distribution of the economic impact of the nine relevant hazards is similar to the Parish as a whole: tropical storms, hurricanes, and flooding have the greatest impact by far.

Abita Springs has 1,018 buildings, with 253 of them in the 100-year floodplain. Tropical storms, hurricanes and flooding cause the greatest average annual damage.

Table 3-20 Property Damage Summary for Abita Springs			
Hazard	**Property Damage from Single Occurrence**	**Annual Chance**	**Average Annual Damage**
Tropical storm	$2,069,463	0.8300	$1,717,654
Category 2 hurricane	$4,270,874	0.0526	$224,648
Category 5 hurricane	$137,234,477	0.0055	$754,790
5-year stormwater flood	$7,591,830	0.2000	$1,518,366
100-year flood	$10,782,750	0.0100	$107,827
Tornadoes	$6,000	1.0000	$6,000
Wildfires	$1,238	1.0000	$1,238
Drought	$0		$0
Fog	$8,000	1.0000	$8,000
Earthquake	$15,098	0.0100	$151
Hailstorm	$135,870	0.1600	$21,739
Land failure	$0		$0
Severe winter	$145,203	0.0500	$7,260
Dam failure	$0		$0
Levee failure	$0		$0
Termites	$340,000	1.0000	$340,000
Total			$4,707,673

Folsom has 596 buildings and a relatively small 100-year floodplain with only 8 buildings in it. Tropical storms and stormwater flooding cause the greatest average annual damage.

Table 3-21 Property Damage Summary for Folsom			
Hazard	**Property Damage from Single Occurrence**	**Annual Chance**	**Average Annual Damage**
Tropical storm	$1,345,151	0.8300	$1,116,475
Category 2 hurricane	$2,776,068	0.0526	$146,021
Category 5 hurricane	$89,202,410	0.0055	$490,613
5-year stormwater flood	$4,934,690	0.2000	$986,938
100-year flood	$410,550	0.0100	$4,106
Tornadoes	$3,900	1.0000	$3,900
Wildfires	$804	1.0000	$804
Drought	$0		$0
Fog	$5,200	1.0000	$5,200
Earthquake	$9,814	0.0100	$98
Hailstorm	$88,316	0.1600	$14,131
Land failure	$0		$0
Severe winter	$94,382	0.0500	$4,719
Dam failure	$0		$0
Levee failure	$0		$0
Termites	$221,000	1.0000	$221,000
Total			$2,994,006

Sun is the smallest municipality, with 375 buildings, 56 of them in the 100-year floodplain. Tropical storms, hurricanes and flooding cause the greatest damage.

Table 3-22 Property Damage Summary for Sun			
Hazard	**Property Damage from Single Occurrence**	**Annual Chance**	**Average Annual Damage**
Tropical storm	$931,258	0.8300	$772,944
Category 2 hurricane	$1,921,893	0.0526	$101,092
Category 5 hurricane	$61,755,515	0.0055	$339,655
5-year stormwater flood	$3,416,324	0.2000	$683,265
100-year flood	$6,130,250	0.0100	$61,302
Tornadoes	$2,700	1.0000	$2,700
Wildfires	$557	1.0000	$557
Drought	$0		$0
Fog	$3,600	1.0000	$3,600
Earthquake	$6,794	0.0100	$68
Hailstorm	$61,142	0.1600	$9,783
Land failure	$0		$0
Severe winter	$65,341	0.0500	$3,267
Dam failure	$0		$0
Levee failure	$0		$0
Termites	$153,000	1.0000	$153,000
Total			$2,131,232

Pearl River is the largest of the four cities. It has 1,275 buildings, with 260 of them in the 100-year floodplain. Tropical storms, hurricanes and flooding cause the greatest average annual damage.

Table 3-23 Property Damage Summary for Pearl River			
Hazard	**Property Damage from Single Occurrence**	**Annual Chance**	**Average Annual Damage**
Tropical storm	$2,483,355	0.8300	$2,061,185
Category 2 hurricane	$5,125,048	0.0526	$269,578
Category 5 hurricane	$164,681,372	0.0055	$905,748
5-year stormwater flood	$9,110,196	0.2000	$1,822,039
100-year flood	$16,490,900	0.0100	$164,909
Tornadoes	$7,200	1.0000	$7,200
Wildfires	$1,485	1.0000	$1,485
Drought	$0		$0
Fog	$9,600	1.0000	$9,600
Earthquake	$18,118	0.0100	$181
Hailstorm	$163,045	0.1600	$26,087
Land failure	$0		$0
Severe winter	$174,244	0.0500	$8,712
Dam failure	$0		$0
Levee failure	$0		$0
Termites	$408,000	1.0000	$408,000
Total			$5,684,724

3.18. References

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2. Flood insurance claims records, Federal Emergency Management Agency, as of July 31, 2003.
3. Flood Insurance Study and Flood Insurance Rate Map, St. Tammany Parish Unincorporated areas, FEMA, April 19, 1999.
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5. *Hazard Mitigation Plan: Hazard Profiles*, Louisiana Office of Emergency Preparedness, April 18, 2003
6. *Multi-Hazard Identification and Risk Assessment*, Federal Emergency Management Agency, 1997.
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11. *Surface Transportation Weather Applications*, Paul Pisano and Lynett C. Goodwin, undated
12. *The Economic Base of St. Tammany Parish, Louisiana*, Taimerica Management Company, January, 2003
13. *The Physical Protection of Critical Infrastructures and Key Assets*, US Department of Homeland Security, 2003
14. *Times-Picayune* articles
15. *Understanding Your Risks – Identifying Hazards and Estimating Losses*, FEMA 286-2, 2001

Chapter 4. Goals

Goals are needed for this planning effort to guide the review of the possible mitigation measures. This Plan needs to make sure that the recommended actions are consistent with what is appropriate for St. Tammany Parish. Mitigation goals need to reflect community priorities and be consistent with other plans for the Parish.

4.1. Background

4.1.1. ND 2025 The goals of this plan need to be consistent with and complement the goals of other Parish planning efforts. The primary planning effort is the program called "New Directions 2025" (ND 2025). While the ND 2025 plans are still being developed, in 1999, the ND 2025 Steering Committee and the Parish Police Jury adopted the "Vision Element" to provide direction to the effort.

As with the entire ND 2025 effort, the Vision Element has a Natural Hazards section. Although the Vision Element does not have specific goals, the "value statements" provide guidance, similar to goals statements. There are four value statements for natural hazards:

1. All residents and their property will be protected from natural hazards to the maximum feasible extent. We will find ways to achieve these goals that also enhance and complement the natural beauty of St. Tammany Parish.

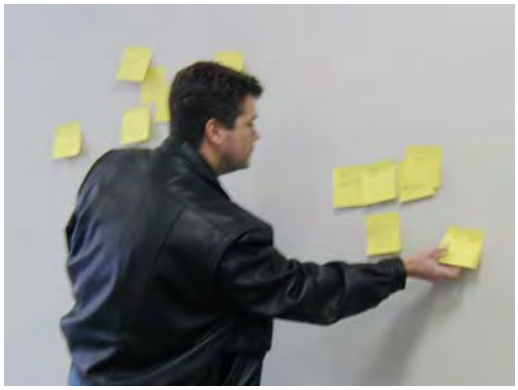
2. For those natural hazards from which residents cannot be protected in place, both adequate warning and safe escape measures will be available to save as many lives as possible.

3. All future development will be sited and constructed in such a way so as to not only (a) be at less risk than existing development but also (b) to not increase the risk to pre-existing developments.

4. Enhanced cooperation will exist among all bodies of local government.

4.1.2. Goal setting exercise On December 6, 2003, the Hazard Mitigation Planning Committee conducted an exercise to outline its goals for this mitigation plan. Each member was given the handout that appears on the next page, asking for their five goals for the mitigation program. The handout includes a list of possible responses.

Committee members wrote down their top five choices on a Post-it card. Each member then posted them on the wall and explained their choices.



Planning Committee goals exercise

Goals Exercise

What should be the goals of our mitigation program?

Here are possible answers to this question. They are just food for thought. Pick the five that you think are most important. You may reword them or add new ones if you want.

You have five cards. Use one card for each of your top five answers.

Protect businesses from damage
Protect homes from damage
Protect new/future buildings from damage
Protect forests
Protect marshes/wetlands/environmentally sensitive areas
Protect people's lives
Protect public health
Protect public services (fire, police, etc.)
Protect critical facilities
Protect streets and utilities
Protect the Causeway and bridges to New Orleans
Protect power stations and power lines
Protect downtowns/shopping centers
Protect centers of employment
Protect schools
Protect scenic areas, greenways, buffers, etc.
Protect cars and other vehicles
Protect farms, crops and livestock
Protect repetitively flooded areas
Protect a particular area: _____
Protect a particular property: _____
Protect a particular property: _____
Make sure future development doesn't make things worse
New developments should pay the full cost of protection measures
Restrict development in hazardous areas
Minimize public expenditures
Minimize property owners' expenditures
Maximize the share paid by benefiting property owners
Maximize use of state and federal funds
Use public/private partnerships
Help people protect themselves
Other: _____
Other: _____
Other: _____

The cards were then organized by similar topics. There was quite a bit of consistency in the members' topics. The handout has more than 30 possible goal statements, but the members' nominations covered no more than 10 topics. Several of them were not listed in the handout. The Committee members' nominations were relatively easy to fit into a concise number of goals.

Organizing Committee members' goals

The exercise revealed important information to guide the planning effort, both in what was selected from the handout and what was not selected from the handout. For example, members did not stress protecting natural areas or which sources of funding to use. They focused on protecting people and property.

There was no favoritism shown for, say, residences over other types of property, but there was a strong concern to protect critical facilities and public services, particularly to make sure they will be able to protect people when needed. While this Plan addresses all hazards, flooding was foremost in the members' minds because it has proven to be the most common and damaging of the hazards reviewed.

4.2. Goals

At the end of the exercise, the Mitigation Planning Committee agreed on six general goals for this planning effort:

1. Protect the lives and health of the Parish's residents from the dangers of natural hazards.

2. Ensure that public services and critical facilities operate during and after a disaster.

3. Ensure that adequate evacuation routes, streets and utilities are maintained and available during and after a disaster.

4. Protect homes and businesses from damage.

5. Keep the problems caused by natural hazards from getting worse through wise management of new development.

6. Give special attention to repetitively flooded areas.

These goals are certainly consistent with the vision statements of ND 2025 and practically repeat the first three statements of that earlier planning effort.

Chapter 5. Property Protection

Property protection measures are used to modify buildings or property subject to damage. Property protection measures fall under three approaches:

- Modify the site to keep the hazard from reaching the building,
- Modify the building so it can withstand the impacts of the hazard, and
- Insure the property to provide financial relief after the damage occurs.

Property protection measures are normally implemented by the property owner, although in many cases technical and financial assistance can be provided by a government agency. These are discussed later in this chapter.

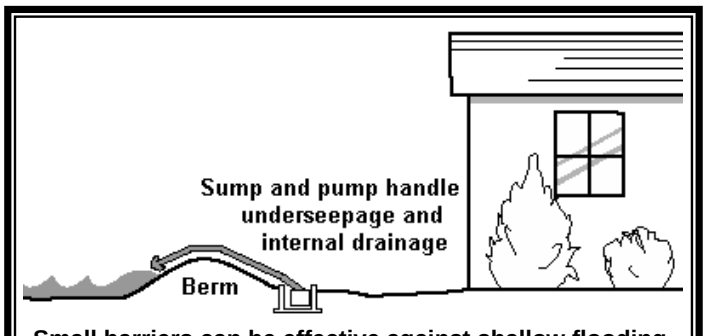
5.1. Keeping the Hazard Away

Generally, natural hazards do not damage vacant areas. As noted in Chapters 2 and 3, the major impact of hazards is to people and improved property. In some cases, properties can be modified so the hazard does not reach the damage-prone improvements. A fire break is an example of this approach – brush and other fuel are cleared away from the building so a fire may not reach it. Keeping the hazard away works for three of the hazards addressed in this plan: flooding, wildfires, and termites.

5.1.1. Flooding: There are four common methods to keeping a flood from reaching and damaging a building:

- Erect a barrier between the building and the source of flooding,
- Move the building out of the floodprone area,
- Elevate the building above the flood level, and
- Demolish the building.

Barriers: A flood protection barrier can be built of dirt or soil ("berm") or concrete or steel ("floodwall"). Careful design is needed so as not to create flooding or drainage problems on neighboring properties. Depending on how porous the ground is, if floodwaters will stay up for more than an hour or two, the design needs to account for leaks, seepage of water underneath, and rainwater that falls inside the perimeter. This is usually done with a sump and/or drain to collect the internal groundwater and surface water and a pump and pipe to pump the internal drainage over the barrier.



Small barriers can be effective against shallow flooding.

Barriers can only be built so high. They can be overtopped by a flood higher than expected. Barriers made of earth are susceptible to erosion from rain and floodwaters if not properly sloped, covered with grass, and maintained. A berm can settle over time, lowering its protection level. A floodwall can crack, weaken, and lose its watertight seal. Therefore, barriers need careful design and maintenance (and insurance on the building, in case of failure).

This low floodwall has landscaping to minimize the adverse impact on the property's appearance.

Relocation: Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier structures, such as those with exterior brick and stone walls, and for large or irregularly shaped buildings. However, experienced building movers can handle any job.

Small, wood frame buildings are the easiest to relocate

Source: Kennedy House Movers, Huntsville, AL

In areas subject to flash flooding, deep waters, or other high hazard, relocation is often the only safe approach. Relocation is also preferred for large lots that include buildable areas outside the floodplain or where the owner has a new flood-free lot (or portion of the existing lot) available.

Building elevation: Raising a building above the flood level can be almost as effective as moving it out of the floodplain. Water flows under the building, causing little or no damage to the structure or its contents.

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with floodplain regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

Elevated house in the Bayou Liberty area

One concern with elevation is that it may expose the structure to greater impacts from other hazards. If not braced and anchored properly, an elevated building may have less resistance to the shaking of an earthquake and the pressures of high winds.

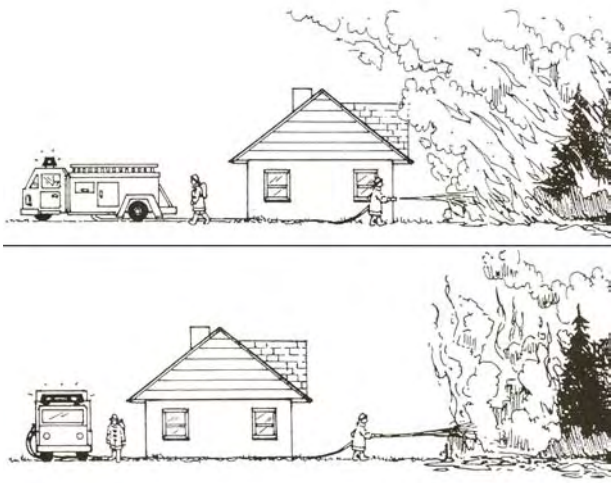
Demolition: Some buildings, especially heavily damaged or repetitively flooded ones, are not worth the expense to protect them from future damage. It is cheaper to demolish them and either replace them with new, flood protected structures, or relocate the occupants to a safer site. Demolition is also appropriate for buildings that are difficult to move—such as larger, slab foundation, or masonry structures—and for dilapidated structures that are not worth protecting. Generally, demolition projects are undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public open space use, such as a park.

One problem that sometimes results from an acquisition and demolition project is a "checkerboard" pattern in which nonadjacent properties are acquired. This can occur when some owners, especially those who have and prefer a waterfront location, prove reluctant to leave. Creating such an acquisition pattern in a community simply adds to the maintenance costs that taxpayers must support.

Demolishing a repetitively flooded home

5.1.2. Wildfire One way to defeat fire is by keeping fuel away from the building. This is called the concept of "defensible space." Defensible space involves providing sufficient space between the structure and flammable vegetation.

Within this space, the fire service has room to battle the wildfire before it reaches the structure or to stop a structural fire before it ignites the wildland vegetation. With sufficient defensible space, the structure even has a chance to survive on its own when fire service personnel and equipment are not available, as often happens during a significant wildfire.


The concept of defensible space

Source: *Wildland/Urban Interface Fire Protection*

5.1.3. Termites The best way to protect a house from termites is to not let them in. One way to do this is to create a continuous chemical barrier which blocks potential routes of termite entry. A trench is dug around slabs, piers or other supports touching the soil. The soil put in the trench is saturated with termiticides. This approach will protect a structure for approximately five years. Other barriers include wood treatment, termiticide foams, and bait stations.

5.1.4. Implementation in St. Tammany Parish The Parish and the cities of Slidell, Mandeville, Covington and Abita Springs have had a good deal of experience with acquisition, demolition, or elevation to protect buildings from flooding. All have received several grants from FEMA to manage these programs. In the last year, the Parish assumed day to day administration from a contractor and created a four person Flood Hazard Mitigation office in the Department of Planning.

Over 100 properties have been acquired and cleared or elevated in St. Tammany Parish. Elevation projects have included both elevating the whole structure and adding a second story and abandoning the first, floodprone, floor. Examples are illustrated below.

Parish staff have learned many lessons from this work. The main concern is constraints placed on them by Federal funding rules. It is believed that funds could be saved and projects administered more quickly if more local flexibility were allowed.

It is assumed that property owners have constructed defensible spaces and termite barriers, but there is no government involvement or data.

Small barriers are successful when flooding is short term and soils are relatively impermeable. That was not the case for this barrier. The repetitively flooded property is being acquired by the Parish.

An example of the checkerboard pattern that results when only one or two properties are purchased and cleared. All FEMA funded acquisition/elevation projects are voluntary.

This St. Tammany Parish house was elevated with FEMA funding support.

The roof has been removed as this house is being readied for a new second story.

5.1.5. CRS Credit The Community Rating System provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved.

The CRS provides the most credit points for acquisition and relocation because this measure permanently removes insurable buildings from the floodplain. Under Activity 520 – Acquisition and Relocation, the Parish would receive 100 points.

The CRS credits barriers and elevating existing buildings (Activity 530 – Flood Protection). Elevating a building above the flood level will also reduce the flood insurance premiums on that individual building. Because barriers are less secure than elevation, not as many points are provided. The Parish would receive 20 – 25 points.

Higher scores are possible, but they are based on the number of buildings removed compared to the number remaining in the floodplain. In both cases, the Parish would receive what is known as the lower "default" credit. The default approach favors large communities that may have acquired or elevated many structures, but still have thousands left in the floodplain.

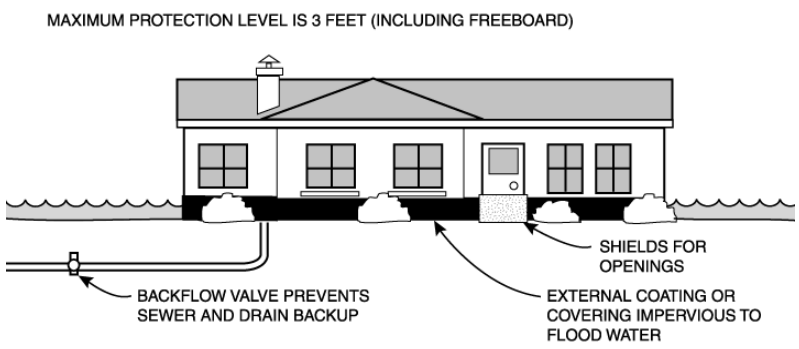
Sun is not in the National Flood Insurance Program and therefore ineligible for CRS credits. Folsom has not joined the CRS. It has no acquired or elevated properties, so it would not receive any credit.

5.2. Retrofitting

Section 5.1 focused on keeping the hazard from reaching a building or damage-prone part of a property. An alternative is to modify or "retrofit" the site or building to minimize or even prevent damage. There are a variety of techniques to do this. This section looks at the measures that can be implemented to protect existing buildings from damage.

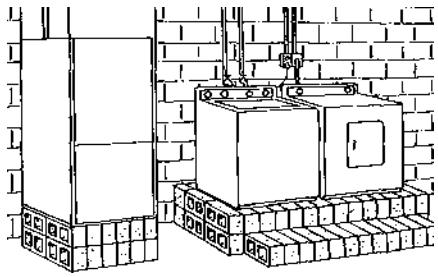
5.2.1. Flooding Flood retrofitting measures include **dry floodproofing** where all areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings (doors, windows, and vents) are closed, either permanently, with removable shields, or with sandbags.

Dry floodproofing of new and existing nonresidential buildings in the regulatory floodplain is permitted under State, FEMA and local regulations. Dry floodproofing of existing residential buildings in the floodplain is also permitted as long as the building is not substantially damaged or being substantially improved. Owners of buildings located outside the regulatory floodplain can always use dry floodproofing techniques.



Dry floodproofed house

The alternative to dry floodproofing is **wet floodproofing:** water is let in and everything that could be damaged by a flood is removed or elevated above the flood level. Structural components below the flood level are replaced with materials that are not subject to water damage. This is the approach used for the first floor of the elevated homes illustrated in the previous section.


Wet floodproofed appliances

For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater, and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms.

5.2.2. Wind The high wind forces of tropical storms, hurricanes and tornadoes can be resisted by securing the roof, walls and foundation with adequate fasteners or tie downs. These help hold the building together when the combination of high wind and pressure differences work to pull the building apart.

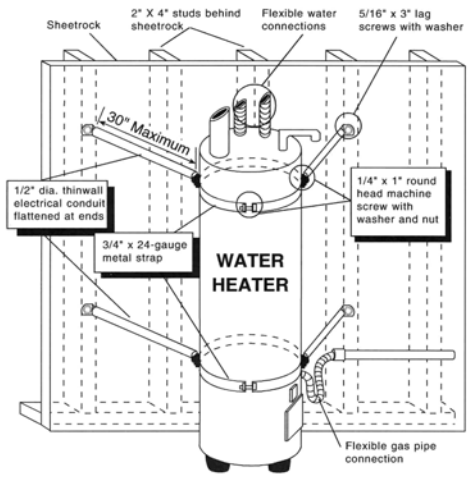
Another retrofit is to strengthen garage doors, windows and other large openings. If winds break the building's "envelope," the pressures on the structure are greatly increased. Windows can be protected with storm shutters or special glass.

Tornado retrofitting measures include constructing an underground shelter or "safe room" to protect the lives of the occupants. Their worth has been proven by recent tornadoes in Oklahoma, as shown in the photo to the right. They can be installed for approximately $3,000.

Interior rooms can be reinforced and retrofitted to be tornado "safe rooms"

5.2.3. Earthquake Earthquake retrofitting measures include removing masonry overhangs that will fall onto the street during shaking. Bracing the building provides structural stability, but can be very expensive.

Less expensive approaches may be more cost-effective for an area like St. Tammany Parish that faces a relatively low earthquake threat. These include tying down appliances, water heaters, bookcases and fragile furniture so they won't fall over during a quake and installing flexible utility connections that will not break when shaken.



Earthquake retrofitting

The Homeowners Guide to Earthquake Safety

5.2.4. Other hazards and measures

- Burying utility lines is a retrofitting measure that addresses the winds from tornadoes and thunderstorms and the ice that accompanies winter storms.
- Installing or incorporating backup power supplies minimizes the effects of power losses caused by downed lines.
- Roofs can be replaced with materials less susceptible to damage by hail, such as modified asphalt or formed steel shingles.
- Wildfire retrofitting measures include replacing roofing with fireproof materials and installing spark arrestors on chimneys.
- Winter storm retrofitting measures include improving insulation on older buildings and relocating water lines from outside walls to interior spaces. Windows can be sealed or covered with an extra layer of glass (storm windows) or plastic sheeting.

5.2.5. Implementation in St. Tammany Parish Some properties have been retrofitted to protect them from flooding, wildfire, and high winds. However, because these projects are so small, they generally do not require a building permit. Therefore, there are no records of them.

A study of flood retrofitting behavior was conducted in Slidell in the 1980's by the University of New Orleans. Questionnaires were distributed to homes in floodprone areas. Of the respondents who had had water in their homes, 31% reported to have later implemented one or more flood protection measure.

There is one known case of a house in the Bayou Liberty area that had its walls dry floodproofed. When flooded, though, the water seeped underneath through the slab and the house suffered damage. This highlights the need for technical guidance, a thorough investigation of the condition of the structure, and careful construction of any retrofitting measure for flood protection.

5.2.6. CRS credit: Credit for dry and wet floodproofing and sewer backup protection is provided under Activity 530 – Retrofitting. Because these property protection measures are less secure than barriers and elevation, not as many points are provided. Retrofitting to protect a building for hazards other than flooding is not credited under the CRS.

5.3. Insurance

Technically speaking, insurance does not mitigate damage caused by a natural hazard. However, it does help the owner repair, rebuild and (hopefully) afford to incorporate some of the other property protection measures in the process. Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work.

5.3.1. Private property A standard **homeowner's insurance** policy will cover a property for the hazards of tornado, wind, hail, and winter storms. Separate endorsements are usually needed for earth movement (e.g., earthquake) coverage.

Most homeowner's insurance policies will pay for collapse or other structural damage caused by termites. Insurance for termites can also come in the form of a warranty sold by the company that applied the termiticide to the structure.

Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program. **Flood insurance** coverage is provided for buildings and their contents damaged by a "general condition of surface flooding" in the area. Sample premiums are shown in Table 5-1.

Most people purchase flood insurance because it is required by the bank when they get a mortgage or home improvement loan. Usually these policies just cover the building's structure and not the contents. Renters can buy contents coverage, even if the owner does not buy structural coverage on the building. A review of the 6,500 claims that have been paid in the planning area found that over one-half did not include a claim for damage to contents, a signal that the policy holders did not have contents coverage.

Table 5-1 Example Flood Insurance Premiums

Building Exposure	Premium
In the Special Flood Hazard Area (AE Zone)	
Pre-FIRM ("subsidized") rate	$1,345
Post-FIRM (actuarial) rates	
2 feet above the base flood elevation	$413
1 foot above the base flood elevation	$575
At the base flood elevation	$841
1 foot below the base flood elevation	$3,085
Outside the Special Flood Hazard Area	$792

Premiums are for $150,000 in building coverage and $75,000 in contents coverage for a one story house with no basement and a $500 deductible. Premiums are lower in Community Rating System communities.

5.3.2. Public property Governments can purchase commercial insurance policies. Larger local governments often self-insure and absorb the cost of damage to one facility, but if many properties are exposed to damage, self-insurance can be a major drain on the treasury. Communities cannot expect Federal disaster assistance to make up the difference after a flood.

Under Section 406(d) of the Stafford Act.

> If an eligible insurable facility damaged by flooding is located in a [mapped floodplain] … and the facility is not covered (or is underinsured) by flood insurance on the date of such flooding, FEMA is required to reduce Federal disaster assistance by the *maximum* amount of insurance proceeds that would have been received had the buildings and contents been fully covered under a National Flood Insurance Program (NFIP) standard flood insurance policy. [Generally, the maximum amount of proceeds for a non-residential property is $500,000.]
>
> [Communities] Need to:
>
> - Identify all insurable facilities, and the type and amount of coverage (including deductibles and policy limits) for each. The anticipated insurance proceeds will be deducted from the total eligible damages to the facilities.
> - Identify all facilities that have previously received Federal disaster assistance for which insurance was required. Determine if insurance has been maintained. *A failure to maintain the required insurance for the hazard that caused the disaster will render the facility ineligible for Public Assistance funding….*
> - [Communities] *must* obtain and maintain insurance to cover [their] facility - buildings, equipment, contents, and vehicles - for the hazard that caused the damage in order to receive Public Assistance funding. Such coverage must, at a minimum, be in the amount of the eligible project costs. FEMA will not provide assistance for that facility in future disasters if the requirement to purchase insurance is not met. – FEMA Response and Recovery Directorate Policy No. 9580.3, August 23, 2000

In other words, the law expects public agencies to be fully insured as a condition of receiving Federal disaster assistance.

5.3.3. Implementation in St. Tammany Parish Data on private insurance policies are not available. Flood insurance has been available in St. Tammany Parish since the early 1970's. Current flood insurance coverage and historic claim payments are shown in Table 5-2.

Some additional statistics include:

- Of the 23,561 policies in the unincorporated Parish, 20,284 (86%) are for post-FIRM buildings, i.e., built since the early 1970's.
- 42% of the policies are for buildings in the mapped floodplain. The fact that the majority of the policies are not in the "official" Special Flood Hazard Area indicates the extent of the stormwater flooding problem.
- Using this Plan's estimate of 17,600 buildings in the floodplain, between 50% and 60% of the buildings in the Special Flood Hazard Area are covered by insurance. Put another way, at least 40% of the mapped floodprone buildings are not insured for flood damage.

These figures show that there is broad awareness of flood insurance, 50% coverage is above the national average. However, coverage is still below what it should be in an area as floodprone as St. Tammany Parish.

Table 5-2 Flood Insurance Coverage				
Coverage	**No. of Policies**	**Total Coverage**	**No. of Paid Claims**	**Total Paid Claims**
Unincorporated Parish				
1-4 family	22,568	$3,962,774,500	6,234	$81,996,221
Other residential	508	$43,952,500	55	$1,118.865
Other structures	485	$114,309,800	149	$2,612,215
Small businesses	0	$0	46	$794,774
Total	23,561	$4,121,036,800	6,486	$86,558,709
Abita Springs				
1-4 family	207	#31,870,900	48	$600,465
Other residential	0	$0	0	$0
Other structures	17	3,002,700	0	$0
Small businesses	0	$0	0	$0
Total	224	$34,873,600	48	$600,465
Folsom				
1-4 family	32	$4,911,700	9	$77,829
Other residential	0	$0	0	$0
Other structures	0	$0	0	$0
Small businesses	0	$0	0	$0
Total	32	$4,911,700	9	$77,829
Pearl River				
1-4 family	98	$14,088,800	19	$235,654
Other residential	0	$0	0	$0
Other structures	2	$533,400	0	$0
Small businesses	0	$0	0	$0
Total	100	$14,622,200	20	$235,654
Source: Federal Emergency Management Agency. Figures are as of 10/31/03				

Folsom insures its public buildings under a commercial property insurance policy, which excludes earthquake and flood coverage. Abita Springs and Pearl River have commercial policies, but do not have flood insurance coverage on Town properties. The Parish has a policy that covers for fire, wind, hail and broken water pipes. It does not include earthquake coverage. All Parish buildings in the Special Flood Hazard Area are covered by flood insurance.

The Parish has a risk manager who calculates how much damage can be absorbed by the Parish in order to have lower insurance premiums. For most properties and coverage, there is a $100,000 deductible per occurrence, making the Parish self-insured for the first $100,000 in damage from most events. There are lower deductibles for some liability exposures and on a few buildings.

5.3.4. CRS Credit There is no credit for purchasing flood or other kinds of insurance, but the Community Rating System does provide credit for local public information programs that explain flood insurance to property owners. The CRS also reduces the premiums for those people who do buy NFIP coverage.

5.4. The Government's Role

Property protection measures are usually considered the responsibility of the property owner. However, local governments should be involved in all strategies that can reduce flood losses, especially acquisition and conversion of a site to public open space. There are various roles the Parish or a municipality can play in encouraging and supporting implementation of these measures.

5.4.1. Possible roles There are several different ways the Parish or a village could support property protection activities by private property owners.

Government facilities: One of the first duties of a local government is to protect its own facilities. Fire stations, water treatment plants and other critical facilities should be a high priority for retrofitting projects and insurance coverage. This also sets the example and provides models for private property owners.

Public Information: Providing basic information to property owners is the first step in supporting property protection measures. Owners need general information on what can be done. They need to see examples, preferably from nearby. Public information activities that can promote and support property protection are discussed in Chapter 9.

Financial assistance: The local government can be a pass through and administrator for State or Federal funding programs, or it can contribute its own funds to provide more locally-appropriate arrangements. This is discussed more in the next section.

Acquisition agent: The community can be the focal point in an acquisition project. Most funding programs require a local public agency to sponsor the project. The Parish or a municipality could process the funding application, work with the owners, and provide some or all of the local share. In some cases, the local government would be the ultimate owner of the property, but in other cases a school or other public agency could assume ownership and the attendant maintenance responsibilities.

Mandates: Mandates are considered a last resort if information and incentives aren't enough to convince a property owner to take protective actions. An example of a fire safety retrofitting mandate that many communities have is the requirement that the electrical service on an older house be brought up to current code as a condition of any building permit.

There is a mandate for improvements or repairs made to a building in the mapped floodplain. If the project equals or exceeds 50% of the value of the original building it is considered a "substantial improvement." The building must then be elevated or otherwise brought up to current flood protection codes.

Another possible mandate is to require less expensive hazard protection steps as a condition for any building permit. For example, if a person applied for a permit for electrical work, the community could require that the service box be moved above the base flood elevation.

5.4.2. Financial Assistance Communities can help owners by helping to pay for a retrofitting project. Financial assistance can range from full funding of a project to helping residents find money from other programs. Some communities assume responsibility for sewer backups, street flooding, and other problems that arise from an inadequate public sewer or public drainage system.

Less expensive community programs include low interest loans, forgivable low interest loans and rebates. A forgivable loan is one that does not need to be repaid if the owner does not sell the house for a specified period, such as five years. These approaches don't fully fund the project but they cost the community treasury less and they increase the owner's commitment to the project. Often, small amounts of money act as a catalyst to pique the owner's interest to get a self-protection project moving (see box).

The more common outside funding sources are listed below. Unfortunately, some are only available after a disaster, not before, when damage could be prevented.

Property Protection Rebates

The City of Guthrie, Oklahoma has a rebate program for installation of tornado shelters and safe rooms. The City provides up to $1,500 per house, which can cover the majority of the cost.

The Village of South Holland, Illinois received national recognition for its rebate program to help property owners fund retrofitting projects to protect against surface and subsurface flooding. If a project is approved, installed, and inspected, the Village will reimburse the owner 25% of the cost up to $2,500. Over 450 floodproofing and sewer backup protection projects have been completed under this program. Perhaps not surprisingly, contractors have become some of the best agents to publicize this program.

Pre-disaster funding sources

- FEMA's Pre-Disaster Mitigation (PDM) grants (administered by the Louisiana Office of Emergency Preparedness, LOEP)
- FEMA's Flood Mitigation Assistance (FMA) grants (administered by LOEP)
- Community Development Block Grant (administered by the Office of Governor's Division of Administration)
- Small Business Administration's Pre-Disaster Mitigation Loan Program
- The Statewide Flood Control Program managed by the Louisiana Department of Transportation and Development
- Conservation organizations, such as the Conservation Foundation, although generally these organizations prefer to purchase vacant land in natural areas, not properties with buildings on them
- The U.S. Army Corps of Engineers funds acquisition and elevation projects. There are plans to elevate over 160 structures in the Parish under SELA (see section 8.2).

Post-disaster funding sources

- Insurance claims
- The National Flood Insurance Program's Increased Cost of Compliance. This provision increases a flood insurance claim payment to help pay for a flood protection project required by code as a condition to rebuild the flooded building. It can also be used to help pay the non-federal cost-share of an elevation project.

Post-disaster funding sources, Federal disaster declaration needed

- FEMA's disaster assistance (for public properties), however as noted in section 5.3.2, after a flood, the amount of assistance will be reduced by the amount of flood insurance that the public agency should be carrying on the property) (administered by LOEP)
- Small Business Administration disaster loans (for non-governmental properties)
- FEMA's Hazard Mitigation Grant Program (administered by LOEP)

In addition to the limited amounts of funding available is the restriction on the use of those funds. Currently, FEMA programs, the sources with the most resources for property protection, are limited to acquisition, elevation, and, under certain circumstances, small local drainage projects. Acquisition means the property is cleared and preserved forever as public open space.

An alternative FEMA-funded approach is being piloted in Jefferson Parish. Called "demo/rebuild," the funds are used to purchase the floodprone structure and demolish it. The owner is allowed to keep the lot, provided a new structure is built that meets or exceeds FEMA's protection standards for new construction.

5.4.3. Implementation in St. Tammany Parish The Parish has been very active as a financial assistance and acquisition agent, using FEMA funds to purchase or elevate flooded properties. FEMA funds pay for 75% of the costs and the balance is paid by the property owner. The Parish fully funds the four person office that administers this program, a commitment that is above and beyond most other communities in the state.

The mitigation staff has found the following:

- If given the option, most people prefer to sell their homes rather than elevate them and stay in the floodplain.
- The Parish shares the concern that even though the structure may be protected from flood damage, leaving homes in floodprone areas presents health and safety hazards.
- Most elevation projects have been second story conversions. Because there are many complications with elevating a slab foundation and few qualified contractors, the Parish is no longer encouraging this approach.
- The cost to elevate a 2,000 square foot home using the preferred second story conversion approach has been between $150,000 and $200,000.

- Homeowners pay 25% of the cost of a project. They must provide their share up front. Because of these costs, somewhat more than half of the offers to mitigate have been declined by the owners.
- The cost to maintain acquired properties that are turned over to the Parish has increased. The Parish does little for those properties in rural areas, but is obligated to mow those in developed neighborhoods. A recent bid for a mowing contract for 16 properties will cost $12,000 each year.
- The Parish has not pursued financial assistance on less expensive retrofitting projects.
- Parish staff have provided some information and technical assistance, as discussed in Chapter 9.
- Parish staff are very interested in more flexible funding arrangements, such as the "demo/rebuild" approach.

5.4.4. CRS credit Except for public information programs, the Community Rating System does not provide credit for efforts to fund, provide incentives or mandate property protection measures. The CRS credits are provided for the actual projects, after they are completed (regardless of how they were funded or who instigated them).

On the other hand, in order to participate in the CRS, a community must certify that it has adequate flood insurance on all properties that it has been *required* to insure. The minimum requirement is to insure community-owned properties in the mapped floodplain that have received Federal aid, as specified by the Flood Disaster Protection Act of 1973.

5.5. Conclusions

1. There are several ways to protect individual properties from damage by natural hazards. The advantages and disadvantages of each should be examined for each situation.

2. Property owners can implement some property protection measures at little cost, especially for sites in areas of low hazards (e.g., shallow flooding, earthquakes, and winter storms). For other measures, such as relocation, elevation and safe rooms, the owners may need financial assistance.

3. Less than 60% of the buildings in the Parish's floodplains are covered by flood insurance.

4. The Parish and the Villages have appropriate levels of self-insurance and commercial insurance coverage on their own properties.

5. Local government agencies can promote and support property protection measures through several activities, ranging from public information to financial incentives to full funding.

6. The Parish has actively helped residents implement property protection measures with FEMA funds, but could do more with information, technical assistance, and more flexible FEMA funding rules. Alternatives to public acquisition and the traditional elevation approaches are needed.

5.6. Recommendations

1. Public information efforts that explain property protection measures that can help owners reduce their exposure to damage by natural hazards and the various types of insurance coverage that are available should be continued.

2. Because properties in floodplains will be damaged sometime, a special effort should be made to provide information and advice to floodplain property owners. Special attention should be given to repetitive loss areas.

3. All property protection projects that use FEMA funds must be voluntary. Other than State and Federally-mandated regulations, local incentives should be positive, such as providing financial and technical assistance.

4. Each public entity should evaluate its own properties to determine if they need to be retrofitted.

5. The Parish should seek State and Federal funding support for property protection measures and flexible funding arrangements to allow rebates for lower cost measures and alternatives to elevation and acquisition of severely flooded properties.

5.7. References

1. *A Guide for Integrated Pest Management of Termites*, Louisiana State University Agricultural Center, 2000

2. *Disaster Mitigation Guide for Business and Industry*, Federal Emergency Management Agency, FEMA-190, 1990

3. *Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings*, Federal Emergency Management Agency, FEMA-259, 1995.

4. *Flood Insurance Agent's Manual*, FEMA, 2003

5. *Flood Proofing Techniques, Programs and References*, U.S. Army Corps of Engineers National Flood Proofing Committee, 1991.

6. *Floodproof Retrofitting: Homeowner Self-Protective Behavior*, Shirley Bradway Laska, 1991.

7. *A Guide to the Wetlands of the Lake Pontchartrain Basin*, Unviersity of New Orleans, 2000.

8. *High and Dry – Raising Buildings in Amite River Floodplains,* Louisiana State University Agricultural Center, not dated

9. *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding.* Federal Emergency Management Agency, FEMA-312, 1998.

10. *Is Your Home Protected from Hail Damage?* Institute for Business & Home Safety, 2002

11. *Local Flood Proofing Programs*, U.S. Army Corps of Engineers, 1994.

12. Materials supplied by Parish offices and municipalities, Fall 2003.

13. *Promoting Mitigation in Louisiana – Performance Analysis*, Federal Emergency Management Agency, 2002

14. *Taking Shelter from the Storm: Building a Safe Room Inside Your House*, Federal Emergency Management Agency, FEMA-320, 1998.

15. *The Homeowners Guide to Earthquake Safety*, California Seismic Safety Commission, 2000

16. *Wildland/Urban Interface Fire Protection*, FEMA, 1989

Chapter 6. Preventive Measures

Preventive measures are designed to keep the problem from occurring or getting worse. Their objective is to ensure that future development is not exposed to damage and does not increase damage to other properties. They include the following:

6.1 Planning and zoning
6.2 Open space preservation
6.3 Subdivision regulations
6.4 Building codes
6.5 Manufactured home regulations
6.6 Floodplain regulations
6.7 Drainage regulations
6.8 Coastal zone and wetlands protection
6.9 Urban forestry

The first two measures, planning, zoning and open space preservation, work to keep damage-prone development *out* of the hazardous or sensitive areas. The other measures impose standards on new developments to protect them from natural hazards, especially flooding and stormwater flooding.

6.1. Planning and Zoning

6.1.1. General: Planning and zoning activities direct development away from problem areas, especially floodplains and wetlands. They do this by allowing land uses that are more compatible to the natural conditions of the land. Use of the land can be tailored to match the land's hazards, typically by reserving hazardous areas for parks, greenways, golf courses, backyards, wildlife refuges, natural areas, or similar compatible uses. They can also allow developers more flexibility in arranging improvements on a parcel of land through the planned development approach.

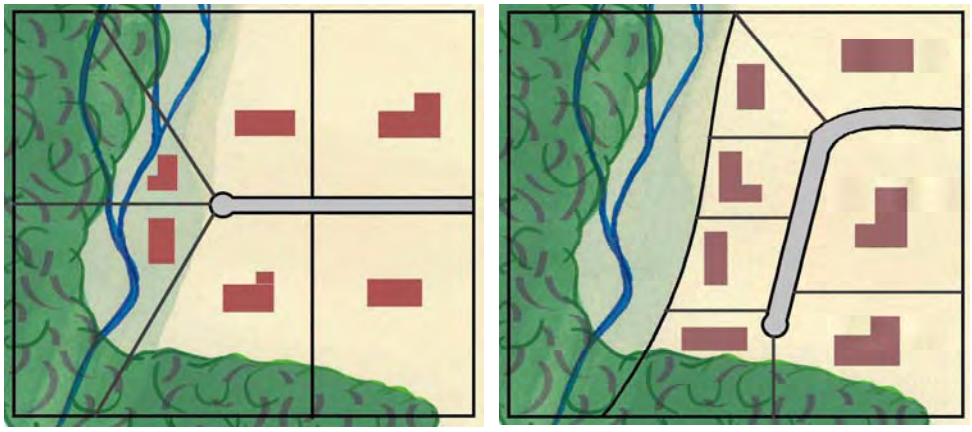
Comprehensive Plans: These plans are the primary tools used by communities to address future development. They can reduce future property damage by indicating open space or low density development within floodplains and other hazardous areas. Unfortunately, natural hazards are not always emphasized or considered in the specific land use recommendations.

Generally, a plan has limited authority. It reflects what the community would *like to see* happen. Its utility is that it guides other local measures, such as capital improvement programs, zoning ordinances, and subdivision regulations.

Zoning: A zoning ordinance regulates development by dividing a community into zones or districts and setting development criteria for each zone or district. Zoning codes are considered the primary tool to implement a comprehensive plan's guidelines for how land should be developed.

Zoning ordinances can limit development in hazardous areas, such as reserving floodplain zones for agricultural uses. Often, developers will produce a standard grid layout, like that shown in the R-1 district in the photograph to the right. As an alternative. the ordinance can allow or encourage flexibility in lot sizes and location so developers can avoid hazardous areas. One way to do this is through the planned unit development (PUD) approach. The PUD approach allows adjustment of site designs standards and land use densities to preserve open space and/or floodplains from development.

A zoning ordinance can designate wetlands and floodprone areas for agricultural, conservation, or other uses that suffer minimal damage from a flood.



PUD: In the standard zoning approach (left), the developer considers six equally-sized lots without regard for the flood hazard. Two properties are subject to flooding and the natural stream is disrupted. An alternative, flexible, PUD approach is shown on the right. The floodplain is dedicated as public open space. There are seven smaller lots, but those abutting the floodplain have the advantage of being adjacent to a larger open area. Four lots have riverfront views instead of two. These amenities compensate for the smaller lot sizes, so the parcels are valued the same. The developer makes the same or more income and the future residents are safer.

Capital Improvement Plans: A capital improvement plan will guide a community's major public expenditures for the next 5 to 20 years. Capital expenditures may include acquisition of open space within the hazardous areas, extension (or withholding) of public services into hazardous areas, or retrofitting existing public structures to withstand a hazard.

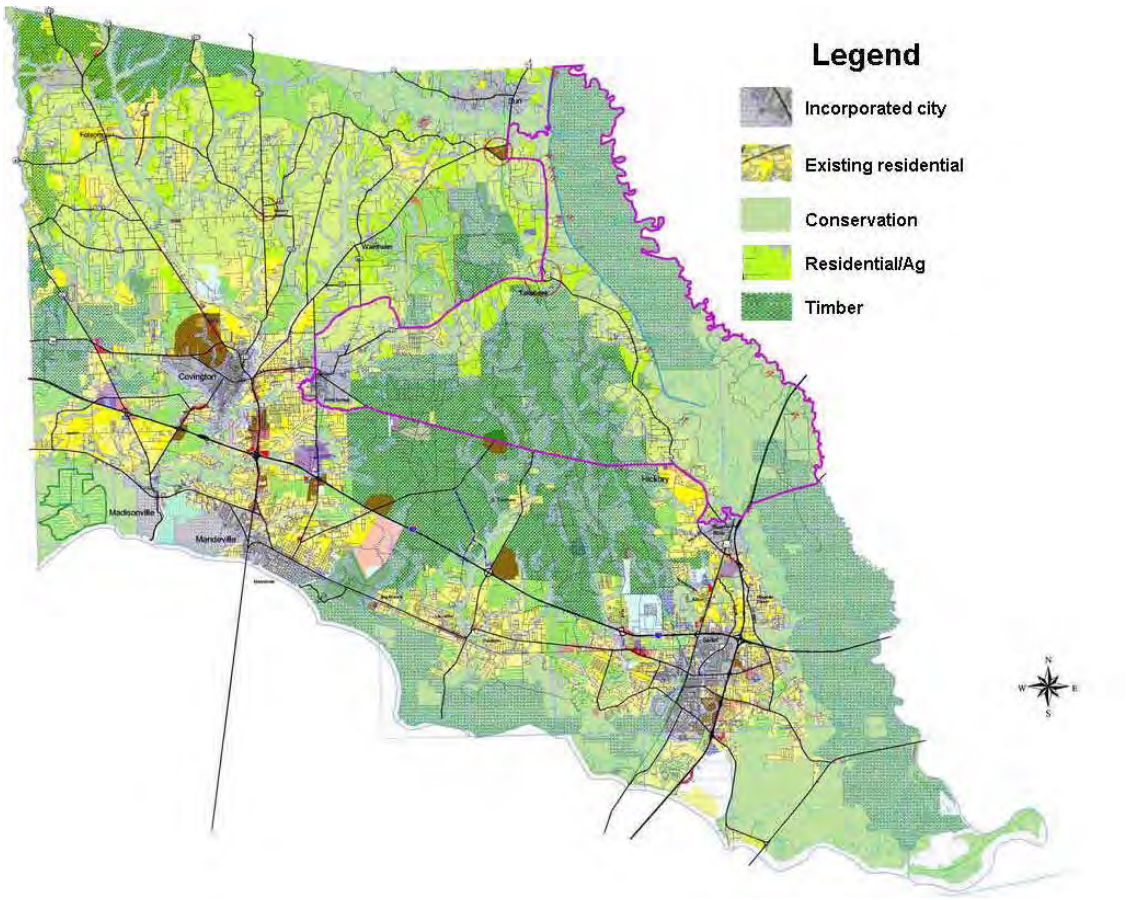
6.1.2. Implementation in St. Tammany Parish It must first be noted that some of the traditional land use planning and zoning approaches assume that development sites have both hazardous and non-hazardous land. The approaches assume that a developer can chose to not build in a floodplain. These approaches need to be tempered by the fact that 50% of St. Tammany Parish is in the floodplain and all of it is subject to many of hazards discussed in Chapter 2, especially stormwater flooding.

The Comprehensive Plan for St. Tammany Parish is being revised under the program called "New Directions 2025" (ND 2025). To date, this effort has produced the "Vision Element" which is discussed in Chapter 4. Some of the other elements, such as transportation, have been published or are coming out soon.

The natural hazards element is still a working draft. The latest draft calls for keeping new development away from hazardous areas, where possible. The third value statement is:

3. All future development will be sited and constructed in such a way so as to not only (a) be at less risk than existing development but also (b) to not increase the risk to pre-existing developments.

ND 2025 is also developing a land use element. It includes a future land use plan, the current draft of which is shown as Map 6-1. Comparing Map 6-1 to the floodplain in Map 2-7 shows that the draft land use element goes far toward setting aside the floodprone areas. Most of the undeveloped areas in the Bogue Chitto and Pearl River floodplains and the lakeshore floodplain (areas south of US 190) are preserved as conservation (light green). Many other floodplains are reserved for timber.



Map 6-1 ND 2025 Future Land Use Plan Draft

The 2025 Land Use Plan - Supporting Policy and Statement of Fundamental Principles include many statements that support preserving floodplains and natural areas as open spaces. It also promotes clustering rather than sprawl, something promoted in the PUD approach illustrated on page 6-2. Some example statements include:

III. Recommended Policies

B. Land Use Considerations

1.c) …Commercial and institutional uses should be located on major highways or at crossroads, within Planned Districts, and not in flood prone areas or impaired watersheds….

2.c) Participants in the ND 2025 Land Use planning process recommend that industrial uses be avoided in flood plains or in areas where they would adversely affect drainage, water or air quality, sensitive environmental areas and traffic.…

6.b) Among influences that should guide the designation of residential development areas cited by citizen participants are:

(1) Proximity to employment centers (including the south shore of Lake Pontchartrain);

(2) Siting, relative to floodplains, commercial and industrial uses and to environmentally sensitive areas, and site plan design quality;

(3) The clustering of homes within a significant greenspace, in addition to the "large lot" approach; …

(11) Planning of residential developments to ensure no added flood loading to watersheds or sewage effluent that travels beyond individual tracts (unless it passes to a central treatment system).

7.c) Rural Conservation Areas

(5) Expand and extend existing protected areas, and establish a "network" of contiguous green space throughout the Parish. This will facilitate species preservation and leverage the value of existing green spaces and corridors (such as the public and private preserves already dedicated, and the Tammany Trace and stream corridors). The 100-year flood plain network throughout the Parish (as currently defined by the Federal Emergency Management Agency (FEMA), or as may be updated) should be a base starting point for designation of green space/ conservation use.

Land use and zoning decisions need to account for protecting floodplains and preserving green space

(6) Corollary benefits of land conservation and habitat protection include (among others): flood protection; stream water quality; hunting, fishing, bird watching, and other "nature-based" recreational activities; and the preservation of St. Tammany's pre-eminent biodiversity (foremost in Louisiana) for future research and related benefits.

C. Other Significant Elements

1. Flood protection

   a) Much of St. Tammany, including coastal areas as well as stream floodplains, is subject to storm water or tidal flooding. The coastal (lakefront) areas, south of Interstate 12, are also heavily populated and developed. Recent flooding experiences (whether caused by tropical storms or heavy rain falls) have dramatically illustrated the number of lives and value of property at stake. *Accordingly, prevention of any additional contribution to flooding in the Parish was identified as one of the top four priorities for future land use decisions in the Parish.* [emphasis added]

6. Sewage and stream water quality …

   c) New septic or sewer systems should be carefully regulated within the 100-year floodplain and within 100 feet of any stream. Central sewer systems should be mandated for new developments.

   d) Any development within the 100 or 200-year floodplain (as currently defined or as may be revised in the future by an authoritative source) should be strictly controlled, and low impact development techniques required.

The element also notes the need for capital improvements programming as a way to affect future losses from hazards and to coordinate flood protection with other Parish objectives, such as water quality and recreation:

5. Adequate Public Facilities

   a) … Continued development, unsupported by adequate public facilities and services (including green spaces), will destroy or damage property through flooding and otherwise diminish residents' quality of life and property values. Accordingly, the Parish, its citizens, landowners, developers and municipalities must find ways to provide adequate facilities and services, or limit growth until such time as they can do so. …

   c) Parish planning must be pro-active and anticipatory, since it is much more expensive to address public facility and service needs after development occurs than before.

The ND 2025 materials note:

> The Maps depict generalized areas designated for future land uses, by broad category (as clarified below and noted on the maps). Neither the Map nor this document constitutes a "zoning" map or policy, nor do they indicate – except broadly – levels of intensity of use. Efforts that will follow adoption by the Parish Council of this 2025 Land Use Plan and Policy Statement will develop detailed zoning and other parish policies (such as, capital improvement, incentives, and regulatory) that will, in effect, "implement" this recommended Plan. These policies will provide greater detail than was called for in these documents, although the intent of these documents is to direct the formulation of such new or revised Parish policies regarding future Land Use.

Accordingly, rather than review the current zoning ordinance and capital improvements plan, this *Mitigation Plan* calls for adoption of the *2025 Land Use Plan and Policy Statement* and drafting of zoning regulations and a capital improvements plan that are consistent with the land use patterns shown in Map 6-1 and the policy statements, such as those listed above.

The Parish does allow planned unit developments (PUDs).

The Villages of Folsom and Sun and the Towns of Abita Springs and Pearl River do not have separate comprehensive or land use plans. All four communities have zoning ordinances. Folsom's small floodplain is zoned for small lot residential use.

6.1.3. CRS Credit The Community Rating System provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved.

Up to 100 points are provided for regulations that encourage developers to preserve floodplains or other hazardous areas from development. There is no credit for a plan, only for the enforceable regulations that are adopted pursuant to a plan. Up to 600 points are provided for setting aside floodplains for low density zoning, such as 5 acre lots or conservation. ND 2025's Future Land Use Plan encourages such zoning. These credits are found in Activity 430LD – Land Development Criteria.

Sun is not in the National Flood Insurance Program and therefore ineligible for CRS credits. Folsom would receive no credit.

6.2. Open Space Preservation

6.2.1. General Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. Open space can be maintained in agricultural use or can serve as parks, greenway corridors and golf courses.

Comprehensive and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees to not build on the part set aside in the easement.

Although there are some Federal programs that can help acquire or reserve open lands, open space lands and easements do not always have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes. These are usually linear areas along property lines or channels. Maintenance easements also can be donated by streamside property owners in return for a community maintenance program.

Map 6-2 Areas preserved as open space

6.2.2. Implementation in St. Tammany Parish There is currently a sizeable amount of the Parish preserved as open space in the form of National and State wildlife and game refuges and state parks. These are shown in Map 6-2. The largest coincide with mapped floodplains along the Pearl River or the Lake Pontchartrain shoreline.

As noted in the previous section, the New Directions 2025 Plan calls for preserving even more floodplains, wetlands and other sensitive areas as open space. A recent referendum to increase local taxes to fund setting lands aside for conservation and open space purposes failed to pass. It was concluded that a greater effort would be needed to inform the public about both the recreational and flood protection benefits of preserving open space.

The Bogue Chitto National Wildlife Refuge provides recreation benefits while preserving the Pearl River floodplain from development.

Section 40-039.0 of the Parish's subdivision regulations requires that the developer of each subdivision with more than 25 lots shall set aside land within their development for the use of the residents for recreational purposes at a ratio of not less than 580 square feet per residential lot. The developer may pay a fee in lieu of dedicating land for open space.

Sun does not have a mapped floodplain. Folsom's floodplain is either currently developed as residential or open for residential development.

6.2.3. CRS credit Preserving floodprone areas as open space is one of the highest priorities of the Community Rating System. Up to 700 points can be given, based on how much of the floodplain is in parks, wildlife refuges, golf courses, or other uses that can be depended on to stay open (Activity 420 – Open Space Preservation).

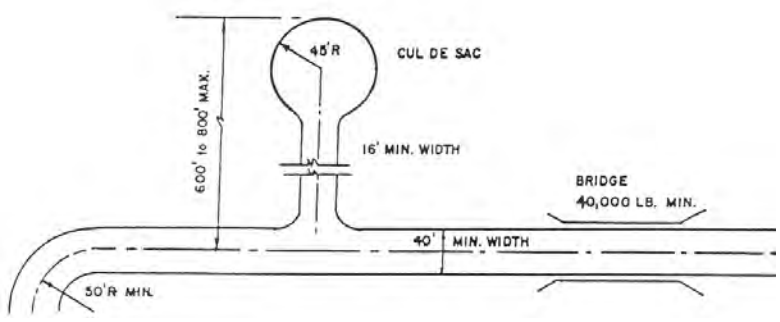
The CRS is a Federal program designed to credit state and local activities above and beyond what the Federal government does. Therefore, there is no credit for Federal lands kept as open space. Based on the open space areas shown in Map 6-2, the Parish would receive an estimated 38 points. Additional credit is provided if there are deed restrictions on the parcels or if they are kept in a natural state. The state wildlife refuge would qualify for this last credit.

Abita Springs and Pearl River should receive 38 points, too. Folsom would receive no open space credit and Sun is not in the National Flood Insurance Program and therefore ineligible for CRS credits.

6.3. Subdivision Regulations

6.3.1. General Subdivision regulations govern how land will be subdivided and sets construction standards. These standards generally address roads, sidewalks, utilities, storm sewers and drainageways. They can include the following hazard protection standards:

- Requiring that the final plat show all hazardous areas
- Road standards that allow passage of fire fighting equipment and snow plows
- Requiring power or phone lines to be buried
- Minimum water pressures needed for fire fighting



Subdivision regulations need to ensure that streets can handle emergency vehicles

Source: *Wildland/Urban Interface Fire Protection*

- Requiring that each lot be provided with a building site above the flood level
- Requiring that all roadways be no more than one foot below the flood elevation.

6.3.2. Implementation in St. Tammany Parish Subdivision Regulatory Ordinance No. 499 has the following provisions related to natural hazard protection:

- The placement of fill is restricted on lots less than 90 feet wide in areas where there are no approved drainage plans. Bringing fill in from off the site is restricted to the area below the building's roof line. "There shall be no net change in the average elevation of the natural grade of the lot outside of the roofshed." This provision will help protect neighbors from the adverse stormwater drainage effects of filling lots.
- The initial subdivision plan submitted to the Parish for review must show wetlands, state the flood zone and designate the slab elevations.
- A qualified hydrologist shall present engineering proposals "to certify that the runoff will not be increased by the proposed development."
- Finished floor elevation for residential home construction must be at least 6" above the nearest adjacent road.
- Floodplain standards are prescribed for mobile home parks, recreational vehicle parks, and campgrounds.
- Standards are set for water supply and fire hydrants in subdivisions in areas with community water supplies.
- Subdivision plans are to be reviewed by the local fire chief.
- The inside turning radius in a cul-de-sac shall be at least 26 feet.

– "Access to a mobile home for fire protection services shall be such as to permit fire apparatus to approach within one hundred feet (40') [sic] of each mobile home."

Local subdivision regulations set street design standards to ensure access by emergency vehicles

Sun does not have a subdivision ordinance, but Folsom, Abita Springs and Pearl River do. Folsom's regulations have the following provisions:

– The ordinance sets drainage standards and requires easements along all drainage channels.
– It requires areas subject to flooding to be clearly marked on preliminary and final plats.
– Cul-de-sacs must have at least a 40 foot turn around radius.

Pearl River's is shorter, although cul-de-sacs must have a 50 foot radius. The Town also requires a "servitude" of at least 25 feet on each side of a "canal or important surface drainage course."

6.3.3. CRS credit Some credit is provided for prohibiting fill or requiring compensatory storage. The Parish's provision would need a special review to receive credit. It would also receive up to 10 points for requiring finished floor elevations to be 6" above the street.

Folsom and the Parish would receive 5 points for requiring final (i.e., filed) subdivision plats to show the floodplain. This is credited as a real estate disclosure activity, which is also discussed in Chapter 9. There are no CRS credits for requirements for hazards other than flooding.

6.4. Building Codes

6.4.1. General The building code provides one of the best methods of addressing all the hazards in this plan. It is the prime measure to protect new property from damage by high winds, tornadoes, earthquakes, hail, and winter storms. When properly designed and constructed according to code, the average building can withstand the impacts of most of these forces.

Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Provisions that should be included are:

- Requiring sprinkler systems for fire protection in larger or public buildings.
- Setting roof and chimney standards to minimize fire hazards.
- Mandating hurricane protection standards for windows and doors.
- Making sure roofing systems will handle high winds and there is adequate hurricane strapping,
- Providing special standards for tying the roof, walls and foundation together to resist the effects of wind (see illustration),
- Including insulation standards that ensure protection from extreme heat and cold as well as energy efficiency,
- Regulating overhanging masonry elements that can fall during a quake,
- Requiring new buildings to have tornado "safe rooms," and
- Ensuring that foundations are strong enough for earth movement and that all structural elements are properly connected to the foundation.

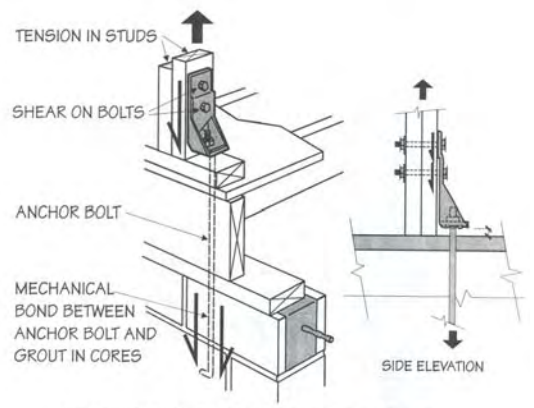


Fig. 14 - TYPICAL TIE-DOWN DETAIL TO FOUNDATION

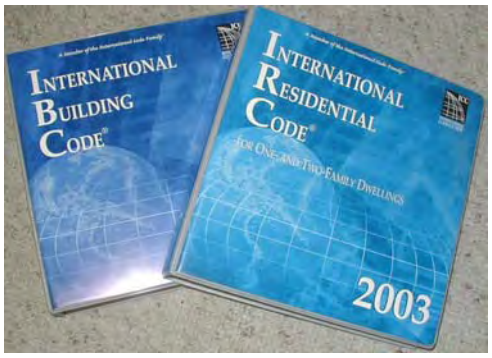
Both builders and inspectors need to know the details of proper anchoring to protect new buildings from high winds.

Source: *Windstorm Mitigation Manual for Light Frame Construction*, page 95.

6.4.2. State building code Louisiana RS 40:1728 B states: "If a building code is adopted by any political subdivision of this state, it must adopt the state uniform construction code." This is to ensure that community codes meet minimum standards and so builders will have the same set of rules in different communities. Up to now, the state Code has been the Standard Building Code of the Southern Building Code Congress International, Inc..

As with the other national model building codes, the Standard Building Code provides the basis for good building safety programs, especially protection from fire and electrical hazards. However, it is not "state of the art" when it comes to addressing natural hazards. Nationally, the model codes are being replaced by the new International Code series.

On January 1, 2004 the State Uniform Construction Code will change as a result of Act 387, which became law on June 18, 2003. Louisiana's State Uniform Construction Code now consists of:



The new state building code will be the International Series of codes

- The 2000 edition of the International Building Code, published by the International Code Council, which replaces the 1997 Standard Building Code.
- The 1999 edition of the National Electrical Code Published by the National Fire Protection Association.
- The 2000 edition of the Louisiana State Plumbing Code, published by Louisiana Department of Health and Hospitals.

Act 387 requires that local governments adopt the latest version of the State Uniform Construction Code by January 1, 2004.

6.4.3. I-Code standards

Here is some information on the International or I-codes.

Wind standards: After a disaster, FEMA often sends a Building Performance Assistance Team to evaluate how well buildings built to code held up. A recent evaluation of wind and tornado damage concluded that the local codes should be amended to incorporate wind load standards ASCE 7-95 and 7-98. The new I-codes have already incorporated these standards into their codes.

The Institute for Business and Home Safety (IBHS) has also reviewed the I-codes with respect to hazards such as hurricanes, floods, hail, and tornadoes. The IBHS recommends that the International Residential Code should be amended to increase design for wind loads to meet hurricane resistant standards, SSTD-10-99.

Tornado safe rooms are discussed in section 5.2. A building code could require them in new construction.

Flood standards: The I-Codes have a section on flood protection that communities must adopt separately. These are discussed in section 6.6.

Fortified Homes: IBHS has a set of recommendations to strengthen a building to better resist the impacts of natural hazards. The specific requirements for a "Fortified" home are available through the IBHS website at www.ibhs.com. A Fortified Tornado Windstorm Protection Checklist, provided on the website, defines nearly 20 standards, such as the size and depth of anchor bolts and materials for windows and skylights.

IBHS has researched the cost for implementing the Fortified program. Table 6-1 shows the increased cost of constructing a "Fortified" home. For less than 10% above the cost of the average home, a builder can incorporate all of the recommended criteria for a safer building.

Table 6-1 Cost of a home meeting IBHS' "Fortified" code recommendations

	Standard Home	"Fortified" Home	Incremental Cost
Impact resistant windows and doors	$5,450	$15,500	$10,050
Garage doors	$650	$1,250	$600
Roof decking	$650	$1,750	$1,100
Sealing roof joints	$0	$650	$650
Roof covering	$2,350	$3,350	$1,000
Concrete/steel down pours	$0	$500	$500
Fortified inspection costs	$0	$1,000	$1,000
Total incremental cost			$14,900
Percentage of base cost			9.8%

Source: Institute for Business and Home Safety
Note that cost figures are for Florida

Hail standards: The IBHS also supports stronger codes for roofing standards so they can better resist damage from hail. It recommends that communities adopt the Underwriters Laboratory Standard 2218, to increase the impact resistance of roofing.

6.4.4. Code Administration Just as important as the code standards is the enforcement of the code. There were many reports of buildings that lost their roofs during Hurricane Andrew in Florida because sloppy construction practices did not put enough nails in them. Adequate inspections are needed during the course of construction to ensure that the builder understands the requirements and is following them. Making sure a structure is properly anchored requires site inspections at each step.

There is a national program that measures local building code natural hazard protection standards and code administration. The Building Code Effectiveness Grading Schedule (BCEGS) is used by the insurance industry to determine how well new construction is protected from wind, earthquake and other non-flood hazards. It is similar to the 10-year old Community Rating System and the century-old fire insurance rating scheme: building permit programs are reviewed and scored, a class 1 community is the best, and a class 10 community has little or no program.

A building code is worthless without adequate plan reviews and inspections during construction to ensure compliance

6.4.5. Implementation in St. Tammany Parish St. Tammany Parish has been enforcing the Standard Building Code and the CABO code for one and two family dwellings. Plans are to adopt the I-Codes as required by State law by May 2004. Abita Springs and Pearl River will also need to adopt the required codes.

BCEGS is administered by the Property Insurance Association of Louisiana. Due to staff shortages, PIAL has only reviewed those communities that have requested a classification. The BCEGS residential/commercial code enforcement scores for Mandeville and Slidell are 3/3 and 5/5, respectively. The other cities and St. Tammany Parish have not requested a BCEGS score.

6.4.6. CRS credit The Community Rating System encourages strong building codes. It provides credit in two ways: points are awarded based on the community's BCEGS classification and points are awarded for adopting the International Code series. Up to 120 points are possible. St. Tammany Parish would receive up to 60 points when it adopts the current State Uniform Construction Code requirements.

The CRS also has a prerequisite for a community to attain a CRS Class 8 or better: the community must have a BCEGS class of 6 or better. To attain a CRS Class 4 or better, the community must have a BCEGS class of 5 or better. In other words, a strong building code program is a must to do well in the Community Rating System.

Mandeville received a BCEGS class of 3/3 which allowed it to become a CRS Class 7 last year. A Class 7 is the best rating in the state at this time. St. Tammany Parish would have to request a BCEGS classification if it wanted the BCEGS credit and to improve its classification to be better than a Class 8.

6.5. Manufactured Homes

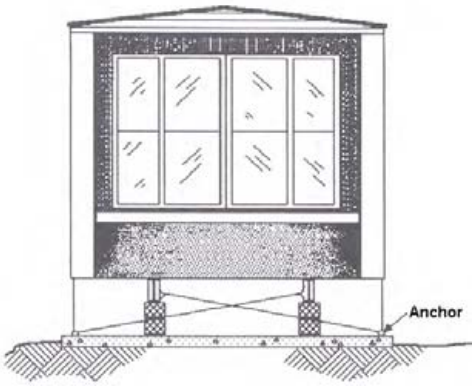
6.5.1. General Manufactured or "mobile" homes are usually not regulated by local building codes. They are built in a factory in another state and are shipped to a site. They do have to meet construction standards set by the US Department of Housing and Urban Development. All mobile type homes constructed after 1976 must comply with HUD's National Manufactured Home Construction and Safety Standards. These standards apply uniformly across the country and it is illegal for a local unit of government to require additional construction requirements. Local jurisdictions may regulate the location of these structures and their on-site installation.

As is well known, the greatest mitigation concern with manufactured housing is protection from damage by wind. The key to local mitigation of wind damage to mobile homes is their installation.

There are national standards for construction of manufactured homes, but installation is a state or local responsibility

Following tornadoes in Oklahoma and Kansas, FEMA's Building Performance Assistance Team found that newer manufactured housing that had been anchored to permanent foundations performed better. They also found that newer homes are designed to better transmit wind up-lift and overturning forces to the foundation. Unfortunately, the FEMA team found that building officials were often unaware of manufacturer's installation guidelines with respect to permanent foundations.

6.5.2. State requirements The Louisiana Manufactured Housing Commission was created in 2001. It is responsible for licensing and regulating the sale and installation of mobile homes. RS 51:912 establishes a variety of installation requirements including frame and roof tie downs. An installer must be licensed and must obtain a state permit. Installation must be done in accordance with manufacturers' specifications and the installer must certify to the Commission that a home is in compliance with Part 912. These state installation standards preempt any local regulations.



Manufactured home tie-downs

Source: *Manufactured Home Installation in Flood Hazard Areas*

The law notes that "In flood-prone areas, the foundation shall comply with the requirements set forth in the manual, Manufactured Home Installation In Flood Hazard Areas, published by the Federal Emergency Management Agency."

6.5.3. Implementation in St. Tammany Parish Parish permits are required for installation of a mobile home, either on its own lot or in a mobile home park. Permit staff check tie-downs and, in the floodplain, make sure the lowest floor and air conditioning unit are elevated above the base flood elevation.

6.5.4. CRS credit The NFIP allows communities to exempt mobile homes in existing mobile home parks from some of the flood protection requirements. The CRS provides up to 50 points if the community does not use this exemption. Because the St. Tammany Parish Flood Hazard Area Ordinance does not differentiate between mobile homes parks and those not in parks, it would receive this credit.

Folsom's Flood Damage Prevention Ordinance does have the exemption, so the Village would not receive this credit. There are no CRS credits for manufactured housing standards for hazards other than flooding.

6.6. Floodplain Regulations

6.6.1. General Most communities with a flood problem participate in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for the participating communities' standards for development, subdivision of land, construction of buildings, installation of mobile homes, and improvements and repairs to buildings. These are usually spelled out in a separate ordinance.

The NFIP minimum requirements are summarized in the box on the next page. It should be stressed that these are *minimum* requirements. While there are no additional state requirements in Louisiana, local conditions, such as high velocity flooding or the presence of a potential dam failure, warrant higher local standards.

6.6.2. Enforcement To ensure that communities are meeting the NFIP standards, FEMA periodically conducts a Community Assessment Visit. During this visit, the maps and ordinances are reviewed, permits are checked, and issues are discussed with staff. Failure to meet all of the requirements can result in one or more consequences:

- Reclassification under the Community Rating System to a lower class,
- Probation, which entails a $50 surcharge on every flood insurance policy in the community, or
- Suspension from the NFIP.

Lafourche Parish was recently cited and told it will be reclassified from a CRS Class 9 to a Class 10, in effect kicking it out of the CRS. Suspension is more serious. It means that the community is out of the NFIP and the following sanctions would go into effect:

- Flood insurance will not be available. No resident will be able to purchase a flood insurance policy.
- Existing flood insurance policies will not be renewed.
- No direct Federal grants or loans for development may be made in identified flood hazard areas under programs administered by Federal agencies such as HUD, EPA, and the Small Business Administration.
- Federal disaster assistance will not be provided to repair insurable buildings located in identified flood hazard areas for damage caused by a flood.
- No Federal mortgage insurance or loan guarantees may be provided in identified flood hazard areas. This includes policies written by FHA, VA, and others.
- Federally insured or regulated lending institutions, such as banks and credit unions, must notify applicants seeking loans for insurable buildings in flood hazard areas that there is a flood hazard and the property is not eligible for Federal disaster relief.

These sanctions can be severe for any community with a substantial number of buildings in the floodplain. Most communities with a flood problem have joined the NFIP and are in full compliance with their regulatory obligations.

Minimum National Flood Insurance Program Regulatory Requirements

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, communities that participate in the NFIP agree to regulate new construction in the area subject to inundation by the 100-year (base) flood. The floodplain subject to these requirements is shown as an A or V Zone on the Flood Insurance Rate Map (FIRM).

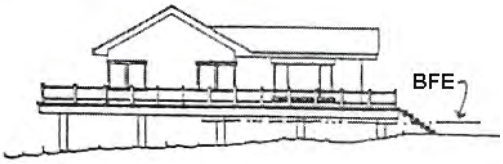
There are five major floodplain regulatory requirements. Additional floodplain regulatory requirements may be set by state and local law.

1. All development in the 100-year floodplain must have a permit from the community. The NFIP regulations define "development" as any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

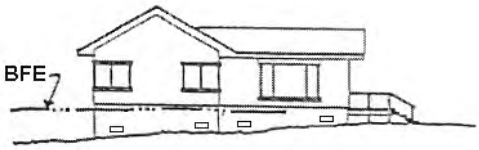
2. Development along a river or other channel cannot obstruct flows so as to cause an increase in flooding on other properties. An analysis must be conducted to demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

3. New buildings may be built in the floodplain, but they must be protected from damage by the base flood. In riverine floodplains, the lowest floor of residential buildings must be elevated to or above the base flood elevation (BFE). Nonresidential buildings must be either elevated or floodproofed.

4. Development in the coastal high hazard area (shown as a V Zone on the FIRM) cannot obstruct the flow of waves, so the lower areas of an elevated building must remain open, as illustrated in the middle example to the right.



5. Under the NFIP, a "substantially improved" building is treated as a new building. The NFIP regulations define "substantial improvement" as any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. This requirement also applies to buildings that are substantially damaged.



Communities are encouraged to adopt local ordinances that are more comprehensive or provide more protection than the Federal criteria. The NFIP's Community Rating System provides insurance premium credits to recognize the additional flood protection benefit of higher regulatory standards.

One way to assure good administration and enforcement is to have certified floodplain managers on staff. The Association of State Floodplain Managers administers the national Certified Floodplain Manager (CFM®) program. Certification involves a three hour exam and a requirement for continuing education each year. The exam covers the regulatory standards of the National Flood Insurance Program as well as mapping, administration, enforcement, and flood hazard mitigation.

6.6.3. Implementation in St. Tammany Parish The Parish's Flood Hazard Area Ordinance meets all of the NFIP's floodplain regulatory requirements. As noted in the previous section, the rules for mobile home parks are higher than the minimum requirements. The Ordinance also designates an area to the east of Slidell where new buildings must be elevated one foot above the base flood elevation.

Folsom's, Abita Springs' and Pearl River's Flood Damage Prevention Ordinances meet the minimum requirements. Sun has a Flood Insurance Rate Map, but does not have floodplain regulations and is not in the NFIP. The sanctions listed in section 6.6.2 are in effect within the Village limits.

The Parish and all eight municipalities received a Community Assessment Visit (CAV) in 1999. Over 150 "potential violations" to the regulations were recorded. Most of them related to not having floors or equipment elevated high enough or enclosing and reusing areas that are supposed to be kept floodable. Most of them have been resolved through later work with FEMA and the State NFIP Coordinator's office.

Another finding was the absence of mapped floodways. Floodways were felt to be inappropriate given the shallow, wide and slow moving streams in the Parish. They are a regulatory tool that prevents new development from increasing flood levels on other properties. The CAV report noted "Without delineation of floodways this requirement is almost impossible to enforce." It noted that an alternative approach used by several communities is to restrict the total amount of fill allowed on a floodplain lot.

The "No. 1" recommendation was that all nine communities adopt a higher standards ordinance, including counting improvements cumulatively and requiring one foot of freeboard above the base flood elevation. The CAV report also recommended that the Village of Sun join the NFIP, administrators of the floodplain regulations go to more training, and better procedures be adopted for post-flood inspections and determining substantial damage.

The CAV report noted several discrepancies in the Flood Insurance Rate Map that should be corrected. There will soon be a parish-wide FIRM with new flood elevations and maps. This will be coordinated with the watershed mapping being conducted by the Parish and described in section 8.3. Formal coordination of these efforts could be established under FEMA's Cooperating Technical Partnership agreements.

Although there are more than 1,500 Certified Floodplain Managers in the country and hundreds in Texas and Oklahoma, there are only 14 in Louisiana. There are no CFMs on the Parish's staff or any of the cities' staffs.

6.6.4. CRS credit: There are many higher regulatory standards that warrant CRS credit. As noted above, the Parish only qualifies for two of 13 different elements. The towns and villages do not have any higher standards.

There are many additional floodplain management standards that the Parish and the municipalities could adopt that would be helpful for protecting new buildings. These include:

- Delineating a floodway, the area of higher hazard near the channel. This would allow development outside the floodway (called the "floodplain fringe") without engineering studies to determine their impact on others.
- Requiring all new construction to be elevated one or two feet above the base flood elevation to provide an extra level of protection from waves and higher floods. As shown on Table 5-1, this extra protection is reflected in a distinct reduction in flood insurance rates.
- Having all developers (not just the larger ones) provide flood data where none are available.
- Specifications to protect foundations from erosion, scour and settling.
- Prohibiting critical facilities from all or parts of the floodplain.
- Prohibiting hazardous materials.
- Requiring buffers adjacent to streams or natural areas.
- Restrictions on use of enclosures below elevated buildings.
- Flood storage lost due to filling and construction must be compensated for by removal of an equal volume of storage.

The CRS also provides credit for having trained staff and a higher credit if the staff are Certified Floodplain Managers.

It should be noted that one of the prerequisites for participation in the CRS is that the community be in full compliance with the minimum requirements of the NFIP. A community with a number of "potential violations" risks being removed from the CRS entirely.

6.7. Drainage Regulations

New development in mapped floodplains can be protected from overbank and coastal flooding by floodplain regulations. As discussed in Section 2.2.1, St. Tammany Parish is also subject to stormwater flooding, i.e., flooding from stormwater runoff that has not yet reached the larger channels.

6.7.1. General There are three ways to prevent flooding problems caused by stormwater runoff:

- Ensure that new subdivisions and other development have adequate storm sewers and/or drainageways to carry the water away,
- Require new developments to hold their excess runoff on site, so it won't overload the existing drainageways, and
- Set construction standards so buildings are protected from shallow water.

Drainageway standards are typically in subdivision regulations. Standards for storm sewers, ditches, culverts, etc. are best set when an area is laid out and developed. Traditionally, the national standard is to require that the local drainage system carry the 10-year storm. Recently, communities are finding that older estimates of the 10-year storm understated the true hazard, so they are addressing larger storms.

One problem with requiring the drainage system to carry water away is that runoff increases with urban development (see the illustration on page 2-14). The runoff equivalent of a 10-year storm occurs more frequently, from smaller storms. The problem is just sent downstream onto someone else's property.

Accordingly, modern subdivision regulations require new developments to ensure that the post-development peak runoff will not be greater than under pre-development conditions. This is usually done by constructing retention or detention basins to hold the runoff for a few hours or days, until flows in the system have subsided and the downstream channels can accept the water without flooding

If the storm sewers or roadside ditches cannot handle a heavy rain, the standard subdivision design uses the streets to carry excess runoff. If the flows exceed the street's capacity, adjacent properties will flood. Therefore, the third approach to protecting from stormwater flooding is to make sure new buildings are elevated one or two feet above the street or above adjacent grade.

2002 stormwater flooding showing how close the floor is to the ground

Source: Dept of Public Works

To protect new buildings from drainage problems requires adequate storm sewers or roadside ditches, and elevation well above the street level on fill, piers, or crawlspaces.

6.7.2. Implementation in St. Tammany Parish Section 40-037.0 of the Parish's subdivision regulations has some specific drainage requirements for new developments. Two special rules are of note. Section 40-037.01 has special rules for subsurface drainage in District 13, the floodprone area east and south of Slidell. Section 40-037.02 sets standards for the Parish to accept maintenance responsibility for new retention/detention basins.

Section 40-037.04 and .05 set requirements for filling. Importing fill is restricted to the area under the roof and "There shall be no net change in the average elevation of the natural grade of the lot outside of the roofshed." If the finished floor must be more than 2 feet above grade to meet floodplain regulations, the building must be on piers or pilings.

Section 40-061.01 requires a hydrological study for all new subdivisions to design the appropriate retention/detention facility. The standards for the facility are in subsection 4:

> 4. All drainage structures will be designed to provide for reductions in peak rate of runoff for all storm events up to the 100 year storm. The peak rate of runoff for the 25, 50 and 100 year storm shall be reduced by 25%. At no time shall the rate of runoff exceed that of the pre-development conditions of the subject parcel.

Subsection 6 requires that the first floor of all new buildings be at least 6 inches above the street.

Sections 40-037.04 and .05 have different standards for different floodplain zones. Chapter 7 of the Parish Code, Drainage and Flood Control, has additional requirements for protecting drainageways and the use of fill. At the end of the floodplain regulations are sections on drainage and paving plans. When comparing the rules in the subdivision ordinance, the floodplain ordinance, and other locations in the Parish Code, these provisions can be confusing.

These rules would be amended under proposed revisions to the subdivision regulations and new Watershed Protection Regulations. The current drainage regulations would be replaced by watershed-based rules. Developers will be prohibited from filling certain areas and must prepare drainage plans before they can receive a permit. Conflicts between ordinances will be cleared up under these proposals.

Sun does not have a subdivision regulation. Folsom's ordinance requires drainage facilities to provide for a 5-year storm (Section 18.3(h)). There is no mention of retention or detention of stormwater or elevating buildings above the street level. Neither Abita Springs or Pearl River require new developments to provide retention/detention basins.

6.7.3. CRS credit: The Parish's drainage and retention/detention regulations are exemplary and would score very well under the CRS. The retention/detention rules would receive the maximum possible score for managing storms up to and including the 100-year storm. It would get a very high score for the provisions for Parish maintenance. These scores would be adjusted to reflect the fact that they are not enforced everywhere, but would still be in the neighborhood of 150 points.

The filling rules would receive some credit, but because they are unique, a special review would be needed to score them. The requirement for drainage plans and elevation of buildings above the street would qualify for 25 points. The erosion and sediment control rules would receive 30 points.

The municipalities' programs would not be credited by the CRS.

6.8. Coastal Zone and Wetlands Protection

6.8.1. General The area south of Interstates 12 and 10 has been designated as the Parish's coastal zone. This zone acts as a buffer to storm surge, protecting inland areas form flooding. Wetlands provide water storage during floods and regulate the rate of flow of flood waters. A study in Illinois found that for every 1% increase in protected wetlands along a steam corridor, peak stream flows decreased by 3.7%.

Research is showing that wetlands can provide effective treatment of wastewater. The coastal zone and wetlands are habitat to as diverse a population of species as the rain forest. It is the nursery ground for the marine species that support the area's commercial and recreational fishing industries. The State dubs them "the richest, most productive ecosystem in the world."

St. Tammany Parish wetland

Because of all these factors, the coastal zone and wetlands have been set aside for special protection. The Department of Natural Resources, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service administer several programs to protect and restore them. Several private organizations, particularly the Lake Pontchartrain Foundation, the Sierra Club, and sportsmen's association, are also active.

Central to hazard mitigation and preventive activities are the requirements for a State Coastal Use Permit (CUP) and a Corps' 404 wetlands permit. The objective of these programs is to make certain that any activity affecting the coastal zone or wetlands, such as a project that involves dredging or filling, will cause the least amount of damage. Less damage to these areas means more protection of the Parish from storm surge and flooding.

Some other permits that may be required for work in wetlands or near waterbodies include a Department of Environmental Quality Water Quality Certification, a State Lands Office Permit, or a Scenic Streams permit. All of these programs have been charged with reviewing certain activities that take place in the Louisiana Coastal Zone. Their work is somewhat coordinated with a common permit application form.

Generally, the agencies responsible for coastal use or 404 permits want to protect waters and wetlands by preventing development that will adversely affect them. If a permit is issued, the impact of the development is typically required to be mitigated. Wetland mitigation can include creation, restoration, enhancement or preservation of wetlands. The appropriate type of mitigation is addressed in each permit.

6.8.2. Implementation in St. Tammany Parish The Parish's coastal zone program was approved by the State in 1992. The guidance for St. Tammany Parish is that any development that takes place on a waterway or below the 5' contour should apply for a Coastal Use Permit (CUP) from the State or a local CUP from the Parish's Coastal Zone Management Office.

Which agency will review the application depends on the nature of the use and its location. For example, those activities on state water bottom will be "Uses of State Concern" and the state would handle the application. A boat slip being dug off of a man made canal would constitute a "Use of Local Concern" and be processed by the Parish. However, applications are sent to the DNR for that determination.

6.8.3. CRS credit: The CRS favors activities that directly impact flood damage to buildings. It does provide extra credit for regulations that protect an area's natural and beneficial functions (25 points) and for preserving open space areas in their original natural state. The latter credit is not available for lands owned by the Federal government, such as a national wildlife refuge, but is provided for state lands.

6.9. Urban Forestry

6.9.1. General Trees are particularly subject to damage by wind, ice and snow storms. Downed trees and branches break utility lines and damage buildings, parked vehicles and anything else that was under them. An urban forestry program can reduce the damage potential of trees.

Urban foresters or arborists can select hardier trees which can better withstand high wind and ice accumulation. Only trees that attain a height less than the utility lines should be allowed along the power and telephone line rights-of-way. Just as important as planting the right trees is correct pruning after a storm. If not done right, the damaged tree will not heal properly, decay over the next few years, and cause a hazard in the future. A trained person should review every damaged tree to determine if it should be pruned or removed.

Trees are the first victims of ice storms

By having stronger trees, programs of proper pruning, and on-going evaluation of the trees, communities can prevent serious damage to their tree population. A properly written and enforced urban forestry plan can reduce liability, alleviate the extent of fallen trees and limbs caused by wind and ice build-up, and provide guidance on repairs and pruning after a storm. Such a plan helps a community qualify to be a Tree City USA.

TREE CITY USA.

Tree City USA is a program sponsored by The National Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters. These standards were established to ensure that every qualifying community would have a viable tree management plan and program. They were also designed so that no community would be excluded because of size.

To qualify for Tree City USA, a town or city must meet four standards:

1. A tree board or department – Someone must be legally responsible for the care and management of the community's trees. This may be a professional forester or arborist, an entire forestry department, or a volunteer tree board.

2. A tree care ordinance – The ordinance must designate the establishment of a tree board or forestry department and give this body the responsibility for writing and implementing an annual community forestry work plan.

3. A community forestry program with an annual budget of at least $2 per capita – A little investigation usually reveals that more than this amount is already being spent by the municipality on its trees.

4. An Arbor Day observance and proclamation

Source: www.arborday.org/programs/treecityusa.html

6.9.2. Implementation in St. Tammany Parish There are only 23 Tree Cities USA in Louisiana, but they include Abita Springs, Covington and Mandeville. Counties and parishes are not eligible for the program, but they can implement the credited activities.

Pearl River also has a forestry program. The Town has two ordinances that regulate trees and landscaping (Ordinances #96-1112 and #01-00). These ordinances set requirements on the size of new trees allowed near power lines and protect existing trees and foliage. Ordinance #96-1112 establishes a Town Tree Committee to monitor compliance and requires tree trimming contractors to be licensed.

6.9.3. CRS credit Being a part of the National Flood Insurance Program, the CRS recognizes only activities that affect flood damage. It does not provide credit for projects or programs that only affect damage from other types of hazards.

6.10. Conclusions

1. New Directions 2025 and its future land use plan have many recommendations that support natural hazard mitigation, especially protection of future development from flooding. It is important that the zoning ordinance, capital improvement plan, and other products that will be prepared pursuant to ND 2025 implement those recommendations.

2. While the larger floodprone areas are preserved under Federal and State ownership, there are more opportunities to preserve more open space, especially as when new developments are proposed.

3. The Parish has very good standards and requirements for new subdivisions.

4. The International series of codes have improved provisions for protecting new buildings from damage by natural hazards. The Parish has not yet adopted the I-Codes nor has it had its program reviewed by the Building Code Effectiveness Grading Schedule.

5. Installation of new mobile homes appears to be adequately administered to ensure proper tie downs and flood protection.

6. The Parish's Flood Insurance Rate Map will be updated. A formal agreement between FEMA and the Parish would help.

7. The Parish's floodplain regulations barely exceed the minimum national requirements. Both the standards and enforcement could be strengthened in several ways.

8. The Parish has excellent standards and requirements for new subdivisions and drainage regulations.

9. The Parish's programs for drainage regulations and coastal zone and wetlands protection are good. The former will be greatly improved with the adoption of the proposed Watershed Protection Regulations.

10. An urban forestry program can be effective against damage and power losses from wind and ice storms.

6.11. Recommendations

1. The next zoning ordinance, capital improvement plan, and other products that will be prepared pursuant to ND 2025 should implement the 2025 plan's recommendations.

2. The Parish should use every opportunity to preserve floodplain areas as open space or other use compatible with the flooding hazard.

3. The Parish and the municipalities with building codes should adopt the latest International series of codes, the new state Uniform Construction Code.

4. The Parish should request a BCEGS rating from the Property Insurance Association of Louisiana.

5. In cooperation with the municipalities in the Parish, permit department staffs should review the I-Codes and the recommendations of the Institute for Business and Home Safety and draft language to strengthen new buildings against damage by high winds, tornadoes and hail.

6. The Parish should continue to administer its regulations for subdivisions, mobile homes, and coastal zone and wetlands protection.

7. The Parish should enter into a Cooperative Technical Partnership with FEMA to guide development of the new Flood Insurance Rate Map. When the Flood Insurance Rate Map is being revised, the benefits of mapping a regulatory floodway should be reviewed.

8. In cooperation with the construction industry, the Parish should review and strengthen its floodplain regulations. Community Rating System credits should be used as an initial guide for regulatory standards.

9. The Parish should review and strengthen its procedures for administering and enforcing its floodplain regulations. In particular, procedures are needed to require permits and conduct inspections after a flood or other disaster.

10. The Parish should have at least two Certified Floodplain Managers on staff.

11. The Parish should implement an urban forestry program based on the criteria of the Tree City USA program.

12. The Village of Sun should join the National Flood Insurance Program.

13. The Parish Council should adopt the proposed Watershed Protection Regulations.

6.12. References

1. *CRS Coordinator's Manual*, FEMA, 2002.

2. *Design and Construction Guidance for Community Shelters*, FEMA, 2000.

3. Interviews and meetings with Parish staff, Fall 2003

4. *Manufactured Home Installation In Flood Hazard Areas*, FEMA-85, 1985.

5. *Midwest Tornadoes of 1999, Observations, Recommendations and Technical Guidance*, FEMA, Building Performance Assessment Report, Preliminary Report, July 13, 1999

6. *Multi-Hazard Identification and Risk Assessment*, Federal Emergency Management Agency, 1997.

7. Ordinances and regulations for the Villages of Sun and Folsom and the Towns of Abita Springs and Pearl River.

8. St. Tammany Parish Code of Ordinances:

   – Appendix B, Chapter 40, Subdivision Regulatory Ordinance No. 499
   – Chapter 7, Drainage and Flood Control
   – Chapter 7, Article 2. Flood Hazard Area Ordinance

9. St. Tammany Parish *Permit Handbook*

10. "St. Tammany Parish, Louisiana, CAV Summary Report," Halff Associates, 1999

11. *Subdivision Design in Flood Hazard Areas*, American Planning Association and FEMA, PAS Report 473, 1997.

12. Websites of the Institute for Business and Home Safety (www.ibhs.org) and various state agencies.

13. *Wildland/Urban Interface Fire Protection*, FEMA, 1989

14. *Windstorm Mitigation Manual for Light Frame Construction*, Illinois Emergency Management Agency, 1997

Chapter 7. Emergency Services

Emergency services measures protect people during and after a disaster. A good emergency management program addresses all hazards, and it involves all Parish departments and municipalities.

> Hazardous conditions and situations exist in all communities, and St. Tammany Parish is no exception. They range from such natural hazards as hurricanes and flooding to serious chemical spills and nuclear attack. … The Parish Office of Emergency Preparedness (OEP) has the responsibility to identify real and potential hazards and, to the extent possible, prepare plans for coping when and as they occur.
>
> – St. Tammany Parish Multi-Hazard Emergency Operations Plan, 2002

At the state level, programs are coordinated by the Louisiana Office of Emergency Preparedness (LOEP). St. Tammany Parish emergency services are coordinated through the St. Tammany Parish Office of Homeland Security and Emergency Preparedness (OHS/EP). The Villages of Folsom and Sun rely on the Parish for emergency services and do not have their own staff or activities.

This chapter reviews emergency services measures following a chronological order of responding to an emergency:

7.1. Threat recognition – identifying an oncoming problem before it hits
7.2. Warning – getting the word out
7.3. Response – doing what can be done in the time available
7.4. Evacuation and shelter – getting people out of harm's way
7.5. Recovery and mitigation – clean up, repair and prepare for the next one

7.1. Threat Recognition

The first step in responding to a hurricane, flood, tornado, or other natural hazard is knowing when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

7.1.1. Tropical storms/hurricanes The National Weather Services' National Hurricane Center in Miami monitors all tropical storm and hurricane activity. It uses computer models to estimate where the storm will make landfall, the predicted wind speeds and the likely storm surge levels. These predictions are updated periodically and disseminated to the media and through emergency management channels.

The Hurricane Center runs the predicted storm through a computer model called SLOSH (Sea, Lake, and Overland Surges from Hurricanes). This provides information on how deep and how far inland storm surges are expected to go.

7.1.2. Floods A flood threat recognition system predicts the time and height of the flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On larger rivers, the measuring and calculating is done by the National Weather Service. Support in NOAA's efforts is provided by cooperating partners from state and local agencies. Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio. NOAA Weather Radio is considered by the federal government as the official source for weather information.

On smaller rivers, locally established rainfall and river gages are needed to establish a flood threat recognition system. The National Weather Service may issue a "flash flood watch." This means the amount of rain expected will cause ponding and other flooding on small streams and depressions. These events are so localized and so rapid that a "flash flood warning" may not be issued, especially if no remote threat recognition equipment is available.

In the absence of a gauging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding.

7.1.3. Severe weather The National Weather Service is the prime agency for detecting meteorological threats, such as tornadoes, fog, hailstorms, and winter storms. Severe weather warnings are transmitted through the NOAA Weather Radio System. As with floods, the Federal agency can only look at the large scale, e.g., whether conditions are appropriate for formation of a tornado.

For tornadoes and thunderstorms, local emergency managers can provide more site-specific and timely recognition by sending out trained spotters to watch the skies when the Weather Service issues a watch or warning.

Severe snow storms can often be forecast days in advance of the expected event, which allows time for warning and preparation. Though more difficult, the National Weather Service can also forecast ice storms.

7.1.4. Wildfires The Wildland Fire Assessment System is an internet-based information system administered by the U.S. Forest Service in Idaho. It monitors weather conditions, such as moisture and wind, and provides a national view of weather and fire potential, including national fire danger and weather maps. Current conditions and predictions are available at www.fs.fed.us/land/wfas/map_list.htm

The Wildland Fire Assessment System predicts conditions favorable for wildfires. There must be a local observation system to identify and report local fires.

7.1.5. Dam failure A key part of a dam safety program is for the emergency management office to be in touch with the operators of upstream dams. There should be periodic communication checks and clear criteria for when a dam appears threatened and when the community should notify downstream properties.

7.1.6. Implementation in St. Tammany Parish The Sheriff's Communications Office monitors NOAA's Weather Wire and Radio. If a problem is broadcast, OHS/EP is notified. As the threat level increases, the OHS/EP gears up for action, staffs the Emergency Operations Center, issues standby notices to shelters, etc.

Tropical storms: OHS/EP has the SLOSH model in-house and can run it based on data from the National Hurricane Center. This allows the Parish to know where the worst hit areas will likely be and where to issue evacuation orders. There are also gages in Lake Pontchartrain that can provide more specific local information on lake and surge levels.

The Parish has six coast watchers along the lakeshore. These volunteers have weather station equipment and call in to OHS/EP with information such as barometric pressure and wind direction and speed.

Floods: The National Weather Service monitors five river gages in St. Tammany Parish. It issues periodic updates of current river levels and predicted stages. The gages monitored are listed in the example NWS Hydrologic Statement in the box. They are also located on Map 2-6. Their stage data are listed in Table 2-12.

For the gages it monitors, the Weather Service is able to issue a specific *prediction* of when and how high the river will crest. The example to the right was issued on a Sunday. The Pearl River was predicted to crest on Monday at river stage 10.8 at Bogalusa and be at 7.4 at Pearl River. Table 2-12 notes that the datum for the Pearl River gage is 6.13 feet above sea level, so on Monday the river at Pearl River will be at 6.13 + 7.3 = 13.43 feet above sea level. This elevation can be transferred to a contour map to determine what areas will be affected. The emergency managers do not have to wait for the flood to come to know where it will go.

HYDROLOGIC STATEMENT
NATIONAL WEATHER SERVICE NEW ORLEANS/BATON ROUGE LA
1002 AM CST SUN DEC 21 2003

FORECASTS INCLUDE 24-HR OBSERVED RAINFALL ENDING AT 6AM CST TODAY AND FORECAST RAINFALL THROUGH 6AM CST TOMORROW

FOR FLOOD CREST STAGE AND DATE INFORMATION SEE THE LATEST RIVER FLOOD WARNING OR STATEMENT NEWFLWNEW OR NEWFLSNEW

LOCATION	FLD STG	STG TDA	24-HR CHG	FORECAST 7AM MON	TUE	WED	THU	FRI
TCHEFUNCTE RIVER								
FOLSOM	16	5.5	0.0					
US HWY 190 NR	20	9.8	0.0					
BOGUE FALAYA								
CAMP COVINGTON	45	34.5	0.0					
COVINGTON	6	0.1	0.5					
BOGUE CHITTO RIVER								
TYLERTOWN	15	6.1	0.0	6.1	6.0	6.0	6.0	6.0
FRANKLINTON	12	0.2	0.0	0.2	0.1	0.1	0.1	0.0
BUSH	11	3.6	0.0					
LOWER PEARL RIVER								
BOGALUSA	18	11.0	M	10.8	10.5	10.3	10.0	9.8
PEARL RIVER	14	7.5	-0.1	7.4	7.3	7.0	6.9	6.7

National Weather Service river stage report and flood prediction statement

River gage information is disseminated on the NOAA Weather Wire and is available to the public at www.srh.noaa.gov/lix/html/rvs.shtml. OHS/EP is developing GIS maps that can relate different flood stages to the ground and show what areas will be affected by different flood levels. The plan is to eventually link the GIS software to the gage data and produce real-time flood inundation maps.

The National Weather Service can also issue more general flood statements on smaller streams throughout the Parish.

Severe weather: OHS/EP is working with the National Weather Service to better coordinate severe weather notifications, more specific than the Weather Radio or Weather Wire.

Wildfire: There are several Forest Service fire towers in the northern part of the Parish that monitor fire conditions. Alerts for the general public and burn bans are issued during drought and windy weather conditions.

Dam failure: There are only two "dams" on the State Dam Safety Program's list that are considered of significant hazard. These are the two Corps of Engineers' locks on the Pearl River Canal. Because at times of high flow these locks can be opened by the Corps, the potential for a dam failure is remote. Procedures have not been established to give early warning to the Parish of a possible failure.

7.1.7. CRS credit Credit can be received for utilizing National Hurricane Center warnings and river flood stage predictions for the gages listed on the previous page. The actual score is based on how much of the community's floodplain is affected by these systems. A total of 40 points is possible under Activity 610 – Flood Warning Program.

7.2. Warning

7.2.1. General After the threat recognition system tells the emergency management office that a flood, tornado, thunderstorm, winter storm or other hazard is coming, the next step is to notify the public and staff of other agencies and critical facilities. The earlier and the more specific the warning, the greater the number of people who can implement protection measures.

The National Weather Service issues notices to the public using two levels of notification:

Watch: conditions are right for flooding, thunderstorms, tornadoes or winter storms.

Warning: a flood, tornado, etc. has started or has been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone activated receivers in key facilities
- Outdoor warning sirens
- Sirens on public safety vehicles
- Door-to-door contact
- Mobile public address systems
- E-mail notifications

Multiple or redundant systems are most effective – if people do not hear one warning, they may still get the message from another part of the system. Each has advantages and disadvantages:

- Radio and television provide a lot of information, but people have to know when to turn them on. They most appropriate for hazards that develop over more than a day, such as a tropical storm, hurricane, or winter storm.
- NOAA Weather Radio can provide short messages of any impending weather hazard or emergency and advise people to turn on their radios or televisions, but not everyone has a Weather Radio.

NOAA Weather Radios

NOAA Weather Radio is a nationwide network of radio stations that broadcasts warnings, watches, forecasts and other hazard information 24 hours a day. For St. Tammany Parish, information comes from transmitters in New Orleans and Bogalusa.

NOAA weather radios can be very effective for notifying people, businesses, schools, care facilities, etc., of weather threats. They have a monitoring feature that issues an alarm when activated by the Weather Service.

- Outdoor warning sirens can reach many people quickly as long as they are outdoors. They do not reach people in tightly-insulated buildings or those around loud noise, such as at a factory, during a thunderstorm, or in air conditioned homes. They do not explain what hazard is coming, but people should know to turn on a radio or television.
- Automated telephone notification services are also fast, but can be expensive and do not work when phones lines are down. Nor do they work for unlisted numbers and calling screener services, although individuals can sign up for notifications.
- Where a threat has a longer lead time, going door-to-door and manual telephone trees can be effective.

Just as important as issuing a warning is telling people what to do. A warning program should have a public information aspect. People need to know the difference between a tornado warning (when they should seek shelter in low spot) and a flood warning (when they should stay out of low areas).

7.2.2. StormReady The National Weather Service established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather related warnings for the public.

To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center,
- Have more than one way to receive severe weather warnings and forecasts and to alert the public,
- Create a system that monitors weather conditions locally,
- Promote the importance of public readiness through community seminars, and
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

Being designated as a StormReady community by the Weather Service is a good measure of a community's emergency warning program for weather hazards. It is also credited by the Community Rating System.

7.2.3. Implementation in St. Tammany Parish Annex C of the *St. Tammany Parish Multi-Hazard Emergency Operations Plan* sets warning procedures. It states

> The primary public warning system is the parish-wide telephone system. The details of that operation protocol are confidential and not part of this annex.

The Parish has contracted with FirstCall Interactive, a commercial telephone service company in Baton Rouge. Staff can send FirstCall an address, an area, a radius around a site, or other geographical description and FirstCall can send out hundreds of phone messages at one time to all the people in that area. This is known as a reverse 911 system.

Annex C mentions other methods of disseminating a warning, including cable TV, radio, and the Emergency Alert System. The rest of the Annex is relatively generic and does not provide specific guidance. Here is an example:

> When a warning or information regarding an emergency is received, the Emergency Preparedness Director will notify key local officials, alert emergency personnel in response organizations, and notify the population by using the public emergency warning system.

There are no details on things like what constitutes "an emergency" and who are the key officials who should be notified.

OHS/EP staff have NOAA Weather Radios and encourage their use. However, it is not known how many schools, hospitals and other facilities have them.

The Parish has worked with the Emergency Alert System and can implement a cable TV override system that can send an emergency message to everyone watching television or listening to a radio. This approach can be very effective for those hazards that have a longer lead time, such as tropical storms.

StormReady: Currently Bossier and Caddo Parishes are the only Louisiana communities in StormReady. Nearby, Waveland, Columbia and Hattiesburg, Mississippi are StormReady communities.

7.2.4. CRS credit Community Rating System points are based on the number and types of warning media that can reach the community's floodprone population. Depending on the location, communities can receive up to 25 points for the telephone calling system and the Parish's Emergency Alert Radio System and more points if there are additional measures, such as telephone trees. Being designated as a StormReady community can provide 25 more points. These credits are in Activity 610 – Flood Warning Program.

7.3. Response

7.3.1. General The protection of life and property is the most important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

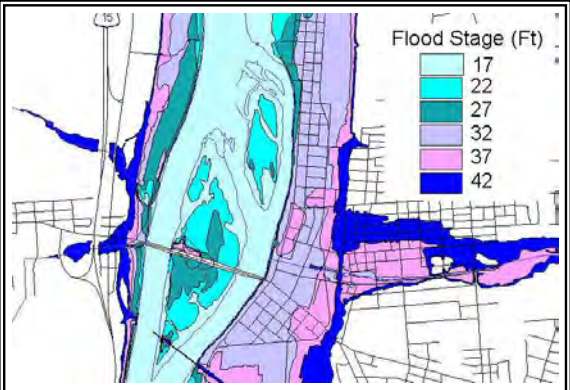
Emergency response planning make flood response activities more efficient

- Activating the emergency operations center (emergency preparedness),
- Closing streets or bridges (sheriff or public works),
- Shutting off power to threatened areas (utility company),
- Passing out sand and sandbags, (public works),
- Holding children at school/releasing children from school (school superintendent),
- Opening evacuation shelters (Red Cross),
- Monitoring water levels (engineering), and
- Establishing security and other protection measures (police/sheriff).

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given various responsibilities.

Planning is best done with adequate data. One of the best tools is a map that shows what areas would be affected under different conditions. An example is Map 2-4, which shows which areas to evacuate under different hurricane categories.

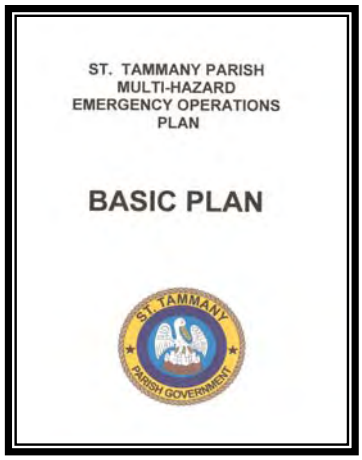
A flood stage forecast map shows areas that will be under water at various flood stages. Different flood levels are shown as color coded areas, so the emergency manager can quickly see what will be affected. Emergency management staff can identify the number of properties flooded, which roads will be under water, which critical facilities will be affected, who to warn, etc.. With this information, an advance plan can be prepared that shows problem sites and determines what resources will be needed to respond to the predicted flood level.



A flood stage forecast map relates predicted flood heights to areas that will be inundated.

Emergency response plans should be updated annually to keep contact names and telephone numbers current and to make sure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner.

7.3.2. Implementation in St. Tammany Parish The objective of the *St. Tammany Parish Multi-Hazard Emergency Operations Plan* is "to provide guidance for the various departments within St. Tammany Parish Government, municipalities within the Parish, and all agencies within the Parish of St. Tammany with an emergency assignment before, during and following any declared emergency."



The *Emergency Operations Plan* is designed to work for all types of natural and technological hazards. The document has a *Basic Plan* which assigns responsibilities, such as communications, law enforcement, evacuation, shelter, and public health, to the various Parish departments.

The *Basic Plan* is augmented with annexes, standard operating procedures and other guidance documents that cover the details of various aspects of emergency response., such as communications, evacuation, sheltering, damage assessment, and severe weather. There are no annexes for specific natural hazards, such as flooding or hurricanes.

Parish staff have developed checklists for the most threatening hazards, tropical storms and hurricanes. There are four levels of preparation:

Level 4. Tropical storm in the Atlantic
Level 3. Tropical storm in the Gulf of Mexico
Level 2. Tropical storm threatening the Parish
Level 1. Imminent danger of storm hit

Action items are listed for each office and each level, as well as routine preparatory activities and post-event assignments. Each action item is assigned to a specific person.

Parish staff have experience working together and responding to disasters, especially tropical storms and flooding. Staff knows how to use the SLOSH model and is developing the basis for GIS-based flood stage forecast maps.

7.3.3. CRS credit: By itself, the *St. Tammany Parish Multi-Hazard Emergency Operations Plan* would not receive CRS credit. However, there is more to the program than this one plan. An in-depth review of the Parish's geographic information system capabilities and the appropriate annexes and checklists would be needed to determine if the Parish's warning program would qualify for up to 100 points.

7.4. Evacuation and Shelter

7.4.1. General In an area subject to the tremendous forces that accompany hurricanes, evacuation is a prime life safety concern. Given the 1 – 2 days of lead time provided by the National Hurricane Center, evacuation on a large scale is a realistic lifesaving task. In other situations, such as a tornado, it is safer to keep people where they are rather than expose them to danger from an event that gives little warning.

"The principle of evacuation is to move citizens from a place of relative danger to a place of relative safety, via a route that does not pose significant danger." (Emergency Management: Principles and Practice, p. 219) There are five key ingredients to a successful evacuation:

- Adequate warning
- Adequate routes
- Traffic control
- Knowledgeable travelers
- Care for special populations (e.g., handicapped, prisoners, hospital patients, and school children)

Adequate routes and traffic control are two key ingredients for an evacuation

Source: FEMA

Those who cannot get out of harms' way need shelter. For tropical storms, a stick-built house (not a mobile home) often suffices, but for hurricanes, something sturdier is needed. That is why schools so often serve as shelters during a storm as well as a place for those who have lost their homes after the storm.

Typically, the Red Cross will staff a shelter and ensure that there is adequate food, bedding and washing facilities. Shelter management is a specialized skill. Managers must deal with problems like scared children, families that want to bring their pets in, and the potential for an overcrowded facility.

7.4.2. Implementation in St. Tammany Parish Annex D of the *St. Tammany Parish Multi-Hazard Emergency Operations Plan* has general guidelines for evacuation. It notes what must be considered and states "Predetermined, detailed plans for specific hazards will be used when these emergencies occur. Appropriate annexes and operating guidelines will be used to coordinate the operation."

One way to double the evacuation routes' carrying capacity is to reverse the flow of traffic in lanes going into the area to be evacuated. As seen in the above photo, there is a lot of wasted roadbed if all lanes are not used to carry people away from danger. Annex D notes that "the State might activate lane reversal evacuation" for a category 3 hurricane. Because the main routes are state highways, only the State has the authority to do this, although OHS/EP will be working closely with State staff.

The Parish's *Emergency Operations Plan* includes the needed assignments of responsibility for determining when an evacuation should be conducted and how to handle special populations. The P
public about what to do when. An
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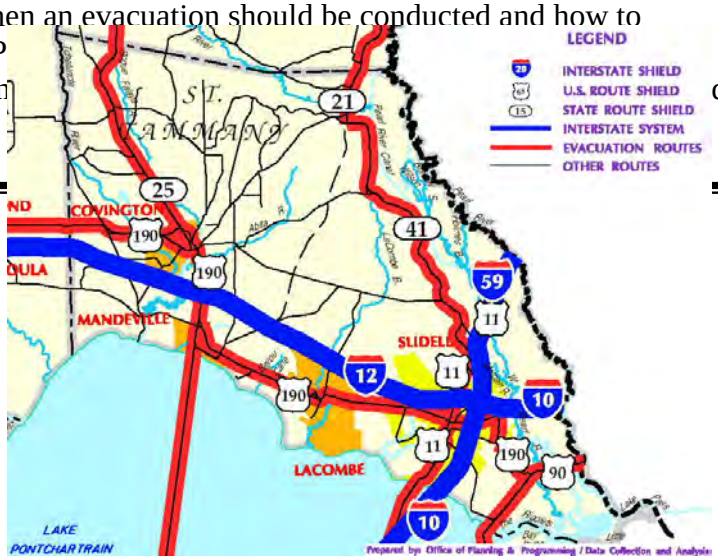


Map 7-1 Evacuation routes

Probably the weakest links in evacuation from St. Tammany Parish are the routes themselves. Map 7-1 shows the main evacuation routes in red and blue. There are only three roads that lead north, away from the Gulf, and two of them are only two-lane highways. Further, they not only have to handle the Parish's population, but thousands more evacuees from New Orleans.

The Causeway Commission has the resources and experience to conduct a reverse lane evacuation. However, currently, traffic is at a standstill during the morning and afternoon commutes on Route 190. It is difficult to imagine the same few roads handling all the evacuees from the New Orleans metropolitan areas, too. As noted in the letter on the cover of the brochure referenced above, "If an evacuation is called, leave immediately. Our roads will be full."

The Parish has four park and ride facilities and has plans for up to 13 more. These will have security cameras that can be monitored at the emergency operations center. These should help reduce some congestion, if people are willing to leave their cars behind.

Another complication during an evacuation during a storm is that some roads will go under water. As discussed in section 2.2, stormwater runoff can flood streets on short notice. The state highways are no exception.

Evacuees who leave the Parish will likely be sheltered in Mississippi. OHS/EP has plans for nursing homes and others with special needs. Annex D of the *Multi-Hazard Emergency Operations Plan* has general guidelines for sheltering and when people return. It designates the Red Cross as the prime staff. Because the strength and likely impact area of a tropical storm or hurricane can be predicted, the OHS/EP can ensure that the shelters that are opened after the disaster will not have been damaged by flood waters.

7.4.3. CRS credit: Because it is primarily concerned with protecting insurable buildings, the CRS does not provide any special credit for evacuation or sheltering of people. It is assumed that the emergency response plan would include all necessary actions in response to a flood.

7.5. Post-Disaster Recovery and Mitigation

7.5.1. General After a disaster, communities should undertake activities to protect public health and safety and facilitate recovery. Appropriate measures include:

- Patrolling evacuated areas to prevent looting,
- Providing safe drinking water,
- Monitoring for diseases,
- Vaccinating residents for tetanus,
- Clearing streets, and
- Cleaning up debris and garbage.

Throughout the recovery phase, everyone wants to get "back to normal." The problem is, "normal" means the way they were before the disaster, exposed to repeated damage from future disasters. There should be an effort to help prepare people and property for the next disaster. Such an effort would include:

- Public information activities to advise residents about mitigation measures they can incorporate into their reconstruction work,
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs,
- Acquiring substantially or repeatedly damaged properties from willing sellers,
- Planning for long term mitigation activities, and
- Applying for post-disaster mitigation funds.

7.5.2. Regulating reconstruction Requiring permits for building repairs and conducting inspections are vital activities to ensure that damaged structures are safe for people to re-enter and repair.

There is a special requirement to do this in floodplains, regardless of the type of disaster or cause of damage. The National Flood Insurance Program requires that local officials enforce the substantial damage regulations. These rules require that if the cost to repair a building in the mapped floodplain equals or exceeds 50% of the building's market value, the building must be retrofitted to meet the standards of a new building in the floodplain. In most cases, this means that a substantially damaged building must be elevated above the base flood elevation.

After a disaster, all buildings need to be inspected to determine if they are safe to reenter. A substantially damaged building needs to be "red tagged" to stop repairs unless it will meet code requirements.

This requirement can be very difficult for understaffed and overworked offices after a disaster. If these activities are not carried out properly, not only does the community miss a tremendous opportunity to redevelop or clear out a hazardous area, it may be violating its obligations under the NFIP. The sanctions for failure to properly enforce the floodplain reconstruction regulations are spelled out in section 6.6.2. In some areas, mutual aid agreements have been established so building inspectors from a community not affected by the disaster can work in the communities that were hit the hardest.

7.5.3. Implementation in St. Tammany Parish The Louisiana Office of Emergency Preparedness has published a *Disaster Recovery Manual* with guidance for communities. It focuses on damage assessment and requesting assistance. It mentions the NFIP and rules for repairing structures where there is a Federal interest, but it does not provide guidance on inspecting buildings. There is one page on public information, but it does not mention messages on reconstruction rules or mitigation. The hazard mitigation section just explains the FEMA grant programs.

Annex K of the *St. Tammany Parish Multi-Hazard Emergency Operations Plan* is Damage Assessment. It is concerned with procedures and does not have any instructions or checklists on inspecting buildings for safety or code requirements. Similarly, Annex N, Public Information, covers procedures and assignments, but does not have any sample materials or messages.

The Parish's *Flood Hazard Area Ordinance* includes the NFIP requirements for determining if a building is substantially damaged. The Parish's practice is to wait for reconstruction applicants to come to the Permits Department. Repairs that do not include structural changes (e.g., those that just include replacing carpeting, sheetrock, and insulation) do not need permits.

There are no special public information activities to tell people to apply for a permit. Residents interested in a mitigation project funded by the NFIP's Increased Cost of Compliance do apply and request a substantial damage determination.

These practices could permit many substantially damaged properties to be repaired without inspection. The result could jeopardize the Parish's standing in the NFIP. These practices also miss opportunities to inform disaster victims about property protection measures that they can incorporate during repairs.

7.5.4. CRS credit: There are no written post-disaster mitigation procedures that would warrant CRS credit. If some were developed and adopted, up to 10 points could be provided as part of the planning credit (Activity 510 – Floodplain Management Planning).

7.6. Conclusions

1. There are several threat recognition systems that can provide the Parish with advance notice of an impending emergency.

2. The Parish depends on telephones and the media for warning residents. These media should reach most people who need to know of the threat.

3. The *St. Tammany Parish Multi-Hazard Emergency Operations Plan* has overall guidance on responding to many different kinds of hazards. There are additional documents, such as annexes and checklists, that provide specific guidance for responding to individual natural hazards. Such guidance could be very helpful when things happen quickly and for hazards that have predictable impacts, such as tropical storms and flooding.

4. Detailed plans and trained traffic control crews are needed to ensure that the already strained highway system can handle the expected load from an evacuation of either the Parish or from Orleans and Jefferson Parishes.

5. There are no specific plans or guidance documents on post-disaster inspections and capitalizing on post-disaster mitigation opportunities. In fact, current procedures do not adequately ensure that the Parish's obligations to the National Flood Insurance Program will be met. They also miss opportunities to advise people on property protection measure they can implement during repairs and reconstruction.

7.7. Recommendations

1. The *St. Tammany Parish Multi-Hazard Emergency Operations Plan* should be reviewed in detail to determine where improvements can be made and how to maximize credit under the Community Rating System.

2. The *Emergency Operations Plan* review should identify where geographic information systems, NOAA Weather Radios, and other new tools can be used to support the Parish's emergency operations. Work that has been initiated to prepare flood stage forecast maps for developed areas should continue and be converted to real-time inundation mapping.

3. The Parish needs to ensure that all steps are being taken to alleviate traffic jams during an evacuation of the Parish and/or New Orleans.

4. The Parish's emergency preparedness, public information, and permits staffs should work together to develop post-disaster procedures for public information, reconstruction regulation and mitigation project identification.

7.8. References

1. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2002
2. *CRS Credit for Flood Warning Programs*, FEMA, 2002
3. *Disaster Recovery Manual*, Louisiana Office of Emergency Preparedness, 2002
4. Emergency Management: Principles and Practice for Local Government, International City Management Association, 1991.
5. FirstCall Interactive website, www.firstcall.net/
6. Flood Fight Operations, FEMA, 1995
7. Guide for All-Hazard Emergency Operations Planning, FEMA SLG-101, 1996
8. *Guidelines on Community Local Flood Warning and Response Systems*, Federal Interagency Advisory Committee on Water Data, 1985
9. Information on StormReady communities can be found on the National Weather Service website, www.nws.noaa.gov/stormready/
10. Interviews and meetings with Parish staff, Fall 2003
11. *St. Tammany Parish Multi-Hazard Emergency Operations Plan*, Office of Emergency Preparedness, 2002
12. Various checklists provided by OHS/EP
13. Various National Weather Service websites
14. Wildland Fire Assessment System website, www.fs.fed.us/land/wfas/

Chapter 8. Flood Control

Flood control projects have traditionally been used by communities to control or manage floodwaters. They are also known as "structural" projects that keep flood waters away from an area as opposed to "non-structural" projects, like retrofitting, that do not rely on structures to control flows.

8.1. Flood Control Measures

Four general types of flood control projects are reviewed here: levees, reservoirs, diversions, and dredging. These projects have three advantages not provided by other mitigation measures:

- They can stop most flooding, protecting streets and landscaping in addition to buildings,
- Many projects can be built without disrupting citizens' homes and businesses, and
- They are constructed and maintained by a government agency, a more dependable long-term management arrangement than depending on many individual private property owners.

However, as shown below, they also have shortcomings. The appropriateness of using flood control depends on individual project area circumstances.

Pros and Cons of Structural Flood Control Projects

Advantages	Shortcomings
May provide the greatest amount of protection for land area used.	They disturb the land and disrupt natural water flows, often destroying wildlife habitat.
Because of land limitations, may be the only practical solution in some circumstances.	They require regular maintenance, which if neglected, can have disastrous consequences.
Can incorporate other benefits into structural project design such as water supply and recreational uses.	They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
Regional detention may be more cost-efficient and effective than requiring numerous small detention basins.	They can create a false sense of security as people protected by a project often believe that no flood can ever reach them.
	Although it may be unintended, in many circumstances they promote more intensive land use and development in the floodplain.

8.1.1. Levees and Floodwalls Probably the best known flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and floodwalls confine water to the stream channel by raising its banks. They must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

Key considerations when evaluating use of a levee include:

- Removal of fill to compensate for the floodwater storage that will be displaced by the levee,
- Internal drainage of surface flows from the area inside the levee,
- Cost of construction,
- Cost of maintenance,
- River access and views, and
- Creating a false sense of security (while levees may reduce flood damage for smaller more frequent rain events, they may also overtop or breach in extreme flood events and subsequently create more flood damage than would have occurred without the levee).

Drainage District 4's levee doubles as a trail

Drainage District 5's levee system requires large pumps to drain the protected area

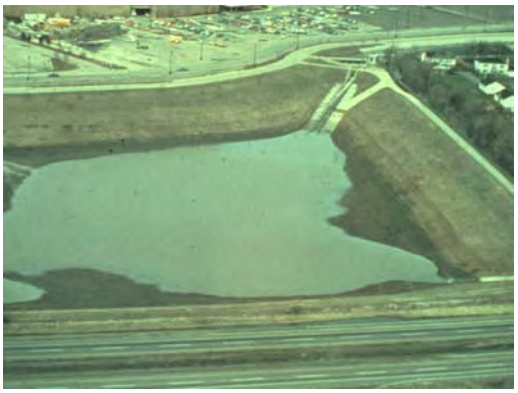
Levees placed along the river or stream edge degrade the aquatic habitat and water quality of the stream. They also are more likely to push floodwater onto other properties upstream or downstream. To reduce environmental impacts and provide multiple use benefits a setback levee is the best project design. The area inside a setback levee can provide open space for recreational purposes and provide access sites to the river or stream.

Floodwalls perform like levees except they are vertical-sided structures that require less surface area for construction. Floodwalls are constructed of reinforced concrete, which makes the expense of installation cost prohibitive in many circumstances. Floodwalls also degrade adjacent habitat and can displace erosive energy to unprotected areas of shoreline downstream.

Seawalls are barriers or retaining walls that are built facing a large lake, ocean or the Gulf. They are intended to protect the land from erosion by wave action. However, they often have an adverse impact on the shore and on neighboring properties and the movement of sand. The natural forces that transport sand and replenish beaches are disrupted by the wall, often increasing shoreline erosion on adjacent properties. Therefore, they are not encouraged and are even prohibited in many areas.

8.1.2. Reservoirs and Detention Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower flood heights by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flood has subsided, then the water in the reservoir or detention basin is released or pumped out slowly at a rate that the river can accommodate downstream.

Reservoirs can be dry and remain idle until a large rain event occurs. Or they may be designed so that a lake or pond is created. The lake may provide recreational benefits or water supply (which could help mitigate a drought).



Urban detention basin

Flood control reservoirs are most commonly built for one of two purposes. Large reservoirs are constructed to protect property from existing flood problems. Smaller reservoirs, or detention basins are built to protect property from the impacts of new development (i.e., more runoff).

The Whisper Wood area will be protected from flooding by this Parish reservoir

Regardless of size, reservoirs protect the development that is downstream from the reservoir site. Unlike levees and channel modifications, they do not have be built close to or disrupt the area to be protected. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store.

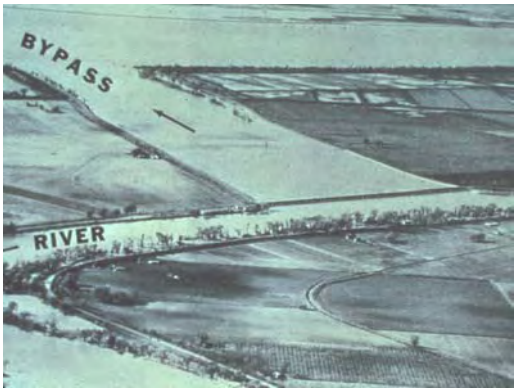
In urban areas, some reservoirs are simply manmade holes, excavated to store floodwaters (see top photo). Reservoirs in urban areas are typically constructed adjacent to streams (though usually outside of the floodplain). When built in the ground, there is no dam for these retention and detention basins and no dam failure hazard. Wet or dry basins can also serve multiple uses by doubling as parks or other open space uses.

There are several considerations when evaluating use of reservoirs and detention:

- There is the threat of flooding the protected area should the reservoir's dam fail,
- There is a constant expense for management and maintenance of the facility,
- They may fail to prevent floods that exceed their design levels,
- Sediment deposition may occur and reduce the storage capacity over time,
- They can impact water quality as they are known to affect temperature, dissolved oxygen and nitrogen, and nutrients, and

– If not designed correctly, in-stream reservoirs may cause backwater flooding problems upstream

8.1.3. Diversion A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river.



A diversion sends high flows from one stream to a lake or larger river

Diversions are limited by topography; they will not work in some areas. Unless the receiving water body is relatively close to the floodprone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed.

8.1.4. Dredging Dredging is often viewed as a form of conveyance improvement. However, it has the following problems:

– Given the large volume of water that comes downstream during a flood, removing a foot or two from the bottom of the channel will have little effect on flood heights.
– Dredging is often cost prohibitive because the dredged material must be disposed of somewhere.
– Unless instream and/or tributary erosion are corrected upstream, the dredged areas usually fill back in within a few years, and the process and expense have to be repeated.
– If the channel has not been disturbed for many years, dredging will destroy the habitat that has developed.

Dredging

To protect the natural values of the stream, Federal law requires a Corps of Engineers permit before dredging can proceed. This can be a lengthy process that requires much advance planning and many safeguards to protect habitat (and adds to the cost of the project).

8.1.5. CRS credit Structural flood control projects that provide 100-year flood protection and result in revisions to the Flood Insurance Rate Map are not credited by the CRS in order to not duplicate the larger premium reduction provided by removing properties from the mapped floodplain.

The CRS credits smaller flood control projects that meet the following criteria:

- They must provide protection to at least the 25-year flood,
- The design and construction must be certified by a licensed professional engineer,
- They must meet certain environmental protection criteria,
- They must meet Federal, State and local regulations, such as Corps of Engineers' 404 permit and State dam safety rules, and
- They must meet certain maintenance requirements.

These criteria ensure that credited projects are well-planned and permitted. Any of the measures reviewed in this section would be recognized under Activity 530 – Flood Protection, although it would be very hard to qualify a dredging project. Credit points are based on the type of project, how many buildings are protected, and to what flood protection level.

8.2. SELA

Larger structural flood control projects have regional or watershed-wide implications and can be very expensive. Because of this, they are often planned, funded and implemented at a regional level by the Parish, State agencies, the U.S. Army Corps of Engineers, or the USDA Natural Resources Conservation Service.

The Southeast Louisiana Urban Flood Control Project, or SELA, was authorized by Congress after the May 1995 floods in Orleans, Jefferson and St. Tammany Parishes. It is specifically charged with dealing with rainfall flooding.

The U.S. Army Corps of Engineers is the lead Federal agency, which will fund 75% of the costs of the projects. In St. Tammany Parish, the Corps has identified seven areas of severe flood threat or repetitive flooding that could qualify for support:

1. Abita Springs: elevating 45 structures along the Abita River to the base flood elevation. No local sponsor identified, yet.
2. Bayou Chinchuba: elevating 36 structures in Mandeville to the base flood elevation. Mandeville would be the local sponsor.
3. Lacombe: elevating 84 structures south of US 90 and west of Bayou Lacombe to the base flood elevation. No local sponsor identified, yet.

The total cost for these three elevation projects is estimated at $8,450,000. These projects need local sponsors to assume the 25% non-federal shares (although the owners could pay the share for their homes, as is the practice for FEMA elevation projects – see section 5.1.4). Currently, some FEMA funded elevation projects are underway in some of the affected areas, which will reduce the economic benefits of a Corps project.

4. Covington: enlarging and concrete lining for 2 miles of Mile Branch to provide 25-year capacity, $4,200,000. Covington would be the local sponsor, but the City had some objections to the latest plan. The City and the Corps are currently discussing options.
5. "Slidell Area:" improvements to several canals and bridges north of the City, $23,275,000. The local sponsor would have been Drainage District #3, but voters turned down a sales tax increase that would have funded the non-federal share. The Corps and Slidell are discussing alternative projects for the W-14 canal.
6. An earlier Hurricane Protection Plan for the Schneider Canal area, south of Slidell, that had been put on hold for lack of a local sponsor: 9 miles of levees and drainage structures for $19,000,000. The potential sponsor, Slidell, has not supported this project.
7. There was also a proposed hurricane protection project for Mandeville, which the City opposed and which may not have been economically justified. It would cost $15,685,000.

In sum, all the SELA projects are dependent on local sponsorship and local assumption of the non-federal cost share. Whether any of them will be funded is in question.

8.3. Watershed Management Plans

Since flood control is generally the most expensive type of mitigation measure in terms of installation costs, maintenance requirements and environmental impacts, a thorough study of alternatives is needed before choosing a project. The best way to do this is with a master plan at the watershed level.

A master plan starts with a computer model of the watershed. The model accounts for factors like rainfall, terrain features, runoff characteristics, existing and proposed development, channel dimensions, and "roughness" of the overbank floodplain. Different storms can be routed through the model to see what happens. Past storms are used to calibrate the model with actual experiences.

Retaining runoff onsite is not always the best way to manage stormwater. With all areas retaining and releasing water at the same time, downstream basins are discharging to a stream at the same time that upstream basins are. There might be less water in the channel if downstream areas were allowed to drain during the storm. By the time upstream basins discharge, stream flows would be back down and better able to handle the flows. A watershed model can calculate these flows, their timing and their impacts.

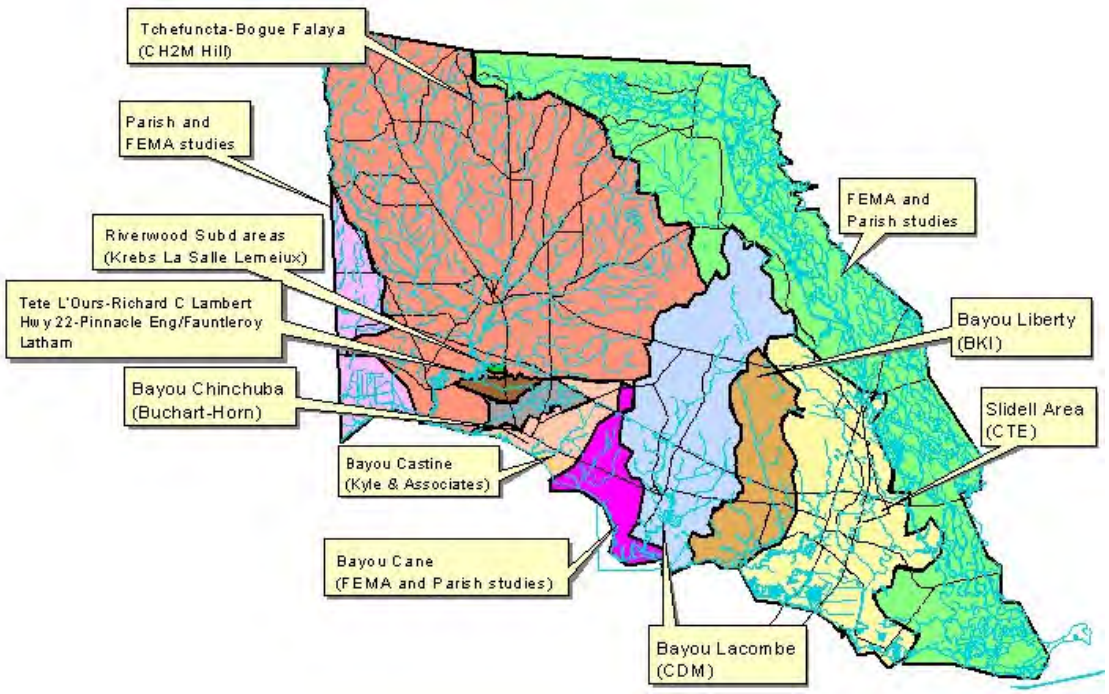
Once developed, the models can perform several services, including:

- Provide an up-to-date map of the 100-year floodplain, which can be used to revise the official FEMA Flood Insurance Rate Map,
- Determine the impact of alternative flood control projects, such as improving a channel here or building a reservoir there,
- Revise floodplain maps, after projects are constructed and operating,
- Determine the impact of new developments on stream flows and whether they should retain runoff on site or speed their excess runoff directly to a large receiving body of water, and
- When coupled with real-time rain or river gage readings, provide an early flood warning service.

The watershed models will be completed during the first half of 2004.

Because watershed modeling is the best way to design flood control projects (and has the other advantages listed above), the Parish's Department of Engineering has embarked on an extensive master planning program. Map 8-1 shows the ten watersheds and subwatersheds that are currently contracted for study. The program is starting with the smaller, more floodprone areas, south of I-12.

Full implementation will depend on having sufficient funding. Current plans are to have each basin pay for its own projects, after they are identified.



Map 8-1 Watershed studies underway for the Department of Engineering

8.4. Drainage Improvements

8.4.1. General Man-made ditches and storm sewers help drain areas where the surface drainage system is inadequate, or where underground drainageways may be safer or more practical. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer improvements are designed to carry the runoff from smaller, more frequent storms.

There are three types of drainage improvements that are usually pursued to reduce stormwater flooding: putting drainageways in underground pipes, channelization, and removing obstructions caused by stream crossings, such as culverts and bridges with small openings

Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water. To reduce the cumulative downstream flood impacts of numerous small drainage projects, additional detention or run-off reduction practices should be provided in conjunction with the drainage system improvements.

8.4.2. Storm sewers Storm sewer improvements include installing new sewers, enlarging small pipes, and preventing back flows. The advantage of converting an open channel to a storm sewer is that it creates more useable ground surface. It also reduces maintenance problems, because it is harder for debris to get in the pipes and clog the flow of water.

While piping a ditch makes more room for surface use, where will the excess water go?

From a flood protection perspective, piping ditches and installing storm sewers has some problems.

- The biggest problem is that a pipe is only so large. What happens to the 10-year storm when a pipe is only designed to carry the 5-year flow?
- Pipe openings and storm sewer inlets need to be kept cleaned in order for the water to get into the pipes.
- It's an expensive approach, although it can save maintenance costs in the long run and reduce the potential for accidents or injuries if someone is hurt in an open channel.

Converting an open channel to a storm sewer should only be done if there are arrangements for handling the overflow, either through a swale over the pipe or through streets.

8.4.3. Channelization "Channelization" means straightening, deepening and/or widening a ditch or drainageway to remedy local drainage or flooding problems. There are the concerns with this approach that need to be kept in mind:

Channelization

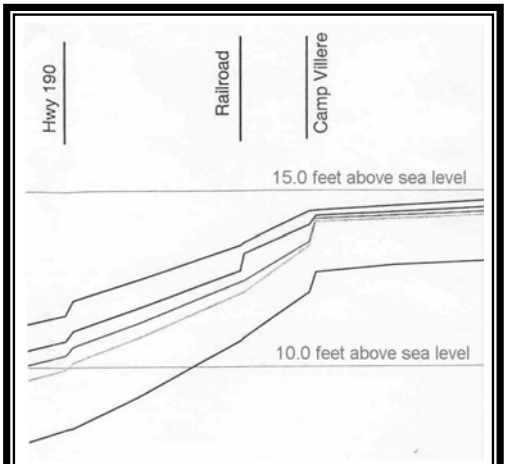
- Channelized streams can create or worsen flooding problems downstream as larger volumes of water are transported at a faster rate.
- Channelized streams rise and fall faster. During dry periods the water level in the channel is lower than it should be, which creates water quality problems and degrades habitat.
- Channelized waterways tend to be unstable and experience more streambank erosion. The need for periodic reconstruction and silt removal becomes cyclic, making channel maintenance very expensive.

On the other hand, properly sloped and planted channel banks are more aesthetically and environmentally appealing, and can prove cheaper to maintain than concrete ditches. A combination of restored wetland detention, vegetated swales, infiltration trenches and other best management practices that increase infiltration (reducing runoff), and improve water quality can be implemented in conjunction with stormwater system improvements. As shown in the photos below, these projects can have multiple benefits.

Drainage improvements do not have to be concrete channels.
They can include measures to improve infiltration and water quality.

8.4.4. Crossings and roadways In some areas, roads and bridges are flooded during heavy rains. While buildings may not be damaged, residents, customers, commuters, and emergency vehicles may not be able to get through. A common safety hazard occurs when people try to drive through flooded streets or assume that a bridge that is underwater is still there. As noted in section 2.2.4, floods kill more people trapped in vehicles than anywhere else.

Another concern is when a small culvert or bridge opening constricts flows and causes localized backwater flooding. One way to identify such places is to check the flood profiles, graphic portrayals of flood elevations. Obstructions that back up water appear as stair steps on the graph (see illustration).



This profile shows that on this tributary to Bayou Liberty, the Camp Villere Road causes nearly a one foot increase in flood heights during smaller flows

The common solution to these problems is to raise the roadbed and enlarge the culvert or bridge opening. However, designers need to consider the potential for a raised road acting as a dam, flooding people upstream and larger openings allowing more water downstream. Plans need to ensure that the projects do not worsen flooding on someone else.

8.4.5. Implementation in St. Tammany Parish The Department of Engineering inspects, surveys, and designs corrections to problem drainage sites. Many of the proposed drainage improvements that involve lateral ditches and natural drains require a Corps of Engineers' wetlands determination, and if needed, a Section 404 Permit.

The Department manages a drainage and special projects program. These projects consist of maintenance and improvements of drainageways, drainage structures, roadways, bridges, retaining wall structures, and erosion control structures. Once analysis and design is complete, the larger projects are bid out to a contractor. The smaller ones are coordinated through the Department of Public Works for project construction.

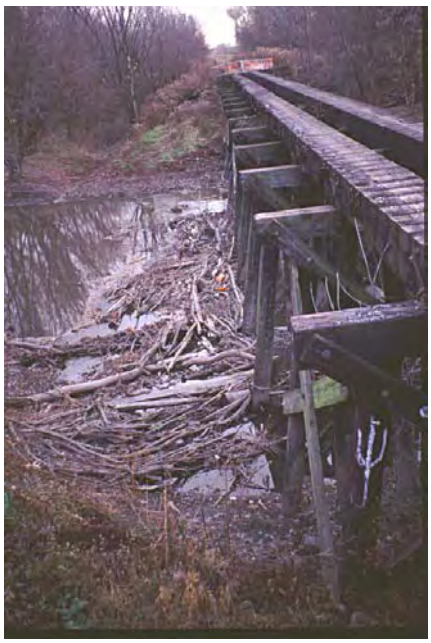
The budget for this work comes from two sources. A two cent sales tax funds work on roads and roadside drainage facilities. Projects away from roads, such as retention basins, are funded from general funds. Currently general funds are budgeted at $900,000 toward flood control and drainage improvements. Some additional funds are provided by "impact fees" that are voluntarily paid by developers. In all, the available funding is not sufficient to make a major impact on the Parish's flooding and drainage problems.

The Town of Pearl River has mapped several locations where roads should be elevated so they can be passable during high water and bridge openings that should be enlarged to reduce the blockage to flow.

8.4.6. CRS credit The Community Rating System credits capital improvement plans that fund drainage improvements that reduce the need for maintenance or that eliminate bottlenecks, logjams and other maintenance problems. Up to 50 points are provided in Activity 540 – Drainage System Maintenance.

8.5. Drainage System Maintenance

8.5.1. General The drainage system may include detention ponds, stream channels, swales, ditches, bayous and culverts. Drainage system maintenance is an ongoing program to clean out blockages caused by debris, sediment or vegetation and repair streambank erosion.



Periodic inspections and debris removal are needed to prevent dams in ditches and streams

"Debris" refers to a wide range of blockage materials that may include tree limbs and branches that accumulate naturally, or large items of trash or lawn waste accidentally or intentionally dumped into channels, drainage swales or detention basins. Maintenance of detention ponds may also require revegetation or repairs of the restrictor pipe, berm or overflow structure.

Maintenance activities normally do not alter the shape of the channel or pond, but they do affect how well the drainage system can do its job. Sometimes it is a very fine line that separates debris that should be removed from natural material that helps form habitat. Therefore, written procedures that are consistent with state laws and environmental concerns are usually needed.

A regular inspection and maintenance program can remove debris before it becomes an obstruction to stream flows.

Government agencies usually accept responsibility for maintaining bridge openings and facilities on public property. However, in most areas, the responsibility for drainageway maintenance on private property, when no easements have been granted, is with the individual private property owner. This often results in very little maintenance being accomplished.

8.5.2. Dumping One approach that can reduce drainage problems and the workload of the maintenance crews is an anti-dumping program. Many communities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property.

Drainageway dumping regulations need to also apply to "nonobjectionable" materials, such as grass clippings or tree branches which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Many people do not realize the consequences of their actions. They may fill in the ditch in their front yard not realizing that it is needed to drain street runoff. They may not understand how regrading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

Stream dumping notice

8.5.3. Implementation in St. Tammany Parish The primary duty of the Department of Public Works is to take care of roads and drainage. The Department maintains an inventory of all roads and ditches under its jurisdiction. Smaller channels and retention basins are the responsibility of the property owners, including homeowner associations. The Department does maintain seven larger basins.

Routine road and drainage maintenance activities include sign replacement, road repairs and grading, ditch cleaning, grass cutting and other miscellaneous duties. This work is performed by up to 125 people who are organized under three areas, each under the direction of a Road Foreman.

Good maintenance allowed this ditch to do its job during Isidore

Source: St. Tammany Parish

Between January 1 and September 30, 2003, the Department issued over 1,700 work orders to clean or remove debris from ditches. Most were based on calls from concerned residents. This routine maintenance is funded by sales and road taxes. The latter limits work to roadside ditches and lateral ditches that will affect Parish roads. If a problem is found that warrants a major project, it is passed on to the Department of Engineering, as noted in section 8.4.5. Abita Springs, Folsom and Pearl River have their own maintenance programs.

The Parish has a very active litter abatement program, with components such as adopt-a-road, recycling, clean up days, public information materials, a Litter Safety Kit, and an extensive website. The informational materials do not stress the impact of litter and debris on drainageways. If they did, it might increase cooperation when people realize how they can be directly affected.

8.5.4. CRS credit: Community Rating System credit is provided for a formal drainage system inspection and maintenance program with published procedures that clearly identify what can be removed and what "debris" should be allowed to stay in natural channels. Up to 250 points are possible under Activity 540 – Drainage System Maintenance. The Parish is currently receiving 200 points.

The CRS also provides up to 30 points for enforcing and publicizing a regulation that prohibits dumping in the drainage system. The Parish is receiving 15 points for its regulation. It would receive the full 30 points if it publicized the rules.

8.6. Conclusions

1. There are several different kinds of flood control projects that can reduce both riverine and stormwater flooding. They have their advantages and disadvantages. Among the advantages are their ability to protect roads and buildings, minimal disruption to the protected properties, and maintenance by a government agency. Among the disadvantages of flood control projects are the disruption to the environment, the potential for sending floodwaters onto other properties, and the construction and long term maintenance costs.

2. Larger flood control projects require planning at the watershed level and could use outside sources of funding. There are several efforts by the Corps of Engineers and the Department of Engineering to do this.

3. Current funding levels are not sufficient to fund all needed flood control and drainage projects.

4. The Parish's drainage system maintenance program is good, but the procedures could be improved to maximize CRS credit.

5. The Parish's dumping regulations could be publicized for better enforcement.

8.7. Recommendations

1. The current approach to flood control projects with watershed modeling and planning should be pursued, provided they meet the following criteria:

    a. Each project's study should look beyond the immediate project site to ensure that no other properties will be adversely impacted.

    b. Each project should be based on a watershed master plan or, at a minimum, coordinated with other projects in the same watershed.

    c. Each project's study should consider alternative non-structural approaches to protect the affected properties from flood damage.

    d. Opportunities for stream and natural areas restoration should be incorporated wherever feasible.

    e. Communities and property owners that may be affected by the project should be notified.

    f. All relevant federal, state and local permits should be obtained.

2. New, dependable sources of funding for flood control, drainage improvements, and drainage maintenance should be sought. More funds are needed for Parish projects and for meeting the cost-share requirement for state and federal projects.

3. The Parish's drainage system maintenance program procedures should be revised to maximize CRS credit.

4. The Parish's dumping regulations should be publicized.

8.8. References

1. *Bayou Liberty Watershed Study*, Phase 2, Burk-Kleinpeter, Inc., August 2003

2. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2002

3. *CRS Credit for Drainage System Maintenance*, FEMA, 2002

4. *Feasibility Drainage Study of Lowe's Pond*, J.V. Burkes & Associates, Inc., 1996

5. Flood Insurance Study and Flood Insurance Rate Map, St. Tammany Parish Unincorporated areas, FEMA, April 19, 1999.

6. Interviews with Parish officials, Fall, 2003.

7. Interview with staff of the US Army Corps of Engineers, New Orleans District, January 2004.

8. Project Fact Sheet, Southeast Louisiana Urban Flood Control Project, U.S. Army Corps of Engineers, New Orleans District, April 2003

9. *St. Tammany Parish, Louisiana, Reconnaissance Study*, U.S. Army Corps of Engineers, New Orleans District, July 1996

10. *The Southeast Louisiana Urban Flood Control Project for St. Tammany Parish, Program Implementation Report*, Richard C. Lambert and Brown, Cunningham & Cannuch, consulting engineers, 2000.

Chapter 9. Public Information

A successful hazard mitigation program involves both the public and private sectors. Public information activities advise property owners, renters, and businesses about hazards and ways to protect people and property from these hazards. These activities can motivate people to take the steps necessary to protect themselves and others.

Information can bring about voluntary mitigation activities at little or no cost to the government. Property owners mitigated their flooding problems long before there were government funding programs. A University of New Orleans study in the 1980's found that people acted on information (see box). In fact, 31% of respondents from the Slidell area had implemented one or more flood protection measure without outside financial assistance.

The usual approach to delivering information involves two levels of activity. The first is to broadcast a short and simple version of the message to everyone potentially affected. The second level provides more detailed information to those who respond and want to learn more.

This chapter starts with activities that reach out to people and tell them to be advised of the hazards and some of the things they can do. It then covers additional sources of information for those who want to learn more. It ends with an overall public information strategy.

Information Brings Results

Dr. Shirley Laska of the University of New Orleans has studied various programs that encourage floodprone homeowner "self-protective behavior." In her book she notes

"The research reported herein demonstrates considerable interest among and effort by flooded homeowners to retrofit their homes to protect them from future flood damage. Several measures were undertaken by those who retrofitted. Moreover, they spent their own money – often considerable sums – to implement the measures….

"Having some source of retrofitting information appeared to encourage retrofitting, and the measures implemented by flooded homeowners who did consult an information source were evaluated by those owners as more protective than the measures implemented by homeowners who did not rely on a source [of information]."

Floodproof Retrofitting – Homeowner Self-Protective Behavior, University of Colorado, 1991, pages 221 and 223

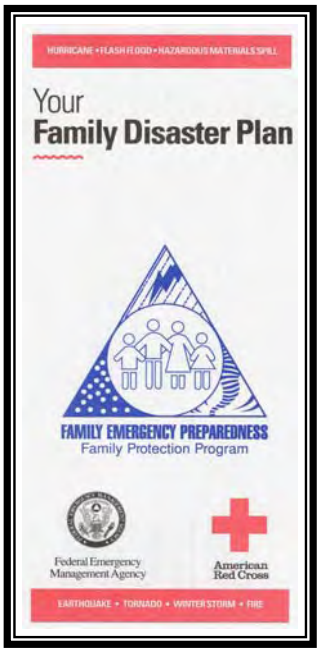
9.1. Outreach Projects

9.1.1. General Outreach projects are the first step in the process of orienting property owners to the hazards they face and the concept of property protection. They are designed to encourage people to seek out more information in order to take steps to protect themselves and their properties.

Research has proven that outreach projects work. However, awareness of the hazard is not enough; people need to be told what they can do about the hazard, so projects should include information on safety, health and property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

Community newsletters/direct mailings: The most effective types of outreach projects are mailed or distributed to everyone in the community. In the case of floods, they can be sent to floodplain property owners.

News media: Local newspapers can be strong allies in efforts to inform the public. Press releases and story ideas may be all that's needed to whet their interest. After a tornado in another community, people and the media become interested in their tornado hazard and how to protect themselves and their property. Local radio stations and cable TV channels can also help. These media offer interview formats and cable TV may be willing to broadcast videos on the hazards.

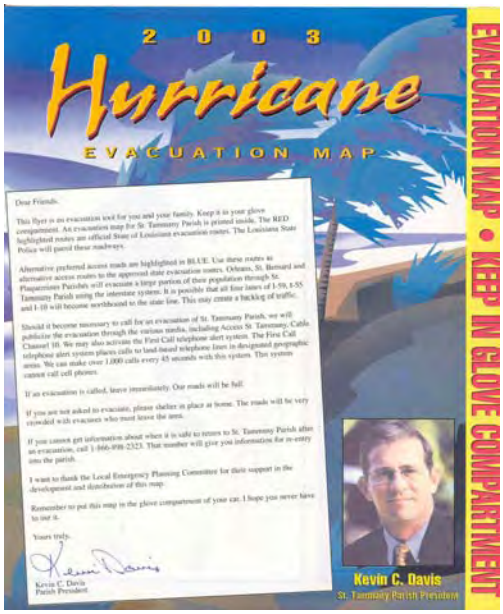


Other approaches: Examples of other outreach projects include:

- Presentations at meetings of neighborhood, civic or business groups,
- Displays in public buildings or shopping malls,
- Signs in parks, along trails and on waterfronts that explain the natural features (such as the river) and their relation to hazards (such as floods),
- Brochures available in municipal buildings and libraries, and
- Special meetings, workshops and seminars.

9.1.2. Implementation in St. Tammany Parish There are several types of outreach projects implemented in the Parish:

- For the past three years, the Parish has printed more than 90,000 colorful brochures on hurricane preparedness (see box). 65,000 are distributed through newspapers, 20,000 to elementary school children, and 5,000 through libraries and other means.
- The Parish's public access channel airs various videos throughout the year. Prepared by FEMA, the National Weather Service, Louisiana State University, and other public organizations, they explain flood and wind mitigation measures, driving safety, "surviving the hurricane," and similar topics.



Each year, the Parish distributes a brochure with hurricane safety information and an evacuation map

- Local newspapers and television stations have special articles and programs at the beginning of hurricane season.
- Several brochures are made available at the permit office and other public places. Most of them were prepared by the State Department of Transportation and Development or Federal agencies, such as FEMA and the EPA. They include information about flood insurance, hurricane safety, and emergency preparedness.
- The Parish developed a brochure that covers several topics for CRS credit: the flood hazard, flood warning procedures, flood safety, flood insurance, property protection and drainage system maintenance. It was developed in 1992 and has not been updated since.
- The Parish has two pages of "flood hazard information" in the Northshore Telephone Directory. It includes similar topics.
- Abita Springs has a quarterly newsletter.
- Pearl River includes news items with its sewer bills.

9.1.3. CRS credit The Community Rating System provides up to 290 points for outreach projects on flood topics. 100 of those points are for having a public information program strategy. This *Plan* qualifies for the strategy credit (see section 9.5).

9.2. Real Estate Disclosure

9.2.1. General Many times after a flood or other natural disaster, people say they would have taken steps to protect themselves if only they had known they had purchased a property exposed to a hazard. There are some Federal and State requirements, but they have their limits.

Federal law: Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building whether the property is in a floodplain as shown on the Flood Insurance Rate Map. If so, flood insurance is required for buildings located within the floodplain if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

State law: State law sets standards for real estate sales and licensing of agents and brokers RS 1454 states "It is unlawful for any person or his agent to file with the commission any notice, statement, or other document, required under the provisions of this Chapter which is false or contains any material misstatement of fact." This can be circumvented by not mentioning anything about natural hazards in the information about a property for sale.

Often homebuyers are not aware of the hazards their properties are exposed to.

RS 37:1455 itemizes reasons for revocation of a real estate license. Section 27 reads: "Failure to disclose to a buyer a known material defect regarding the condition of real estate of which a broker, salesperson, or timeshare interest salesperson has knowledge."

The shortcoming of these laws is that they only affect sales that involve a real estate agent and the salesperson must be aware of the hazard. Due to the sporadic occurrence of flood events, a property owner or an agent may legitimately not be aware of past or potential flooding problems with a property being sold.

Practices by local real estate boards can overcome the deficiencies of these laws and advise newcomers about the hazard earlier than just before closing. They could check the Flood Insurance Rate Map before listing a property or encourage disclosure of past flooding experiences.

9.2.2. Implementation in St. Tammany Parish The Parish has one additional law on the books: Section 40-070.0 lists what must be shown on a final subdivision plat. Subsection aa includes "flood zone and wetland demarcation lines or shading." This only works for subdivisions that have been platted since the requirement went into effect and then only if the title search sees it and advises the buyer.

The area's multiple listing service does not include a listing of whether a property is in a flood zone or wetland. Disclosure practices are left up to the individual broker or agent.

9.2.3. CRS credit Communities in Louisiana receive 5 points for the state law. St. Tammany Parish receives another 5 points for its plat requirement. Up to 46 more points are available if real estate agents implement a program that checks the FIRMs before a property is listed and provides the flood hazard information to house hunters. Ten points would be provided if local real estate agents give out brochures that advise people to check out a property's hazards before they commit to a purchase.

9.3. Libraries and Websites

The two previous activities tell people that they are exposed to a hazard. The next step is to provide information to those who want to know more. The community library and local websites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources.

Books and pamphlets on hazard mitigation can be given to libraries, many of them obtained free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.

There are many hazard protection references that can be put in libraries

Today, websites are becoming more popular as research tools. They provide quick access to a wealth of public and private sites and sources of information. Through links to other websites, there is almost no limit to the amount of up to date information that can be accessed by the user.

In addition to on-line floodplain maps, websites can link to information for homeowners on how to retrofit for tornadoes, earthquakes and floods and a "FEMA for Kids" site. This website teaches children how to protect their home and what to have in a family disaster kit.

9.3.1. Implementation in St. Tammany Parish A search of the St. Tammany Parish Library catalog reveals the following numbers of publications.

- 26 publications on hurricanes
- 50 publications on flood
- 1 video on tornado safety
- 2 publications on wildfires
- 1 publication on fog
- 5 publications on earthquakes
- 1 publication on hail

This guidebook was last revised in 1998.

The documents on the subject of "flood" represent a broad and thorough coverage of the subject, ranging from floodplain maps, to flood protection project reports and floodproofing/retrofitting manuals. There are still some excellent state and local references, including "Building Your Louisiana Home" and other publications from the LSU AgCenter's Extension Service that could be added.

The Parish has an active website, www.stpgov.org, which is kept updated with information on governmental activities, including the mitigation planning process. FEMA's floodplain maps are available on the site and the Parish is developing a more active, GIS-based map service. However, other than a form that people can submit to the Office of Emergency Preparedness on their evacuation and sheltering needs, there is not much information for people wanting to know how to reduce their exposure to natural hazards.

There are some very useful sites that the Parish could link to. The most extensive flood mitigation website in the country is at LSU AgCenter's Extension Service, www.louisianafloods.org. In addition to LSU's many publications, the site offers current river levels and flood predictions, advice on floodproofing and flood insurance, and a link to the national Extension Disaster Education Network (EDEN). There is also a "virtual mall," billed as a "place to 'shop' for floodproofing products, contractors, and professional services, and to see examples of floodproofing installations."

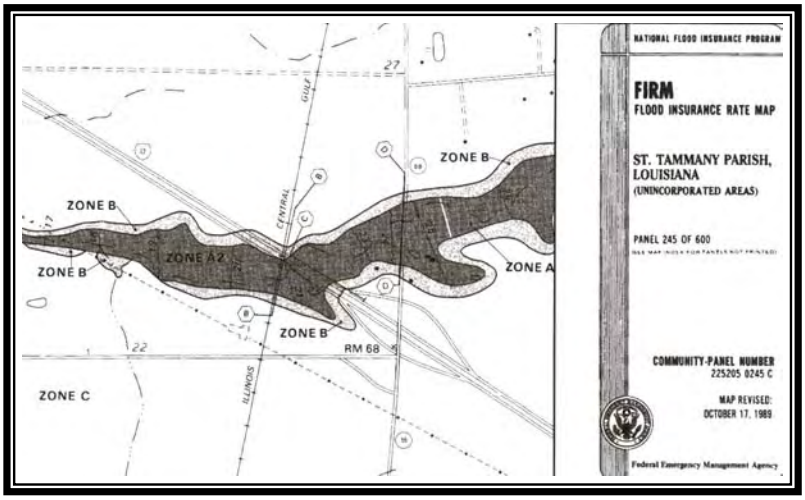
Abita Springs has a website that includes its newsletter. There are no mitigation pages or links to other sites.

9.3.2. CRS credit The Community Rating System provides up to 30 points for having a variety of flood references in the local public library and up to 36 more for similar material on municipal websites (Activity 350 – Flood Protection Information). The Parish is currently earning 27 points for the library.

9.4. Technical Assistance

9.4.1. Hazard information Many benefits stem from providing map information to inquirers. Residents and business owners that are aware of the potential hazards can take steps to avoid problems and/or reduce their exposure to flooding. Real estate agents and house hunters can find out if a property is floodprone and whether flood insurance may be required.

Communities can easily provide map information from FEMA's Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies. They may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is outside the mapped floodplain.



Some communities supplement what is shown on the FIRM with information on additional hazards, flooding outside mapped areas and zoning. When the map information is provided, community staff can explain insurance, property protection measures and mitigation options that are available to property owners. They should also remind inquirers that being outside the mapped floodplain is no guarantee that a property will never get wet.

9.4.2. Property protection assistance While general information provided by outreach projects or the library helps, most property owners do not feel ready to retrofit their buildings without more specific guidance. Local building department staffs are experts in construction. They can provide free advice, not necessarily to design a protection measure, but to steer the owner onto the right track.

Building or public works department staff can provide the following types of assistance:

- Visit properties and offer protection suggestions,
- Recommend or identify qualified or licensed contractors,
- Inspect homes for anchoring of roofing and the home to the foundation,
- Provide advice on protecting windows and garage doors from high winds, and

– Explain when building permits are needed for home improvements.

There is a concern that a local official might provide wrong information and the community would be sued when the project failed. To counter this, there are guidelines for local programs and training on how to identify the right measures.

FEMA conducts a free course at its Emergency Management Institute on property protection measures for flooding. FEMA and the Corps of Engineers periodically conduct one or two day retrofitting workshops.

9.4.3. Implementation in St. Tammany Parish The Permits and Regulatory Department provides map information to any inquirer. This service is publicized by a letter sent each year to local banks, real estate offices and insurance agencies. The FEMA floodplain maps are also available for access on the Parish's website.

The office in the Planning Department that administers the mitigation funding programs does talk to inquirers about the benefits and hazards of alternatives. Staff does not give advice because of resource constraints and the potential for liability.

The Parish has conducted a one day seminar on flood protection measures and mitigation funding programs. This was done in 2000, in conjunction with a flood awareness week. The Parish publicized that during the week, staff would be available at the Government Complex to meet with and talk to people on mitigation.

9.4.4. CRS credit The Community Rating System provides 140 points for providing map information to inquirers. Up to 71 points are available for providing one-on-one flood protection assistance to residents and businesses and making site visits. Both services must be publicized. The Parish is currently receiving the full 140 points for map information, but only 3 points for technical assistance.

9.5. Public Information Program Strategy

9.5.1. General A public information program strategy is a document that receives CRS credit. It is a review of local conditions, local public information needs, and a recommended action plan of activities. A strategy consists of the following parts, which are incorporated into this plan.

– The local flood hazard – discussed in Chapter 2 of this plan.
– The property protection measures appropriate for a specific hazard – discussed in chapter 5.
– Flood safety measures appropriate for the local situation – Flood safety measures are on page 9-8 and Hurricane safety is discussed in the box on page 9-10.
– The public information activities currently being implemented within the community including those by non-government agencies – discussed in sections 9.1 – 9.4.

- Goals for the community's public information program – covered in Chapter 4.
- The outreach projects that will be done each year to reach the goals – in section 9.7's recommendations and Chapter 10's action plan.
- The process that will be followed to monitor and evaluate the projects – in Chapter 10's action plan.

9.5.2. Public information topics At its February 7, 2004, meeting, the Mitigation Planning Committee reviewed the various public information activities currently underway with the goals of this *Mitigation Plan* in mind. An exercise was conducted to identify the most important topics that should be explained to the public.

Each Committee member was given the handout that appears on the next page. The handout lists 54 possible topics that would be useful for residents and businesses to know. The members were asked to check the 10 topics they felt were most important to convey. They could also add other topics not listed.

Flood Safety

- Do not walk through flowing water. Drowning is the number one cause of flood deaths. Currents can be deceptive; six inches of moving water can knock you off your feet. Use a pole or stick to ensure that the ground is still there before you go through an area where the water is not flowing.
- Do not drive through a flooded area. More people drown in their cars than anywhere else. Don't drive around road barriers; the road or bridge may be washed out.
- Stay away from power lines and electrical wires. Electrical current can travel through water. The number two flood killer after drowning is electrocution. Report downed power lines to the Police or Sheriff by calling 911.
- Look out for animals that have been flooded out of their homes and who may seek shelter in yours. Use a pole or stick to poke and turn things over and scare away small animals.
- Look before you step. After a flood, the ground and floors are covered with debris including broken bottles and nails. Floors and stairs that have been covered with mud can be very slippery.
- Be alert for gas leaks. Use a flashlight to inspect for damage. Don't smoke or use candles, lanterns, or open flames unless you know the gas has been turned off and the area has been ventilated.
- Carbon monoxide exhaust kills. Use a generator or other gasoline-powered machine outdoors. The same goes for camping stoves. Charcoal fumes are especially deadly -- cook with charcoal outdoors.
- Clean everything that got wet. Flood waters have picked up sewage and chemicals from roads, farms, factories, and storage buildings. Spoiled food, flooded cosmetics, and medicine can be health hazards. When in doubt, throw them out.
- Take good care of yourself. Recovering from a flood is a big job. It is tough on both the body and the spirit and the effects a disaster has on you and your family may last a long time.

As The Storm Approaches

THESE SIMPLE TASKS COULD SAVE YOUR LIFE AND YOUR HOME

- Listen for weather updates on local stations and on NOAA Weather Radio. Don't trust rumors, and stay tuned to the latest information.
- Check your Disaster Supplies Kit. Obtain any needed items.
- Refill prescriptions. Maintain at least a two week supply during hurricane season.
- Clear yard of potential flying debris; e.g. lawn furniture, potted plants, bicycles and trash cans.
- Protect your windows and glass doors! Brace double entry and garage doors at the top and bottom.
- Fill your car's gas tank and check oil, water and tires. Gas pumps don't operate without electricity.
- Secure your boat early. Drawbridges will be closed to boat traffic after an evacuation order is issued.
- Leave the swimming pool filled and super-chlorinated. (Cover the filtration system.)
- Get cash. Banks and ATMs won't be in operation without electricity and few stores will be able to accept credit cards or personal checks.
- Do not get on congested evacuation routes and try to out run the storm.

IF YOU CAN STAY HOME

If you live in a sound structure **OUTSIDE** the evacuation area and do **NOT** live in a mobile home, stay home.

- Make sure your windows are protected and home is secured.
- Offer your home as shelter to friends or relatives who live in vulnerable areas or mobile homes.
- Clean containers for drinking water and your bath tub for storing clean water. Line the tub with plastic sheeting or clean shower curtain, or caulk the drain with silicone caulking – it will hold water for weeks and cleans up easily when dry. Plan on three gallons per person, per day for all uses.
- Check your Disaster Supplies Kit. Make sure you have at least a two-week supply of non-perishable foods. Don't forget a non-electric can opener.
- During the storm, stay inside and away from windows, skylights and glass doors. Find a safe area in your home – an interior, reinforced room, closet or bathroom on the lower floor.
- Wait for official word that the danger is over. Don't be fooled by the storm's calm "eye."
- If you lose power, turn off major appliances, such as the air conditioner and water heater, to reduce damage.
- If flooding threatens your home, turn off electricity at the main breaker.

IF YOU MUST EVACUATE

Stay tuned to your local radio and television station for emergency broadcasts. If ordered to evacuate, you must do so immediately.

- The official emergency broadcast stations are 870AM and 106.7FM. On the Northshore, 106.1FM will carry St. Tammany information courtesy of Action News.
- Take your Disaster supplies kit with you!
- Take important papers with you, including your driver's license, special medical information, insurance policies and property inventories.
- Let friends and relatives know where you are going. Make sure your neighbors have a safe ride.
- Turn off electricity, water & gas.
- Lock windows and doors.

DISASTER SUPPLIES KIT

One of the most important tools for emergency preparedness is the Disaster Supplies Kit. Below are the most important items. Stock up today and store in a water-resistant container! Replenish as necessary, especially at the beginning of hurricane season, June 1.

- ❑ Two-week supply of prescription medicines.
- ❑ Two-week supply of non-perishable/special dietary foods.
- ❑ Drinking Water/containers: 3 gal/per person/per day for two weeks.
- ❑ Flashlights and batteries for each member of the family. Portable radio and (7 sets) batteries.
- ❑ First aid book and kit including bandages, antiseptic, tape, compresses, non-aspirin pain reliever, anti-diarrhea medication.
- ❑ Mosquito repellent & citronella candles.
- ❑ Two coolers (one to keep food; the other to go get ice).
- ❑ Plastic tarp for roof/window repair, screening, tools, nails, etc.
- ❑ Water purification kit (tablets, chlorine (plain) and iodine).
- ❑ Infant necessities (medicine, sterile water, diapers, ready formula, bottles).
- ❑ Clean up supplies (mop, buckets, towels, disinfectant).
- ❑ Camera and film.
- ❑ Non-electric can opener.
- ❑ Extra batteries for camera, portable TV & lamps, etc.
- ❑ Plastic trash bags.
- ❑ Toilet paper, paper towels and pre-moistened towelettes.

If you evacuate you also should take:

- ❑ Pillows, blankets, sleeping bags or air mattresses.
- ❑ Extra clothing, shoes, eyeglasses, etc.
- ❑ Folding chairs, lawn chairs or cots.
- ❑ Personal hygiene items (toothbrush, toothpaste, deodorant, etc.).
- ❑ Quiet games, books, playing cards and favorite toys for children.
- ❑ Important papers (driver's license, special medical information, insurance policies and property inventories).
- ❑ Food & water for shelter.

Precious commodities before and after a storm:

- ❑ Cash. (With no power, banks may be closed, checks and credit cards unaccepted, and ATMs may not be operational).
- ❑ Charcoal, Wooden Matches and Grill.
- ❑ Ice, food & water for shelter.

After The Storm

For Information Concerning Re-Entry Into St. Tammany Parish

Call 1-866-898-2323

The back cover to the flyer shown on page 9-2 includes hurricane safety tips.

Public Information Topics

There are a variety of messages that can be delivered to property owners, businesses, school children and other members of the "public." The following are listed in alphabetical order.

Please review these messages and check off the **10** that you think are the most important. Scratch out any messages that should not be used and feel free to suggest different words.

–	Beautifying the lakeshore
4	Benefits of open space
–	Dealing with contractors
–	Earthquake safety precautions
4	Economic impact of natural hazards
10	Emergency protection measures
5	Family preparedness
5	Flood Insurance Rate Maps
5	Flood safety precautions
1	Floodproofing a business
4	Floodproofing a house
8	Fog safety precautions
3	Health hazards
9	How to evacuate during a storm/flood
–	How to get out of buying flood insurance
5	Local drainage protection
3	Making sure your yard drains
2	Materials on the website
1	Past disasters in the Parish
–	Preparing a building for a winter storm
4	Preserving and protecting wetlands
2	Protecting a manufactured home from wind
5	Protecting water quality
1	References in the local library
1	Reporting construction violations
5	Reporting dumping violations
–	Retrofitting a building for tornado protection
–	Retrofitting for earthquake protection
4	Rules against dumping in streams
8	Rules on building in the floodplain
1	Safety in buildings
1	Safety in vehicles
2	Sources of assistance
3	Status of flood control projects
1	Status of implementing the mitigation plan
3	Storm safety precautions
1	Substantial damage regulations
7	Termite protection/eradication
1	Tornado safety precautions
3	Warning signals
–	Ways to protect a building from hail
4	What a flood insurance policy covers
2	What other agencies are doing
9	What the Parish is doing
2	When flood insurance must be purchased
5	Whether a building is in a floodplain
2	Who is responsible for flooding
2	Why channel maintenance is important
5	Why it floods
–	Why levee maintenance is important
–	Wildfire property protection measures
–	Wildfire safety precautions
4	Wind protection measures
1	Winter storm safety precautions
2	Other: Keep ditches clear
1	Other: Upgrade building code requirements
1	Other: Enforce building codes
—	Other: _____
—	Other: _____

Handout used to determine the topics that a public information program should cover. The numbers are the number of Committee members who chose that topic as one of their top ten.

The handout on the previous page shows the actual scores for each topic. After a review of the results, the higher scoring topics were organized and combined. It was concluded that the following topics deserved the most attention:

Hazard Mitigation Planning Committee discussing public information activities at its February 7, 2004, meeting

- Safety precautions for all types of hazards, but especially storms, floods and fog. Evacuation is recognized as the most important safety precaution for tropical storms and hurricanes.
- Flood protection measures, including rules for new construction and insurance.
- Termite protection.
- Keeping drainageways clear and protection from local drainage problems.
- Family and emergency preparedness measures.
- What the Parish is doing and sources of assistance.
- Protecting water quality and wetlands and the benefits of open space.

9.5.3. Media A second exercise was conducted to identify the most effective ways to convey the various messages to residents and businesses. This time a handout with 31 different ways to communicate was given to each Committee members. They were asked to identify the five most important ways. The handout with the "votes" of the members is shown on the next page.

The results were tallied and discussed by the Committee. Given that there are 200,000 people living in St. Tammany Parish and over half of them are in the floodplain, the Committee did not favor labor intensive approaches, such as visits to a home or one-on-one technical advice. Mass media are preferred, such as:

- Cable TV notices, videos and TV programs.
- Mailings to everyone, provided they are done without great expense, such as with utility bills.
- News releases, newsletters, newspaper articles, and newspaper supplements.
- Information on the Parish's website with links to other sources.
- Displays at appropriate places and during special events.
- Handouts, flyers and other materials for the displays, to give to school children and libraries, and to distribute at special events and meetings.

9.5.4. CRS credit The Community Rating System provides 100 points for a public information program strategy. A mass mailing to all properties can earn up to 60 more points and can meet the publicity requirements to receive credit for several other activities.

Public Information Media

There are many different ways to convey the messages about hazards, safety precautions, and ways to protect one's property. The following are listed in alphabetical order.

Please review these media and check off the **5** that you think are the most important. Scratch out any media that should not be used and feel free to suggest different ones.

8 Cable TV notices
1 Displays in home improvement stores
3 Educational programs in grade schools
1 Educational programs in high schools
1 Educational programs in junior high
3 Handouts/flyers at public places
3 Homeowner's flood protection handbook
– Mass mailing to all floodplain residents/businesses
1 Mass mailing to all lakeshore residents/businesses
4 Mass mailing to all residents/businesses
6 Newspaper articles
1 Newspaper supplements
6 News releases
– Open houses/contractors' shows
5 Parish/town-wide newsletter
– Park/recreation department educational programs
2 Presentations at neighborhood meetings
– Presentations to banks and lenders
– Presentations to contractors
1 Presentations to insurance agents
– Presentations to organizations or clubs
1 Presentations to real estate agents
2 References available in the library
5 Shopping mall displays
4 Special events (e.g., "Hurricane Awareness Week")
0 Technical advice from Parish staff
0 Telephone book/"Yellow Book"
7 Utility bill stuffers
2 Videos/Cable TV programs
– Visits to a home by Parish staff
5 Web site with links to other sources
4 Other: Reverse 911
— Other: _____

Handout used to determine the best ways for a public information program to convey messages to residents and businesses.

9.6. Conclusions

1. There are many ways that public information can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves.

2. Many of the public information activities can be implemented by community staff By formalizing its activities, a community can earn nearly 500 points under the Community Rating System.

3. Outreach projects, libraries and websites are currently being used as public information services in St. Tammany Parish.

4. The most important topics to cover in public information activities are:

   – Safety precautions for all types of hazards, but especially storms, floods and fog. Evacuation is recognized as the most important safety precaution for tropical storms and hurricanes.
   – Flood protection measures, including rules for new construction and insurance.
   – Termite protection.
   – Keeping drainageways clear and protection from local drainage problems.
   – Family and emergency preparedness measures.
   – What the Parish is doing and sources of assistance.
   – Protecting water quality and wetlands and the benefits of open space.

5. The most appropriate ways to get the messages out are:

   – Cable TV notices, videos and TV programs.
   – Mailings to everyone, provided they are done without great expense, such as with utility bills.
   – News releases, newsletters, newspaper articles, and newspaper supplements.
   – Information on the Parish's website with links to other sources.
   – Displays at appropriate places and during special events.
   – Handouts, flyers and other materials for the displays, to give to school children and libraries, and to distribute at special events and presentations.

9.7. Recommendations

1. Mass media approaches should be used to periodically advise everyone in the Parish about safety precautions, family preparedness, drainage system maintenance, dumping regulations, permit requirements, what the Parish is doing, and where one can receive more information or assistance. These approaches include Cable TV, news releases, and postings on the website.

2. The Parish and the municipalities should each develop a newsletter or other medium, such as a utility bill stuffer, to be distributed to all residents in their jurisdiction. This newsletter should cover the following topics:

   - Safety precautions
   - Family preparedness
   - Drainage system maintenance
   - Dumping regulations
   - Permit requirements
   - What the Parish is doing
   - The Parish's map information service
   - Where one can receive more information or assistance
   - Additional topics specifically credited by the Community Rating System:
     - Property protection measures
     - Flood insurance
     - Substantial improvement/substantial damage regulations
     - Natural and beneficial floodplain functions

3. Handouts and flyers produced by the Parish, the Red Cross, the Parish Schools, FEMA, the State, and other organizations should be reviewed to determine if they should be revised or new ones should be made.

4. A display on safety and property protection should be prepared. It should include floodplain maps, photos of flood retrofitted homes, Red Cross brochures on family preparedness and the Parish's hurricane brochure (see illustrations, page 9-2), photos of good and bad examples of drainage maintenance, and other pictures and handouts on the other priority topics.

   The display materials should be used during public activities, such as home improvement fairs at shopping malls, meetings with neighborhood associations and other organizations, hurricane preparedness week, etc. They could also be loaned to libraries, schools, and other public locations.

5. The Parish's website should have a mitigation page with information and links to other sites.

6. Parish staff should meet with the Northshore Area Board of Realtors to review hazard disclosure practices and how the Parish's map information service can help.

9.8. References

1. *Are You Ready? A guide to Citizen Preparedness*, FEMA, 2002.

2. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2002.

3. *CRS Credit for Outreach Projects*, Federal Emergency Management Agency, 2002.

4. Interviews with Parish officials, Fall, 2003.

5. *Floodproof Retrofitting: Homeowner Self-Protective Behavior*, Shirley Bradway Laska, University of Colorado, 1991.

6. Parish brochures, flyers, and other public informational materials.

7. *Stormwater Management Public Information Resource Guide*, South Suburban Mayors and Managers Association, 1999

8. Websites for St. Tammany Parish, the St. Tammany Parish Library, the Northshore Area Board of Realtors, and LSU's AgCenter.

Chapter 10. Action Plan

The culmination of the St. Tammany Parish *Natural Hazards Mitigation Plan* is this Action Plan. The general direction of the overall program is outlined here. Specific activities pursuant to the general direction are detailed in Sections 10.1 – 10.3. These sections assign recommended projects and deadlines to the appropriate offices.

Goals The overall directions can be summarized under the six goals established by the Planning Committee and listed in Chapter 4:

1. Protect the lives and health of the Parish's residents from the dangers of natural hazards.
2. Ensure that public services and critical facilities operate during and after a disaster.
3. Ensure that adequate evacuation routes, streets and utilities are maintained and available during and after a disaster.
4. Protect homes and businesses from damage.
5. Manage new development to minimize the impact of natural hazards on future construction.
6. Give special attention to repetitively flooded areas.

General recommendations appear at the end of Chapters 5 – 9 for each of the five general mitigation strategies. This chapter converts those general recommendations to specific action items, generally following the same order as Chapters 5 – 9.

Priorities The Planning Committee reviewed and discussed many things that can be done to protect people and property from the 13 natural hazards introduced in Chapter 2. It was recognized that priorities must be set so the Parish's resources can focus on those activities that will do the most good. Accordingly, four factors were used to prioritize what should be pursued:

1. **The greatest threats:** Efforts should focus on those hazards that present the greatest threats to the Parish. Chapter 3 reviewed the Parish's vulnerability to the 13 hazards and concluded in section 3.16.4:

    a. Tropical storms (including hurricanes) and flooding are by far the most severe hazards facing St. Tammany Parish in terms of property damage. Termites and hailstorms are the next most severe.

    b. Fog is the most severe hazard facing St. Tammany Parish in terms of the threat to lives, safety and mental health. Other, more frequent, hazards, such as tornadoes, wildfires, termites and tropical storms are also important.

c. Tropical storms (including hurricanes) and flooding have the greatest overall impact on the area's economy. Termites are an added cost of living in the area.

d. Some types of property and areas are more vulnerable than others. Special emphasis should be placed on protecting manufactured homes and repeatedly flooded properties.

2. **Appropriate measures:** The recommended action items need to be appropriate for the type of threat presented. For example, Chapter 3's analysis notes that the major threat presented by storms and floods is property damage, so property protection and preventive measures, such as acquisition and code enforcement should be directed toward those hazards.

   On the other hand, the threat presented by fog is a life safety one. No property protection measures or building codes will protect people from automobile and airplane accidents. Appropriate measures for life safety threats are emergency warning and public information activities.

3. **Costs and benefits:** The Committee considered the costs and relative benefits of alternative measures. These factors are listed in the description of each action item. Costs can usually be listed in terms of dollars, although most of the recommendations involve staff time rather than the purchase of equipment or services that can be readily measured in dollars.

   In many cases, benefits, such as lives saved or future damage prevented, are hard to measure in dollars, so narrative discussions are provided. In all cases, the Committee concluded that the benefits (in terms of reduced property damage, lives saved, health problems averted and/or economic harm prevented) outweighed the costs for the recommended action items.

4. **Affordability:** Not only must the benefits exceed the costs, the projects must be affordable given the Parish's and municipalities' available resources and staffing. Projects such as acquiring and clearing large floodprone areas were discarded because they did not meet these criteria. Other activities, such as elevating or acquiring selected properties, are dependent on outside or additional funding and further analysis to ensure the benefits outweigh the costs.

Based on these factors, the Committee prioritized the possible activities that could be pursued. Some possible projects, such as constructing more evacuation routes, were not pursued because they did not meet the above criteria. The result was 17 action items that address the major hazards, are appropriate for those hazards, are cost-effective, and are affordable.

Action items Seventeen action items are recommended in the following pages. Each action item starts with a short description. The next four subheadings identify

- the agency responsible for implementing the action item,
- the deadline for accomplishing the action item,
- the cost of implementation, and
- the benefits of implementing the action item.

All of the action items can be tied to the above listed goals and the recommendations in Chapters 5 – 9. These relationships are shown in Table 10-1. The recommendations and the discussions in the earlier chapters provide more background and direction on each action item.

The last column in Table 10-1 shows the activity in the Community Rating System that provides credit points for the action. The column also shows how many points the Parish would receive. These are in addition to the credit points currently received by the Parish. Because it has not joined the CRS, Abita Springs would earn more points than listed.

Section 10.1 addresses general program items and projects. Section 10.2 lists the public information action items and Section 10.3 reviews additional tasks needed to administer and support *Plan* implementation.

Mitigation Committee Several action items refer to the Mitigation Committee. A plan is worthless if there is no instrument for ensuring that it is carried out. Accordingly, the creation of a permanent Mitigation Coordinating Committee is proposed to monitor the implementation of the *Plan*, report to the Parish Council and municipalities on its progress, and recommend revisions to this *Plan* as needed. This is explained in action item 15. Section 10.4 provides a draft resolution for the Parish Council to pass to put the Action Plan into effect.

10.1. Program Action Items

Action Item 1. Property protection projects Continue to seek State and Federal funding support for property protection measures. Priority will be for flood protection projects for repetitive loss properties. All property protection projects that use FEMA funds will be voluntary.

While St. Tammany Parish will continue to support traditional funding programs, staff will also pursue flexible funding arrangements. The first priority will be to fund area-wide flood control or drainage improvement projects that will protect many properties at a lower cost. Where a watershed management plan concludes that certain properties will not be protected by a project, the Parish will seek funding for property protection measures on an individual property basis.

Table 10-1 Action Items, Goals, and Recommendations

Action Item	Goal 1. Protect lives and health	Goal 2. Public services/critical facilities	Goal 3. Evacuation routes, streets, & utilities	Goal 4. Protect homes and businesses	Goal 5. Manage new development	Goal 6. Repetitively flooded areas	Chapter – Recommendation	CRS Activity - Credit Points
10.1. Program Action Items								
1. Property protection projects	X			X		X	5-3, 5-5, 8-1	530 – 84
2. Public property	X	X	X			X	5-4	
3. Plans and regulations					X		6-1, 6-6, 6-13	430 –10
4. Building code					X		6-3, 6-5	430 – 60
5. Permit administration					X	X	6-4, 6-9, 6-10, 7-4	430 – 55
6. Floodplain management					X	X	6-2, 6-8, 6-10, 6-12	430 –100
7. Tree City	X	X	X	X			6-11	
8. Emergency operations	X	X	X				7-1, 7-2, 7-3	610 –150
9. Flood control projects	X	X	X	X		X	8-1	
10. Drainage system maintenance		X		X		X	8-3	540 – 50
10.2. Public Information Strategy								
11. Hazard mitigation materials	X			X			8-4, 9-2, 9-3, 9-4	330 – 50
12. Outreach projects	X			X			9-1, 9-2, 9-3, 9-5	350 – 30
13. Flood maps	X			X	X	X	6-7, 9-5, 9-6	
10.3. Administrative Action Items								
14. *Plan* adoption	X	X	X	X	X	X		510 –200
15. Mitigation Committee	X	X	X	X	X	X		
16. Financing			X	X		X	8-2	540 - 50
17. Community Rating System	X	X	X	X	X	X		

This table relates the 17 action items to the 6 goals of this *Plan*. The goals are stated in full on pages 4-3 and 10-1. The table also shows the relation between the action items and the recommendations at the end of chapters 5 – 9. For example action item 1, Property protection projects, supports goals 1, 4, and 6. It is derived from the 3rd and 5th recommendations at the end of Chapter 5. It is estimated that the Parish would receive 84 points under the CRS for this work. These are in addition to the credit points currently received by the Parish. Because it has not joined the CRS, Abita Springs would earn more points than listed.

Staff will also work with funding agencies to allow funding for rebates for lower cost measures and alternatives to elevation and acquisition of severely flooded properties. Staff will monitor national and regional developments in policies, procedures and programs that protect properties from repetitive flooding.

Responsible agency: Parish Planning Department/Mitigation Office

Deadline: Varies with each funding cycle's application deadline

Cost: Staff time to arrange funding. The local cost share will be funded by the Parish for publicly-administered flood control and drainage improvement projects (see action item 16) and by the property owners for those projects that focus on one property at a time. In 2003, the costs to administer these programs has been $122,000 for staff time $12,000 for overhead and $12,000 to maintain acquired properties.

Benefits: This approach will ensure that those properties most in need of flood protection will be addressed first and that the most cost-effective approaches will be used. The actual benefits of each project will vary, but at a minimum, Federal funding programs require that the Parish demonstrate that the benefits exceed the costs over time. The costs to the Parish should be compared to the millions of dollars in Federal funds that this effort has brought in.

Action Item 2. Public property Each department and municipality will evaluate its own properties to determine if they need to be retrofitted or modified to protect them from the hazards that they are exposed to. Priority will be given to critical facilities and major roads. Projects to protect a critical facility in the floodplain will be forwarded to the Planning Department's Mitigation office for submittal for federal funding support.

Responsible agency: Each agency head

Deadline: Report to the Mitigation Committee by March 31, 2005

Cost: Staff time to do the evaluation. Individual projects will be submitted for the following year's budget.

Benefits: Keeping critical facilities operational during and after a natural disaster is vital to public health and safety. Identifying and addressing their exposure to damage will not only reduce property damage to the facilities, it will ensure that they will be available when needed. It is hard to put a dollar value on potential damage averted, but damage to even one facility could exceed $100,000 in repair costs plus the adverse ripple effect on people and other properties.

Action Item 3. Plans and regulations Revisions to the zoning ordinance, capital improvement plan, and other plans and regulations will incorporate the 2025 plan's recommendations and appropriate recommendations from this *Mitigation Plan*. The Parish and the municipalities will continue to administer their regulations for subdivisions, mobile homes, and coastal zone and wetlands protection. The Watershed Protection Regulations will be adopted.

Responsible agency: Planning and Permits Departments

Deadline: Ongoing.

Cost: Staff time.

Benefits: The current regulatory programs help ensure that hazardous areas will be avoided and new developments will be protected from damage (to some degree). By incorporating the recommendations of the New Directions 2025 plan and the watershed mapping and management efforts, these programs will be strengthened.

Action Item 4. Building code The Parish will adopt the new State Uniform Construction Code, the 2000 IBC, required by Act 387, replacing the Standard Building Code presently enforced. The Parish will consider adopting the 2000 International Residential Code (IRC) and the 2000 International Mechanical Code. Meetings will be held with municipalities, developers and builders to review and address any concerns regarding the adoption of the I-Codes and/or any amendments recommended by the Permit Department Staff to strengthen the standards for new buildings against damage by high winds, tornadoes and hail..

Responsible agency: Permits Department, each municipal permit office.

Deadline: December 31, 2005

Cost: Staff time.

Benefits: This will improve the hazard protection standards for new construction and will ensure the Parish is compliant with State law. Involving the development and construction industry will ensure that the changes are realistic and supported by those who must implement them.

Action Item 5. Permit administration The Parish will request a BCEGS rating from the Property Insurance Association of Louisiana. Based on the BCEGS findings, the Permits Department will review and strengthen its procedures for administering and enforcing the building code and floodplain regulations.

Concurrently, procedures will be developed to require permits and conduct inspections after a flood or other disaster. This will be coordinated with the Office of Emergency Preparedness' assignment to prepare post-disaster procedures for public information and mitigation project identification

Staff from the Permits, Planning and Engineering Departments will review the reference materials for the Certified Floodplain Managers exam and determine which people would be most appropriate to become CFMs.

Responsible agency: Permits, Planning, Engineering and Emergency Preparedness and municipal permit offices

Deadlines:

- Request the BCEGS review by May 31, 2005
- Develop the procedures by May 31, 2005
- Pass the CFM exam by May 31, 2005

Cost: Staff time. The CFM exam is $100 per person plus Association dues ($80/year). There could also be a cost for the required continuing education, depending on how the credits are earned.

Benefits: Improved procedures mean that staff will pay more attention to the details of factors vital to natural hazard mitigation when they review plans and inspect sites, such as ensuring that a structure is securely connected to the foundation. Certification will also ensure that staff understand the Parish's and the municipalities' responsibilities under the National Flood Insurance Program.

Action Item 6. Floodplain management In coordination with the meeting with developers and builders to be held pursuant to action item 4, the Parish's floodplain regulations will be reviewed to determine where revisions would better protect new buildings. Community Rating System credits will be used as an initial guide for regulatory standards.

When the Flood Insurance Rate Map is being revised, the benefits of mapping a regulatory floodway will be reviewed.

The Parish will use every opportunity (within funding constraints) to preserve floodplain areas as open space or other use compatible with the flooding hazard. In coordination with action item 3, developers will be encouraged to set aside floodprone areas toward their open space credits.

It is recommended that Sun join the National Flood Insurance Program.

Responsible agency: Permits, Planning, Engineering

Deadline: Regulatory standard review to be concluded by July 31, 2004

Cost: Staff time.

Benefits: A strong and effective floodplain management program is the most important tool to keep a community's flood problems from getting worse. To be effective, a program needs regulatory standards that address local hazards, adequate maps and appropriate procedures. This action item maps out how to develop those components.

Action Item 7. Tree City The Parish will implement an urban forestry program modeled on the criteria of the Tree City USA program. This will involve:

- A tree care ordinance

- An Arbor Day observance and proclamation
- A landscape architect to provide advice and assistance

Current environmental programs will be reviewed to see how much of these criteria are already underway in the Parish. Note that Abita Spring is already a Tree City, so this action item is for the Town to maintain its eligibility

Responsible agency: Planning

Deadline: December 31, 2005

Cost: Staff time

Benefits: In addition to improving a community's appearance, an active urban forestry program will address the major problems caused by high winds and winter storms – loss of power, telephone and cable services and damage to vehicles and buildings due to falling trees or limbs.

Action Item 8. Emergency operations The *St. Tammany Parish Multi-Hazard Emergency Operations Plan* will be reviewed in detail to determine where improvements can be made and how to maximize credit under the Community Rating System. This process will include the following:

- Identification of where geographic information systems, NOAA Weather Radios, and other new tools can be used to support the Parish's emergency operations,
- Completing the project to prepare flood stage forecast maps for developed areas and adding real-time inundation mapping.
- A review to ensure that all steps are being taken to alleviate traffic jams during an evacuation of the Parish and/or New Orleans.

Responsible agency: Office of Homeland Security and Emergency Preparedness

Deadline: May 31, 2005

Cost: Staff time.

Benefits: An emergency response plan that has been carefully prepared, that is based on all available data on the hazards and their potential impact, that utilizes the latest planning and management tools, and that is regularly exercised will greatly improve local disaster response capabilities. Better disaster response means less loss of life, injury to people and damage to property.

Action Item 9. Flood control projects The current approach to flood control projects with watershed modeling and planning will be pursued. Priority will be given to protecting critical facilities, evacuation routes, and buildings. The criteria spelled out in section 8.7.1 will provide guidelines to ensure that projects do not adversely affect the environment or increase flood problems on other properties.

Responsible agency: Engineering Department

Deadline: Ongoing

Cost: Continue the current budget level of $900,000/year. See also action item 16.

Benefits: The benefits of each project will vary, but this approach ensures that the projects selected will provide the most protection for the cost. This action item calls for ensuring the projects meet the criteria set in Section 8.7.1. Several of those criteria assure that adverse impacts will not be transferred on to neighboring or downstream properties.

Action Item 10. Drainage system maintenance The Parish will continue its program of inspecting and cleaning drainage channels and retention basins. The drainage system maintenance program procedures will be revised to increase CRS credit. This will involve preparing more detailed procedures that identify sites that need special attention more frequently than the rest of the drainage system.

Responsible agency: Public Works Departments

Deadline: Ongoing

Cost: Staff time.

Benefits: An obstruction to a channel, such as a plugged culvert, can result in overbank flooding during a small rainstorm. By inspecting and maintaining the drainage system, potential flood problems can be identified and corrected before the next big rain. A proactive preventive activity can prevent thousands of dollars in flood damage, closed streets and threats to people.

10.2. Public Information Strategy

Public information efforts that explain safety precautions, property protection measures, and insurance coverage will be continued and expanded.

Action Item 11. Hazard mitigation materials As funding permits, the Parish will prepare background information, articles, and other explanations of the hazard mitigation topics listed in section 9.7.2. Projects will include:

- The annual hurricane preparedness and safety brochure (see example, page 9-2).
- Short articles on different topics to be provided to newspapers, the website and other media.
- A newsletter or collection of articles that covers all of the topics listed in section 9.7.2.
- Brochures and handouts that can be reproduced at low cost.
- Short, one-sentence, notices that are appropriate for cable TV crawlers and utility bill messages.

- A collection of videos and programs that can be played on the cable TV's public access channel.
- Materials suitable for a display, such as maps and photographs.

Masters of these materials will be prepared and made available for reproduction and distribution by interested municipalities, schools, and area organizations. As funding permits, Parish offices will reproduce appropriate ones for their use.

Responsible agency: Cultural and Governmental Affairs

Deadline: The first materials will be ready by December 31, 2004

Cost: Staff time to prepare the masters. Reproduction of the materials will be borne by the users.

Benefits: By preparing a master set of locally pertinent articles and materials, each interested office can select the most appropriate media and distribute the messages. By simply inserting an article in a newsletter or putting it on the website, the local level of effort is greatly reduced, which increases that likelihood that the messages will get out. The messages will also be technically correct and consistent throughout the Parish.

Action Item 12. Outreach projects As funding permits, the Parish will prepare and disseminate outreach projects based on the materials provided under action item 11. Such projects will include:

- Distribution of the hurricane preparedness and safety brochure in the early summer.
- News releases issued periodically and in conjunction with special events, such as hurricane preparedness week.
- Playing videos and short programs on the public access cable channel.
- Running one – two sentence crawlers on the public access cable channel.
- Putting brochures out at public places, such as permit offices, libraries, the Courthouse and the administrative offices.
- Setting up a display at appropriate locations and festivities.
- Providing brochures and display materials for Parish officials when they speak to neighborhood and civic organizations.
- Putting more information on the Parish's website and adding links to other sites with relevant materials.

Responsible agency: Cultural and Governmental Affairs, Management Information System

Deadline: The first projects will be released by December 31, 2004

Cost: Staff time.

Benefits: There are many benefits to having a well-informed public. For example, deaths from lightning have steadily decreased over the years because people are more aware of what they should and should not do. More self-help and self-protection measures will be implemented if people know about them and are motivated to pursue them.

Action Item 13. Flood maps The Parish will work with its watershed modeling contractors and FEMA to ensure that the next Flood Insurance Rate Map will accurately depict all flood hazards. The resulting maps (or information from the maps, such as flood elevations) will be made available to the public via the website and the Parish's map information service.

Parish staff will meet with the Northshore Area Board of Realtors to review hazard disclosure practices and how the Parish's map information service can help real estate agents advise purchasers of property about the flood hazard.

Responsible agency: Engineering, Management Information Systems

Deadline:

- The schedule for the new maps are dependent on FEMA's timetable.
- A meeting will be held with the Board of Realtors by December 31, 2004.

Cost: Staff time.

Benefits: Learning about the flood hazard, where it is and how high water can go, is the first step to protecting a property from flood damage. This action item will facilitate making that information available to all present and future residents of the Parish.

10.3. Administrative Action Items

This section reviews the additional action items that are needed to administer and support the recommendations of the two previous sections.

Action Item 14. *Plan* adoption The Parish Council will adopt this *Natural Hazards Mitigation Plan* by passing the resolution in Section 10.4. The Parish's resolution creates the Mitigation Coordinating Committee which is described in the next action item. The participating municipalities will adopt a similar resolution, to include those action items that are pertinent to the community. The municipal resolutions will assign the appropriate person responsible for each action item.

Responsible agency: Parish Council

Deadline: June 30, 2004

Cost: Staff time.

Benefits: Council adoption of the *Plan* will ensure its implementation. This is also a requirement for recognition of the *Plan* by FEMA funding programs and the Community Rating System.

Action Item 15. Mitigation Coordinating Committee The Natural Hazards Mitigation Planning Committee will be converted to a permanent advisory body in the Parish's resolution to adopt this *Plan*. It will:

- Act as a forum for hazard mitigation issues
- Disseminate hazard mitigation ideas and activities to all participants.
- Monitor implementation of this *Action Plan* and
- Report on progress and recommended changes to the Parish Council and each participating municipality.

The Committee will not have any powers over staff or the municipalities. It would be purely an advisory body. Its primary duty is to collect information and report to the Parish Council, the municipalities, and the public on how well this *Plan* is being implemented. Other duties include reviewing mitigation proposals, hearing resident concerns about flood protection and related matters, passing the concerns on to the appropriate entity, and posting its meetings and reports on the Parish's website.

The Mitigation Committee will be, in effect, St. Tammany Parish's hazard mitigation conscience, reminding the member agencies and municipalities that they are all stakeholders in the plan's success. The resolution charges it with seeing the *Plan* carried out and recommending changes that may be needed. While it has no formal powers, its work should act as a strong incentive for the offices responsible for the action items to meet their deadlines.

Responsible agency: Staff support for the Committee will be provided by the Office of Homeland Security and Emergency Preparedness

Deadline: The progress reports are due on the anniversary of the date the *Plan* is adopted by the Parish Council. An annual evaluation of the plan's implementation is required for credit under the Community Rating System. A five year update is required for continuing credit of this *Plan* under the Community Rating System and FEMA's mitigation funding programs.

Cost: Staff time.

Benefits: Those responsible for implementing the various recommendations have many other jobs to do. A monitoring system helps ensure that they don't forget their assignments or fall behind in working on them. The *Plan* should be evaluated in light of progress, changed conditions, and new opportunities.

Action Item 16. Financing More funds are needed for flood protection and drainage projects and for meeting the cost-share requirement for state and federal projects. New,

dependable sources of funding for flood control, drainage improvements, and drainage maintenance will be sought.

Among other things, a dependable source of funds would allow the Parish to prepare an annual capital improvements budget for drainage improvements. This would receive special CRS credit.

Responsible agency: Chief Administrative Officer

Deadline: Ongoing

Cost: Staff time.

Benefits: Flooding and tropical storms are the greatest hazards facing St. Tammany Parish and without proper controls, flooding will get worse. Constructing flood protection and drainage improvement projects are the most expensive hazard mitigation activities recommended by this *Plan*, but they are the only ones that will reduce the impact of these hazards.

Additional funds are needed, if only to help match available State and Federal funds. A dependable source of funds would finance the planning, construction and maintenance needed to reduce flooding and to prevent obstructions and other problems from aggravating flooding.

Action Item 17. Community Rating System St. Tammany Parish is participating in the CRS as a Class 9. Based on the recommendations in this *Mitigation Plan*, the Parish can improve to a Class 8, saving residents in the unincorporated areas over $400,000 each year in flood insurance premiums. Once the appropriate action items have been implemented (see Table 10-1), the Parish will submit a request for the class improvement.

The Town of Abita Springs has an active floodplain management program and staff has attended training. The Town currently administers several activities that would receive CRS credit. Therefore, it is recommended that Abita Springs review the CRS Application and other documents and determine if it should apply to join. For each class in the CRS, Abita Springs' residents would save a total of $2,000 each year, a savings that may not cost any additional effort of Town staff time.

Responsible agency: Planning Department

Deadline: December 31, 2004

Cost: Staff time.

Benefits: In addition to saving residents money, CRS participation has been shown to provide an effective incentive to implement and maintain floodplain management activities, even during times of drought. Therefore, by tying the action items to CRS credits, there is an added reason to ensure that they are implemented.

10.4. Resolution of Adoption

The following draft resolution is recommended for adoption of this *Natural Hazards Mitigation Plan* by the Parish Council and establishment of the Mitigation Committee.

Resolution No. ____

Whereas St. Tammany Parish is subject to tropical storms, hurricanes, flooding, fog, tornadoes, and other natural hazards that can damage property, close businesses, disrupt traffic, and present a public health and safety hazard; and

Whereas the Natural Hazards Mitigation Planning Committee, comprised of representatives from the Parish, municipalities and stakeholder organizations, has prepared a recommended *Natural Hazards Mitigation Plan* that reviews the options to protect people and reduce damage from the hazards; and

Whereas the recommended *Natural Hazards Mitigation Plan* has been widely circulated for review by the Parish's residents and federal, state and regional agencies and has been supported by those reviewers;

Now, therefore, be it resolved that:

1. The *Natural Hazards Mitigation Plan* is hereby adopted as an official plan of St. Tammany Parish.

2. The Mitigation Coordinating Committee is hereby established as a permanent advisory body. It shall be composed of representatives from:

    a. The following Parish offices and departments:

        1) Office of Homeland Security and Emergency Preparedness
        2) Engineering
        3) Cultural and Governmental Affairs
        4) Permits & Regulatory
        5) Planning
        6) Public Works

    b. Those municipalities that pass a resolution to adopt the *Natural Hazards Mitigation Plan* and that send a representative to attend the meetings of the Committee.

    c. Representatives of other interested agencies, organizations and associations appointed by the Parish President to represent the stakeholders in hazard mitigation and the general public.

3. The Committee shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the *Natural Hazards Mitigation Plan*. It shall meet at least once each year to review the status of ongoing projects.

4. The schedule of Committee meetings shall be posted in appropriate places. All meetings of the Committee shall be open to the public.

5. By June 30 each year, the Committee shall prepare an annual evaluation report on the *Mitigation Plan* for the Parish Council and the municipalities. The report will cover the following points:

    a. A review of the original plan.

    b. A review of any natural disasters that occurred during the previous calendar year.

    c. A review of the action items in the original plan, including how much was accomplished during the previous year.

    d. A discussion of why any action items were not completed or why implementation is behind schedule.

    e. Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by the Parish Council and the affected municipality's governing boards as amendments to the adopted plan.

6. The annual evaluation report shall be made available to the public and the media.

7. The director of each Parish office identified as "responsible agency" for the *Mitigation Plan's* action items shall ensure that the action item is implemented by the listed deadline.

8. The Office of Homeland Security and Emergency Preparedness shall provide staff support for the Committee's work.

ADOPTED this the _____ day of _____, 2004

_____
Clerk

APPROVED this the _____day of_____, 2004

_____
Parish President

Appendix A. Public Involvement Activities

As discussed in Section 1.1, St. Tammany Parish's mitigation planning included several efforts to seek public input into the planning process. This appendix includes examples from those efforts.

On page A-2 is the news release that was issued announcing the planning effort and inviting the public to attend the Committee meetings. Several newspapers ran this story.

A link to special website was established on the Parish's site (www.stpgov.org) to explain the program and to solicit public input. Several of the site's pages are shown, starting on page A-3. Copies of the minutes of each Planning Committee meeting were also posted on the site.

The public was invited to submit information on their own experiences with natural hazards. On page A-6 is the questionnaire to facilitate their comments. A click of a button and the results are sent to Solutient.

The announcement for the final public meeting is included on page A-7. This is the news release that was provided to all participants. They were encouraged to distribute it to local media in addition to the official release by the Parish. It is followed by one of the articles that was published.

KEVIN DAVIS, PARISH PRESIDENT
ST. TAMMANY PARISH

P. O. BOX 628
COVINGTON, LA 70434
985-898-2362 AND 985-646-4082
FAX: 985-898-5237
E-MAIL: KDAVIS@STPGOV.ORG
WEB SITE: HTTP://STPGOV.ORG

For Immediate Release, September 30, 2003
Contact: Suzanne Parsons Stymiest at 985-898-5243

Davis Announces New Public Safety Initiative

St. Tammany Parish President Kevin Davis announced a new effort to reduce or prevent St. Tammany Parish's vulnerability to natural disasters. Over the next six months, a Hazard Mitigation Planning Committee will review plans to reduce the safety hazards, health hazards, and property damage caused by tropical storms, floods, tornadoes, and other natural disasters. The Committee will produce a plan to guide parish hazard mitigation measures.

St. Tammany Parish is vulnerable to natural hazards that threaten life and health, as well as cause extensive property damage. Since Hurricane Betsy in 1965, the Parish has been declared a disaster area by the President 13 times. Davis stated, "While these hazards are acts of nature, the impacts on residents, public facilities, businesses, and private property can be reduced through planning."

The Parish's Office of Emergency Preparedness is leading the effort. A Hazard Mitigation Planning Committee, created by the St. Tammany Parish Council, is coordinating public participation. The Committee's members include representatives of Parish offices, interested municipalities, homeowner associations, and public organizations. The public is invited to attend all meetings.

The committee will review a variety of mitigation measures, organized under five general strategies:

- Property protection – e.g., relocation out of harm's way, retrofitting buildings, insurance
- Preventive – e.g., zoning, building codes, and other development regulations
- Emergency services – e.g., warning, sandbagging, evacuation
- Flood control projects – e.g., levees, reservoirs, channel improvements
- Public information – e.g., outreach projects, technical assistance to property owners

The next Hazard Mitigation Planning Committee meeting will be Saturday morning, November 8, 8:30 – 12:30 a.m. at the Office of Emergency Preparedness at the old Courthouse on Boston Street in Covington. The meeting is open to the public. The draft plan is expected to be ready for public and municipal review in February 2004.

For more information on this project, contact Clarence Powe, Deputy Directory (Planning), Office of Emergency Preparedness, 985/645-2492, cpowe@stpgov.org.

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St. Tammany Parish Home

St. Tammany Parish
Natural Hazards Planning

- Hazards Planning Home
- Committee Information
- Meetings Schedule
- Public Input
- More Information
- Links

Background

St. Tammany Parish is subject to natural hazards that threaten life and health and have caused extensive property damage. Since Hurricane Betsy in 1965, the Parish has been declared a disaster area by the President 13 times. As noted by Parish President Kevin Davis, "While these hazards are acts of nature, the impacts on residents, public facilities, businesses, and private property can be diminished through hazard mitigation planning".

The effort is being led by the Parish's Office of Emergency Preparedness. It is being coordinated by a Hazard Mitigation Planning Committee, created by the St. Tammany Parish Council. The Committee's members include representatives of Parish offices, interested municipalities,property owner associations, and public organizations.

The committee will review a variety of mitigation measures, organized under five general strategies:

- Property protection - e.g., relocation out of harm's way, retrofitting buildings, insurance
- Preventitive - e.g., zoning, building codes, and other development regulations
- Emergency services - e.g., warning, sandbagging, evacuation
- Flood control projects - e.g., levees, reservoirs, channel improvements
- Public information - e.g., outreach projects, technical assistance to property owners

Hazard Mitigation Planning Committee meetings are held at the Office of Emergency Preparedness at the old Courthouse on Boston Street in Covington. The meetings are open to the public. The draft plan is expected to be ready for public and municipal review in February 2004.

We want your comments: Use the hazards data form to tell us about your experiences with natural hazards and your suggestions for hazard mitigation activities the Parish could undertake.

For more information:
Clarence Powe, Deputy Director (Planning), Office of Emergency Preparedness, (985) 867-3787
cpowe@stpgov.org

St. Tammany Parish Home

St. Tammany Parish
Natural Hazards Planning

Meetings Schedule

Hazard Mitigation Planning Committee meetings are held at the Office of Emergency Preparedness at the old courthouse on Boston Steet in Covington. The meetings are open to the public. The draft plan is expected to be ready for public and municipal review in February 2004.

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- Links

The St. Tammany Parish Hazards Planning Committee organizational meeting, September 18, 2003

Date	Day	Time	Main Topics
September 18, 2003	Thursday	6:00 PM - 8:00 PM	Organizational meeting, identify sources of hazard data. Read minutes of meeting. (Adobe PDF forr
November 8, 2003	Saturday	8:30 AM - 12:30 PM	Hazard Assessment (what are the hazards facing us? and what can the hazards do to us?), Goal setting Read minutes of meeting. (Adobe PDF forr
December 6, 2003	Saturday	8:30 AM - 12:30 PM	Mitigation activities Read minutes of meeting. (Adobe PDF forr
January 10, 2004	Saturday	8:30 AM - 12:30 PM	Mitigation activities Read minutes of meeting. (Adobe PDF forr
February 7, 2004	Saturday	8:30 AM - 12:30 PM	Action items, draft plan Meeting Agenda. (Adobe PDF format)
To be announced.			Public meeting, final recommendations

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Links

For more information on natural hazards and ways to protect against them, check the following websites:

All Hazards

Fact Sheets
http://www.fema.gov/fima/how2.shtm
Red Cross family disaster planning
http://http://www.redcross.org/services/disaster/beprepared/familyplan.html

Tropical Storms and Hurricanes

Hurricane Awareness Week
http://www.nhc.noaa.gov/HAW2/english/intro.shtml
Hurricane Awareness Downloads
http://www.nhc.noaa.gov/HAW2/english/downloads.shtml

Flood Protection

LSU Ag Center's Louisiana Floods Website
http://www.louisianafloods.org
Avoiding Flood Damage: A Checklist for Homeowners
http://www.fema.gov/pdf/hazards/fldam.pdf
Homeowner's Guide to Retrofitting: Six Ways to Protect Your House From Flooding
http://www.fema.gov/mit/tsd/dl_rfit.htm
Protecting Building Utilities From Flood Damage
http://www.fema.gov/hazards/floods/pbuffd.shtm

Flood Insurance

National Flood Insurance Program - About National Flood Insurance
http://www.fema.gov/nfip/whonfip.shtm
National Flood Insurance Program - How to Buy Flood Insurance
http://www.fema.gov/nfip/answe2d.shtm

Tornadoes

FEMA: Recommendations to Better Protect From Tornado Damage
http://www.fema.gov/hazards/tornadoes/prskit328.shtm

Thunderstorms and Lightning

http://www.fema.gov/hazards/thunderstorms

Winter Storms

http://www.fema.gov/hazards/winterstorms

St. Tammany Parish, Louisiana
Natural Hazards Planning Questionnaire

Please use this form to tell us about your experiences with natural hazards and your suggestions for hazard mitigation activities the Parish could undertake. Please use a separate form for each incident.

In what community did the incident occur? _____

In what Zip code did the incident occur? _____

Type of hazard (check one)

- ☐ Tropical Storms/Hurricanes
- ☐ Drought
- ☐ Land Failure
- ☐ Riverine Flooding
- ☐ Fog
- ☐ Severe Winter
- ☐ Local Drainage Problems
- ☐ Earthquake
- ☐ Dam Failure
- ☐ Tornadoes
- ☐ Hailstorm
- ☐ Levee Failure
- ☐ Wildfires

Dale of incident: _____

Type of damage (check all that apply)

- ☐ Personal Injury/Health Problem
- ☐ Damage to building
- ☐ Damage to vehicle(s)
- ☐ Lost business or work
- ☐ Damage to yard, landscaping
- ☐ Other:

Approximate dollar damage: _____

Percentage of the recovery costs covered by insurance: _____

Recommendations or suggestions for the Hazards Mitigation Planning Committee:

Please fax this form to: (504) 304-2001 or mail to:
Laural Bass – Solutient
2021 Lakeshore Dr., Suite 310
New Orleans, LA 70122

St. Tammany

Parish Government

For Immediate Release, March 18, 2004
Contact: Suzanne Parsons Stymiest at 985-898-5243

Public Meeting to Review Hazards Plan

The St. Tammany Parish Natural Hazards Mitigation Planning Committee announces the completion of its Natural Hazards Mitigation Plan. This six month effort reviewed the major hazards to which the Parish is exposed, including tropical storms, floods, tornadoes, earthquakes, fog, and winter storms.

The Committee evaluated a variety of measures that can reduce exposure to the dangers and damage posed by the hazards, and selected 17 action items recommended for implementation by the Parish and participating municipal governments. Participating municipal governments are Covington, Mandeville, Folsom, Slidell, Abita Springs, Sun and Pearl River.

The resulting plan, including an executive summary, is available for review on the Hazardous Mitigation Planning Committee's website.

A public meeting will be held at 6:00 p.m., March 31st in the Council Chambers at the St. Tammany Parish Administrative Complex located on Koop Drive, Mandeville. Comments may be submitted at the public meeting or, in writing, to:

Clarence Powe
Deputy Directory (Planning)
Office of Homeland Security and Emergency Preparedness
P.O. Box 628
Covington, LA 70434
985/867-3787
Fax: 985/898-3030
cpowe@stpgov.org

The Mitigation Planning Committee will meet after the public meeting, review recommended changes, and submit the mitigation plan to the St. Tammany Parish Council for adoption. The plan will also be submitted to all participating village, town and city councils.

Public can comment on parish hazard mitigation plan

SLIDELL — St. Tammany Parish Natural Hazards Mitigation Planning Committee has announced the results of its Natural Hazards Mitigation Plan.

This six month effort reviewed the major hazards to which the parish is exposed, including tropical storms, floods, tornadoes, earthquakes, fog, and winter storms.

The committee evaluated a variety of measures that can reduce exposure to the dangers and damage posed by the hazards, and selected 17 action items recommended for implementation by the Parish and participating municipal governments. Participating municipal governments are Covington., Mandeville, Folsom, Slidell, Abita Springs, Sun and Pearl River.

The resulting plan, including an executive summary, is available for review on the Parish's website, www.stpgov.org. Click 'Department & Agencies' from the home page and follow link to 'Hazardous Mitigation Planning Committee.'

A public meeting will be held at 6 p.m., this Wednesday, March 31 in the Council Chambers at the St. Tammany Parish

SEE PLAN, PAGE 3A

SA Accepted DIVORCE (uncontested).....$300

Twillie and Avril Doucette and is survived by his stepson, Jonathan Stevens and one great-grandchild, Jayden Edward Twillie.

Local arrangements made by Freddie E. Doyle Funeral Home at 2430 Fourth Street in Slidell.

PLAN: Parish taking input

FROM PAGE 1

Administrative Complex located on Koop Drive, Mandeville. Comments may be submitted at the public meeting or in writing, to:

Clarence Powe, Deputy Directory (Planning), Office of Homeland Security and Emergency Preparedness, P.O. Box 628, Covington, LA 70434.

For other information, call 867-3787.

The Mitigation Planning Committee will meet after the public meeting, review recommended changes, and submit the mitigation plan to the St. Tammany Parish for adoption. The plan will also be submitted to all participating villages, towns and city councils.

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Houmas House Plantation and

Slidell Century, March 29, 2004