City of Monroe Multi-Hazard Mitigation Plan – 2010 Update

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ACRONYMS

CFR	Code of Federal Regulations
CRS	Community Rating System
DMA 2000	Disaster Mitigation Act of 2000
USEPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
DFIRM	Digital Flood Insurance Rate Map
GOHSEP	Governor's Office of Homeland Security and Emergency Preparedness
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
IFR	Interim Final Rule
KAB	Keep America Beautiful Program
KCS	Kansas City Southern Railway
LA DOT	Louisiana Department of Transportation
LGS	Louisiana Geological Survey
LRA	Louisiana Recovery Authority
MHMSC	Monroe Hazard Mitigation Steering Committee
MPO	Metropolitan Planning Organization
NAVD	North American Vertical Datum 1988
NCDC	National Climatic Data Center
NFIP	National Flood Insurance Program
PDM	Pre-Disaster Mitigation
PSMP	Process Safety Management Program
RL	Repetitive Loss
SRL	Severe Repetitive Loss
TBLB	Tensas Basin Levee Board
ULM	University of Louisiana at Monroe
UONWR	Upper Ouachita National Wildlife Refuge
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

1 INTRODUCTION

1.1 BACKGROUND

Hazards such as floods, tornados, windstorms, thunderstorms, and severe winter storms are a natural part of the life experience of the citizens of Monroe. History has shown these hazards to be inevitable and often unpredictable. In their worse form, they threaten the health and welfare of the citizens of Monroe and have the potential to cause considerable damage to public and private property.

In the current world environment, it has become apparent that man-made hazards can also create the potential for disaster and these hazards require our serious attention where they threaten destruction of property and impact the health and welfare of the public.

We cannot eliminate these hazards, but there is much we can do to lessen their long-term impact on our community and our citizens. Through sound planning, aggressive action, and commitment in the community we can mitigate their effects on the community.

The practice of reducing risks to people and property from known hazards is commonly referred to as *hazard mitigation.* The sidebar provides definitions of hazard mitigation and planning by the Federal Emergency Management Agency (FEMA).

A comprehensive hazard mitigation plan (HMP) is one of the most effective tools a community can use to reduce hazard vulnerability. A well documented plan establishes a broad community vision and the guiding principles that include specific mitigation actions designed to eliminate or reduce vulnerabilities. An effective mitigation plan also requires continual attention to ensure that it is updated regularly and its relevance is maintained.

The following definitions are provided by FEMA with regard to Hazard Mitigation Planning:

HAZARD MITIGATION – *Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.*

PLANNING – *the act or process of making or carrying out plans; specifically, the establishment of goals, policies, and procedures for a social or economic unit.*

Effective hazard mitigation planning includes establishing meaningful measures. They are crucial to the success of the plan. Viable measures may include controlling land development; establishing structural regulations for new construction; eliminating repetitive-loss properties; training critical personnel; identifying and maintaining critical response equipment; coordinating response responsibilities among law enforcement, safety, and health organizations; and providing public education. These are just a few of the measures that can be taken to mitigate the effect of hazards and reduce the opportunity for a hazard becoming a disaster.

The Monroe HMP documents and formalizes the continuing efforts being made by the City of Monroe to incorporate hazard mitigation principles and practices into daily activities and planning. The HMP is designed to be a living document whose implementation will help meet the hazard mitigation objectives and goals of the City and ensure a successful outcome.

The development, installation, and maintenance of a comprehensive plan requires the involvement and close cooperation among all affected stakeholders including local governing bodies, critical health organizations, law enforcement, fire departments, businesses, and the citizens of the City of Monroe. Implementing and maintaining the HMP requires the support, both in guidance and funding, of State and Federal agencies. One of the first considerations in developing the HMP was to examine other local, state, and federal hazard mitigation activities to ensure their programs were integrated into the City's HMP process.

The City has been involved with the Louisiana Transportation Trust Fund that supports a statewide flood control program. This involvement has been critical to the installation of an extensive stormwater pumping station project that has significantly reduced the potential for flooding in the 100-year flood zone that courses through the City. The Tensas Basin Levee Board (TBLB) reports to the Louisiana Department of Transportation and Development (LA DOTD) and is responsible for the maintenance and operation of the Ouachita River Levee system. Their mission and efforts support the City's efforts to minimize the opportunity for major flooding. The City works closely with local energy providers to ensure mitigation actions are carried out for known causes of power disruptions resulting from natural disasters. The Mayor, City Council, and its administrators recognize that the best plans cannot eliminate the impact of natural disasters; however, the effects of the hazards can be significantly reduced by acting in an intelligent and timely manner.

City officials have anticipated these needs and coordinate disaster planning and training of personnel in the Planning and Urban Development, Public Works, and Police and Fire Departments with other first responders, particularly the Ouachita Parish Office of Emergency Preparedness, the Governor's Office of Emergency Preparedness and Homeland Security (GOHSEP), and the local Red Cross. These associations ensure employee training is maintained and the appropriate equipment is available for disaster relief. FEMA has been very involved in the local community in flood mitigation and has been financially instrumental in the mitigation of flooding in the City. We will continue to work with all these and other state and Federal organizations as well as the local business community, non-profits, and educational institutions, to assist and support the efforts being made by the City to provide the best possible protection for the citizens against natural disasters.

The following documentation is provided as supporting material for the City of Monroe Hazard Mitigation Plan 2010 Update (2010 HMP Update): public workshop notices and committee meeting agendas (**Appendix A**), repetitive loss and severe repetitive loss properties (**Appendix B**), stormwater control system map (**Appendix C**), critical buildings and facilities (**Appendix D**), City of Monroe Schools (**Appendix E**), HAZUS methodology limitations and outputs (**Appendix F**), HAZUS maps (**Appendix G**), tornado scenarios (**Appendix H**), and the Monroe Hazard Mitigation Steering Committee Project Prioritization Form (**Appendix I**).

1.2 DISASTER MITIGATION ACT OF 2000 (SUMMARY)

The United States Congress enacted the Disaster Mitigation Act of 2000 (DMA 2000) on October 10, 2000, in an effort to reduce the nation's mounting losses to natural disasters. The Act reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. Section 322 of the Act emphasizes the need for State and local governments to coordinate hazard-planning activities. It also establishes new qualification requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation (PDM) program. The Act provides for increased post-disaster funding for those State

and local governments who have in place a comprehensive, documented, and approved pre-disaster HMP prior to a disastrous event.

FEMA is responsible for administering the hazard mitigation program and has published guidelines and requirements for the development, approval, and implementation for hazard mitigation planning. The most recent update was in 2008. The Monroe HMP represents the response by the City of Monroe to the local needs of its citizens and for compliance with the federal government for creating plans to mitigate impacts resulting from hazard events.

1.3 PURPOSE

The purpose of the project is to update the HMP adopted in 2004. FEMA requires that local mitigation plans be updated every 5 years. The update is to be completed in accordance with the statutory requirements as set out in the federal legislation, DMA 2000 and Code of Federal Regulations (CFR) § 201.6(C)(3) will be reviewed for completeness based on the latest available data. The 2010 HMP Update is intended to bring current its existing HMP by adopting and effectively implementing pre-disaster actions to minimize the effect of natural and man-made hazards on public and private property as well as on the safety and health of the general public.

1.4 SCOPE

The City of Monroe HMP reviews all hazards, however, it more specifically addresses those natural and man-made hazards that the Monroe Hazard Mitigation Steering Committee (HMSC) believe are a serious threat to property and to the health and safety of the citizens of Monroe. This HMP does not address situations where there is no significant risk to real property or if the nature of the hazard is primarily one of emergency response. Any mitigation actions adopted by this HMP would be expected to reinforce and/or support emergency response capabilities.

1.5 AUTHORITY

The HMP, developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans, has been adopted by the City of Monroe. The HMP will be routinely monitored and periodically revised to maintain compliance with the following provisions, rules, and legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390);
- FEMA's Interim Final Rule (IFR) published in the federal Register on February 26, 2002, as 44 CFR Part 201; and
- FEMA 2008 Local Multi-Hazard Planning Guidance document.

1.6 MISSION STATEMENT

To make the citizens, businesses, critical services and infrastructure of the City of Monroe less vulnerable to natural and man-made hazards through the development and effective implementation of a pre-disaster HMP. The plan is designed to identify and prioritize those hazards to which the City is most susceptible and implement actions that will minimize their effects.

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2 THE PLANNING PROCESS

CFR § 201.6(c)(1) states:

> *Hazard Mitigation Plan Content: The hazard mitigation plan shall contain the following: "Documentation of the planning process used to develop the hazard mitigation plan, including who was involved in the process, and how the public was involved.*

2.1 UPDATING THE HAZARD MITIGATION PLAN

The local jurisdiction is required by 44 CFR § 201.6(d)(3) to review and revise its plan to reflect progress in local mitigation efforts and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding. The Hazard Planning Process defined by the guide is as follows:

- Organize Resources;
- Assess Risks;
- Update the Mitigation Plan; and
- Implement the Plan and Monitor Progress.

2.2 ORGANIZING RESOURCES AND THE MONROE HAZARD MITIGATION STEERING COMMITTEE

The cost of preparing the 2010 HMP Update was underwritten through HMGP planning funds administered by the GOHSEP. The grant provided funding for the City to contract with CSA International, Inc., a qualified planning firm, to assist in the updating process.

The City of Monroe Department of Planning and Urban Development had primary responsibility for updating the City's HMP. During the initial planning stages, it was recognized that the City would need the participation, input, and support of its staff as well as other area and regional agencies involved in hazard mitigation.

2.2.1 2004 Plan Update Process

The 2004 HMP was prepared by a consultant working with the Department of Planning and Urban Development. The planning effort began in November 2003 and was completed and adopted one year later. The City established the MHMSC, whose role was to serve as an information source for the project coordinator (consultant) (**Table 1**). The MHMSC also was responsible for reviewing and approving the final HMP draft prior to its submission to the State of Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) and FEMA.

Table 1. 2010 Monroe Hazard Mitigation Steering Committee

Committee Member	Organization or Agency
Chris Fisher	Director of Planning and Urban Development, City of Monroe
Joanne Poret	City Planner, City of Monroe
Sinyale Morrison	City Engineer, City of Monroe
Tom Atteberry	Monroe Floodplain Manager and Zoning Administrator
Ron Schleuter	Chief of Police, City of Monroe
Jimmie Bryant	Fire Department Chief, City of Monroe
Michael Andrus	Chief Building Official, City of Monroe
Tom Janway	Director of Public Works, City of Monroe
Charles Westrum	Sewer Manager, Public Works, City of Monroe
Gerald Battaglia	Interim Water Superintendent, Monroe Public Works
Cleve Norrell	Director, Monroe Regional Airport
L. Carroll Babb	Director of Programs, NE Chapter of the Red Cross
John Stringer	Ex. Director, Tensas Basin Levee Board
Larry Ellerman	Chief of Police, University of Louisiana at Monroe
Vickie Irwin	Director, Student Support Services, City of Monroe School Board
Lori Reneau	City of Monroe Chamber of Commerce
Butch Beckham	Director of Office of Homeland Security, Ouachita Parish
Herb Otwell	Assistant Chief, Monroe Police Department
Doug Mitchell	Metropolitan Planning Organization Director, North Delta Regional Planning and Development District
Other Participants	
Lincoln Walther, Consultant	CSA International, Inc. 8502 Kansas Avenue, Stuart , Florida
Patty Sanchez	Governor's Office of Homeland Security and Emergency Preparedness
Jeff LaCour	Federal Emergency Management Agency - Planning

The project coordinator met with the MHMSC on several occasions to review and discuss the progress of the documentation and to provide guidance. The meeting schedule can be found in **Appendix A**. Individual members of the MHMSC and members of other organizations were contacted continuously to aid in gathering critical information. Documentation was submitted to committee members for review as formation of the HMP progressed.

The responsibilities of the MHMSC were to:

- Increase the public's involvement in the planning process;
- Review previously identified hazards that may have impact or have impacted the community;
- Revise the profiles of all identified hazard events;
- Revise and update the assessment of vulnerability to hazards;
- Revise and update the communities' capability to mitigate hazards;
- Revise hazard mitigation goals and objectives for the community;
- Revise and evaluate mitigation actions and projects;
- Update the implementation strategy for the plan;
- Update the plan maintenance strategy for the next 5-year cycle; and
- Write and officially adopt the updated plan.

2.2.2 Public Involvement Process

The 2010 HMP Update process was collapsed into a six-month effort. During that time the MHMSC met three times to discuss the 2010 HMP Update. The purpose of the meetings was to provide data to update information in the existing Plan, provide input on the implementation status of mitigation projects in the existing plan, provide input and prioritize mitigation projects in the updated plan, and review and comment on drafts of the updated plan.

The first two MHMSC meetings were held on March 17 and May 26, 2010, to discuss the City's hazard mitigation project and provide input and local insights to assist the project coordinator in updating the HMP. Agendas from the two meetings and sign-in sheets are provided in **Appendix A**. In addition, once a list of projects was generated, a survey containing a listing of the 20 projects was distributed to MHMSC members. Each member was assigned 10 votes. They were instructed to vote no more than twice for any particular project or initiative. From the seven selection criteria in the surveys, the members were asked to check off the criteria that best supported their viewpoints. A project prioritization list was developed based on the results of the survey (see **Appendix I**).

Due to the time constraint to update the HMP, extensive public participation was not possible to achieve. An evening public workshop was, however, held at the Monroe City Hall on June 24 to provide Monroe residents with an opportunity to review and discuss the draft Plan. The public meeting was advertised in the local newspaper, The Morning Star. All neighboring local governments, businesses, academic institutions, non-profits (e.g., American Red Cross), and local citizens were invited to participate in the plan update process; however, the meeting had limited attendance. A copy of the public workshop notice and The Monroe News Star newspaper article is provided in **Appendix A**. As a result of the comments from the public, three additional mitigation projects have been added to the HMP, however, they were not ranked because the Project Prioritization Survey was distributed earlier to the MHMSC.

Following the evening public workshop, a final meeting of the MHMSC was held on September 16, 2010, to conduct a final review of the updated plan and make any final suggestions prior to submission to GOHSEP and FEMA for compliance approval.

2.3 UPDATED RISK ASSESSMENT DATA AND METHODOLOGY

The 2004 HMP's Risk Assessment was the basis for the updated HMP Risk Assessment. The 2004 HMP risk assessment met all FEMA requirements, but the Parish recognized that there were several opportunities for improving the Risk Assessment during the HMP update process. The 2010 HMP Update contains additional detailed risk calculations and more accurate data collection methods and sources. The Hazard Risk Assessment (**Section 3**) of the updated HMP includes:

Source: FEMA 386-2, 2001.

- Indentifying all natural and technological hazards that are most likely to affect the City;
- Describing the frequency of occurrence of each hazard expected to impact the City;
- Describing each identified hazards' expected magnitude and extent of impacts;
- Highlighting which areas of the Parish are likely to be affected; and
- Calculating expected future losses if the risk is not mitigated.

2.3.1 Hazard Identification

Besides Flood and Tornados, the 2010 HMP Update has expanded to include a list of hazards likely to affect the City of Monroe. Other hazards that have been addressed in the 2010 HMP Update include High Winds (thunderstorms and tropical storms/hurricanes), Severe Winter Storms (including ice storms), Drought, Wildfire, Extreme Heat, Lightning, Hail Storms, Earthquakes, Levee Failure, and Hazardous Materials – Fixed Facilities and Transportation Systems. Dam Failure was identified, but poses no threat at this time.

2.3.2 Hazard Profile

All hazard profiles included in **Section 3**, Hazard Risk Assessment, were updated with the best available and most recent data, resources, and science. Data sources included the National Climatic Data Center (NCDC), U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), FEMA, and National Weather Service Storm Prediction Center. To enhance the community's understanding of hazardous events, visual images were included in the hazard profile of the 2010 HMP Update.

2.3.3 Risk Assessment

The updated HMP's Risk Assessment (**Section 3**) was significantly modified from the 2004 HMP. The update includes increased data collection methods, the utilization of enhanced loss estimation software, and risk changes over the 5-year period. Each hazard has been identified according to risk level (*Low*, *Medium*, or *High*), and assessed according to its description, past occurrences, probability of future occurrence, jurisdiction's vulnerability, geographic area affected, magnitude, and estimated dollar losses.

Section 3 begins with an update of each identified hazard's historical events and documented damage. The NCDC and Louisiana's Department of Agriculture and Forestry are two sources that were utilized to update the historical events. All updated historic events are provided in tables within this section of the 2010 HMP Update.

The updated flood and hurricane risk assessments, in conjunction with updated historical data, utilized FEMA's HAZUS model. HAZUS is a computer software program that estimates the loss of community assets from hurricane, flood, and earthquake events. The utilization of HAZUS during the plan update process has increased the accuracy of the risk assessment for flood and hurricane events.

Updated repetitive loss and severe repetitive loss structure data were received from the GOHSEP. Updated special flood hazard areas were identified utilizing flood rate insurance maps. All updated data, technologies, and resources have increased the accuracy of the City's hazard risk assessment process.

2.4 MITIGATION STRATEGY PROCESS

Section 7, Hazard Mitigation Strategy, includes a description of mitigation goals and objectives to reduce or avoid long-term vulnerabilities to the hazards identified in the Risk Assessment. The section identifies and analyzes a comprehensive range of specific mitigation actions to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

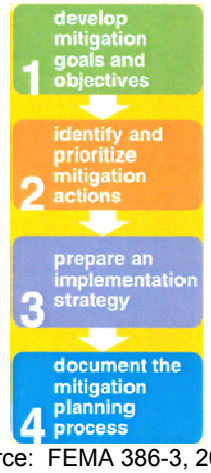
The Hazard Mitigation Strategy (**Section 7**) in the 2010 HMP Update includes several phases:

1. MHMSC-reviewed goals and actions from the original HMP;
2. Incorporated objectives into the Hazard Mitigation Strategy;
3. Experts and members of the MHMSC met repeatedly to identify and develop technical information for additional hazard mitigation actions and strategies;
4. The MHMSC completed a Project Prioritization Survey that ranked projects based on certain criteria (see Project Prioritization Form, **Appendix I**) including those that were a part of the 2004 HMP, but had not been completed and were still retained; and
5. Modification of the HMP to include tables with the prioritization of all mitigation actions.

2.4.1 Mitigation Strategies

Interviews were held with officials representing various City offices and departments to solicit input in developing goals, objectives, and actions. Discussions will be held with appropriate City boards and department representatives in addition to other key agencies and organizations outside the City (i.e., Metropolitan Planning Organization (MPO), City of Monroe Schools, Tensas Basin Levee Board, Northeast Chapter of American Red Cross).

Public meetings of the MHMSC were held to disseminate information and solicit input on the development of mitigation strategies. A survey also was administered to the members of the MHMSC to measure the support for different identified mitigation objectives and actions. All responses were kept confidential and utilized through the aggregation of responses.



Source: FEMA 386-3, 2003.

2.4.2 Prioritization of Mitigation Actions Update

After actions were identified, defined, and evaluated, the remaining process involved project prioritization. The MHMSC established its own prioritization methodology. Each project was assessed in light of criteria the MHMSC endorsed (see **Appendix I**). This information was utilized to provide scores for ranking each proposed mitigation action. The MHMSC's local expertise, public opinion, research, and vulnerabilities will be utilized to measure each variable in the methodology. Over the course of several weeks, the MHMSC will categorically define all new and old actions by the hazard it mitigates and rank them among the total action group.

After presentation and discussion, the MHMSC ranked the potential mitigation measures based on goals addressed, with special attention paid to the measure's cost-benefit review, its ability to be implemented, and the extent to which it would mitigate one or multiple relevant hazards. The MHMSC combined these rankings into one prioritized list, which the Team then presented to the public for comment. At a final public meeting after approval, public comments will be taken into consideration for reprioritization of mitigation measures in future plan updates. This will provide a systematic process to prioritize the updated mitigation actions.

2.5 PLAN MAINTENANCE

The MHMSC decided that the 2010 HMP Update will continue to be reviewed by the MHMSC bi-annually to ensure compliance with FEMA and State requirements for Plan Maintenance (refer to **Section 8**, Plan Maintenance Process, for more details). After the 2010 HMP Update

is approved, the City will implement specific actions to achieve the goals and objectives described in the Hazard Mitigation Strategy (**Section 7**) of the HMP.

The Monroe City Council and Mayor govern the City's business and make the final decision on what projects are implemented and how they will be funded. The MHMSC shall coordinate with the GOHSEP and lead department of each mitigation action to accomplish its goals.

The Monroe Department of Planning and Development will be responsible for the overall HMP monitoring and maintenance. The Director of the Community Planning and Development will provide a report of the entire implementation strategy to the MHMSC at its be-annual meetings. This report will shape the meeting agendas and may include the following:

- Updates on implementation at the public outreach initiatives and community planning levels;
- Updates on mitigation activities undertaken by neighboring jurisdictions;
- Reports on performance measures of the mitigation strategy;
- Changes or anticipated changes in hazard risk and vulnerability at the regional, State, FEMA, and Homeland Security levels;
- Information the Ouachita Parish Office of Homeland Security and Emergency Management for inclusion into the Ouachita Parish Hazard Mitigation Plan;
- Information from the City of Monroe's 2010 HMP Update that can be incorporated into the Northeast Louisiana Region 8 Emergency Operations Plan; and
- Updates presented to the City Council for acceptance.

The MHMSC also will provide updates regarding:

- Any implementation activities undertaken by a department;
- Problems encountered or success stories; and
- Any technical or scientific advances that may alter, facilitate, or create measures.

Finally, the MHMSC will decide on updates to the strategy based on the above information and a discussion of:

- The various resources available through budgetary means as well as any relevant grants;
- The current and expected political environment and public opinion; and
- Meeting the mitigation goals with regards to changing conditions.

See Plan Maintenance Process (**Section 8**) for the complete methods and schedule for updating the HMP.

3 HAZARD RISK ASSESSMENT

3.1 RISK ASSESSMENT PROCESS

The purpose of this chapter is to describe the hazards facing the City of Monroe in terms of potential impact, vulnerability, and loss. The official definition of risk assessment is described in 44 CFR § 201.6(c)(2) (i) and § 201.6(c)(2) (ii). It states that

> *A risk assessment shall include: A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The hazard mitigation plan shall include information on previous occurrences of hazard events and on the probability of future hazard events and a description of the jurisdictions vulnerability to the hazards. This description shall include an overall summary of each hazard and its impact on the community.*

The hazard identification section of this chapter describes each of these hazards, the location, and extent of each identified hazard event by geographic boundaries. The vast majority of hazard data used for the 2010 HMP Update was therefore aggregated at the parish level, not municipal, unless it was determined that it was possible to disaggregate parish level data. Data from the NCDC were used to document past occurrences for the various hazard storm events. While some of the data listed Monroe as the geographic data unit, upon closer inspection, in many instances the description of the event (e.g., tornado, flash flood) actually occurred a mile or more outside of Monroe municipal limits. For hazard events that could not be geographically established such as ice storms, flooding, tropical storms/hurricanes, thunderstorms/straight-line winds, it was assumed that the parish data were an acceptable alternative. In terms of establishing loss, HAZUS-generated data were used for flood and tropical storm/hurricane; however, average estimated losses for other hazards were drawn from the State HMP. Specific sources include FEMA's database of Presidential Disaster Declarations, National Flood Insurance Program (NFIP) flood data, historical accounts of levee failures, the NCDC, and interviews with local citizens and officials; as well as other local reports (i.e., 2004 Monroe HMP, Ouachita Parish HMP, State HMP). In addition, the consultant worked closely with City of Monroe departments (i.e., Planning and Development, Public Works, Public Safety, Engineering). Information was also obtained by reviewing past and declared events, The Monroe News Star newspaper, and the Internet. Finally, other sources of information and data were provided by the GOHSEP, FEMA, NCDC, the LSU Agricultural Center, the Tensas Basin Levee District, U.S. Fish and Wildlife Service, the National Response Center, historic records at the Ouachita Parish Library, and the Library and Police Department at the University of Louisiana at Monroe (ULM), in addition to oral history of local residents.

3.2 HAZARD IDENTIFICATION

The MHMSC was presented with a list of hazards, selecting those events around which meaningful hazard mitigation planning strategies could be developed. The hazards were divided into two classifications: natural and technological. Technological hazards are best defined as those hazards that are considered man-made. Natural hazards occur naturally in the environment. A list of potential hazards was prepared and considered by the MHMSC. The following list of hazards was agreed upon for study by the group. The list was expanded to include technological hazards (e.g., hazardous materials – fixed facilities and transportation

systems, levee and dam failures), which may or may not have occurred in the past but have some likelihood of occurring in the future (**Table 2**).

Table 2. Hazard Events Potentially Affecting the City of Monroe

Natural Hazard Event	Potential Result
Flood (heavy rain)	Flooded buildings (residential, commercial, or public) Flooded infrastructure (roads, water, and sewer lines) Flooded agricultural areas (crop damage) Levee failure
High Winds (thunderstorm, tropical storm/ hurricane)	Damage/collapse of buildings and infrastructure damage
Tornado	Damage/collapse of buildings and infrastructure damage
Drought (low rainfall over an extended period of time)	Crop damage – Monroe is the urban center serving the needs of surrounding agricultural community
Wildfire	Structural damage
Extreme Heat	Health of elderly, handicapped, and young children
Severe Winter Weather/Ice Storms	Infrastructure damage; illness due to cold weather
Lightning (thunderstorms)	Wildfire (structural loss and damage); personal injury
Hail (thunderstorms)	Crop damage
Earthquake	Levee failure
Technological Hazard Event	**Resulting Incident**
Hazardous Materials Incident (transportation & fixed locations)	Chemical spills – human illness and death Economic losses
Levee Failure	Damage/collapse of buildings and infrastructure damage – personal injury and death
Dam Failure	Damage of buildings and infrastructure damage

For each hazard, the MHMSC was presented with available historical data. Each of the hazards was discussed in detail. Further, the Committee also agreed that for a hazard to warrant a mitigation action, it must satisfy one or more of the following conditions:

1. It must be indigenous to the area or man-made and it must not be readily and effectively addressed by some immediate corrective action. It is expected that such hazards should be the subject of an active program and addressed without a long-term mitigation plan.
2. Have a historical record for causing significant damage to public and private property and pose a major threat to the health and safety of the citizens of Monroe. Threats primarily involving emergency response with minimal impact on property would not be included.
3. Have a significant potential risk of occurrence in the City based on past experience. The City may have been spared of such events to date but remain as vulnerable as any other part of the surrounding area.
4. Be adaptable to an effective and achievable mitigation plan.

3.3 PRESIDENTIAL MAJOR DISASTER DECLARATION

A Presidential Major Disaster Declaration is the formal action by the President to make a state eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended. Since 1965 there have been 17 Presidential Disaster Declarations for the City of Monroe. While there were two Declarations

as a result of hurricanes, other Declarations were for flooding and severe winter storms and tornados. Information regarding each of these disasters is displayed in **Table 3**.

Table 3. Presidential Major Disaster Declarations (1965–2009)

Presidential Major Disaster Declarations From 1965 to Present		
Date	**Cause**	**FEMA Identifier**
12/10/2009	Severe storms, tornado, flooding	1863-DR-LA
9/2/2008	Hurricane Gustav	1786-DR-LA
9/24/2005	Hurricane Rita	1607-DR-LA
8/29/2005	Hurricane Katrina	1603-DR-LA
9/15/2004	Hurricane Ivan	1548-DR-LA
10/3/2002	Hurricane Lilli	1437-DR-LA
12/11/2000	Winter storm	1357-DR-LA
1/27/2000	Winter storm	1314-DR-LA
12/23/1998	Winter storm	1264-DR-LA
4/29/1991	Flooding	904-DR-LA
6/19/1989	Severe storm, flooding	904-DR-LA
1/11/1983	Severe storm, flooding	829-DR-LA
9/20/1978	Severe storm, flooding	565-DR-LA
5/19/1975	Hurricane, rain, tornado	470-DR-LA
2/23/1974	Flooding	418-DR-LA
4/27/1973	Severe storm, flooding	374-DR-LA
9/10/1965	Hurricane Betsy	208 DR-LA

Source: Federal Emergency Management Agency, 201, www.fema.gov/news/disasters.fema.
Note: Hurricane Ike is not included in the Major Disaster Declarations because Ouachita Parish was not included as a declared parish yet was eligible for HMGP funds.

These disasters demonstrate the type of natural events that have had a profound effect on the citizenry, businesses, and infrastructure within the City of Monroe. Fortunately, the City of Monroe has been spared significant loss of life; however, the potential for severe injury to the resident population and damage to property and infrastructure exists.

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4 HAZARDS PROFILES

4.1 NATURAL HAZARDS

Source Information

The probability, magnitude, and risk for each hazard are based on existing technical documents and interviews/discussions with local officials.

Plans, Reports, and Studies

The process for identifying hazard events within the city included a review of the following: 2004 Monroe HMP, Ouachita Parish HMP, and State Hazard Mitigation Plan as well as other local reports. In addition, discussions with City Of Monroe departments (i.e., Planning and Development, Public Works, Public Safety, Engineering) and Monroe City School District were held. Information was also obtained by reviewing past and declared events, the Monroe News Star newspaper, and the Internet. Other organizations and agencies consulted included GOHSEP, FEMA, NCDC, LSU Agricultural Center, Tensas Basin Levee District, U.S. Fish and Wildlife Service, the National Response Center, historic records at Ouachita Parish Library, and ULM Library. Information obtained from speaking to local residents also provided valuable input in identifying historical hazard events.

Interviews

The consultant spent considerable time with local city staff such as the Director of Planning and Development, Planning Director, Floodplain Manager/ Zoning Director, staff of the Engineering Department, and Monroe Fire Chief. In addition, discussions were held with individuals that worked for agencies outside the auspices of city government. They included individuals at the Monroe City Schools, the Executive Director of the Tensas Basin Levee Board, the Director of the North Delta Regional Planning and Development District, the Director of the Monroe Metropolitan Planning Organization, staff of the Northeast Louisiana American Red Cross, and the Police Chief and staff of the University Louisiana Police Chief Department (responsible for hazard mitigation at the University). The consultant also had an opportunity to talk with several residents who lived in Monroe for many years. They provided valuable historical insights regarding accounts of disasters such as some of the City's major flood events.

4.1.1 Flood

Torrential rain events constitute a significant hazard in the City of Monroe. The most frequent cause of torrential rains is thunderstorms. A less frequent cause is tropical cyclones (including tropical storms and/or hurricanes). In Monroe, flood hazards have occurred due to different effects of thunderstorms, tropical storms, hurricanes, and other weather-related conditions. Historically, the primary cause of flooding within Monroe as well as Ouachita Parish has resulted from slow moving thunderstorms.

Flooding is a natural event that occurs hundreds of times each year throughout the United States, making it one of the most common hazards nationwide. The City of Monroe is subject to three types of floods: riverine flooding, closed-basin lake flooding, and flash flooding.

Riverine flooding occurs when excess rainfall causes water bodies such as the Ouachita River, Chavin Basin, Youngs Creeks and Bayou LaFourche to overflow its banks and move into the lowlands adjacent to waterbodies that are susceptible to recurring inundation of the floodplain. MHMSC members also indicated that bayous are unique in that they are defined as "sluggish streams that meander through lowlands." There are a number of bayous and streams in and around Monroe. Chauvin Bayou and Youngs Creek are subject to backwater flooding from Bayou Lafourche. Backwater flooding occurs upstream and is caused by downstream conditions such as channel restriction and/or high flow in a downstream confluence stream. Floodplains pose a natural hazard in many areas of the United States because they are home to over nine million households. According to the National Oceanic and Atmospheric Administration, flooding within floodplains causes millions of dollars in damage and kills an average of 150 people per year.

Closed-basin Lake Flooding occurs when excess water accumulates in lakes with either no outlet or a relatively small one.

Flash flooding occurs when a relatively impervious, sloped area receives a large amount of rainfall from slow-moving thunderstorms or chains of thunderstorms moving one after another over the same area. The resulting run-off flows down any terrain feature that will act as a channel (rivers, gullies, roads) carrying with it any debris or loose soil in its path. Flash floods usually occur within six hours of heavy rainfall and according to the National Weather Service, are usually more life threatening. The majority of deaths from flash floods occur when people become trapped in automobiles that stall while driving through flooded areas. Nearly half of all flood fatalities are vehicle-related. Several factors determine the severity of floods, including rainfall intensity (or other water source) and duration. A small amount of rain can also result in floods in locations where the soil is saturated from a previous wet period or if the rain is concentrated in a low area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas.

Previous Occurrences of Flood

Controlling water levels of the rivers is only a part of the solution for the City. Monroe is bordered or interlaced by numerous bayous and lakes all of which contribute to the uniqueness of the City. These same attributes have also been the source of serious local flooding in years past and still present a significant threat today. Heavy downpours during thunderstorms and extended deluges during the normal rainy season have caused serious widespread street flooding, isolated flooding, and overflow of the bayous. All have resulted in damage to residential structures, specifically those located in the 100-year flood zone. This was clearly demonstrated in 1991 when extremely heavy rainfall created several millions of dollars in flood damage. Since 1991 there have been instances of flooding (**Table 4**); however, as the City has upgraded its drainage system, flooding occurs less frequently than prior to 1999. When flooding now occurs, it is more isolated. Since 2004, Hurricane Gustov in 2008 has been the only major rain event. **Figure 1** visually displays the 100-year flood plain and structures flooded after Hurricane Gustav (2008). According to the NCDC, flood damage from Hurricane Gustav amounted to $300,000. Hurricane Ike, which followed Gustov approximately two weeks later, generated $200,000 in damage. These damage figures paled in comparison to those experienced in the coastal parishes and municipalities. However, it must be understood that by the time the storms reached Ouachita Parish and Monroe, the hurricanes had downgraded to tropical storms. In terms of the impact on individuals, no deaths or injuries were reported according to NCDC records.

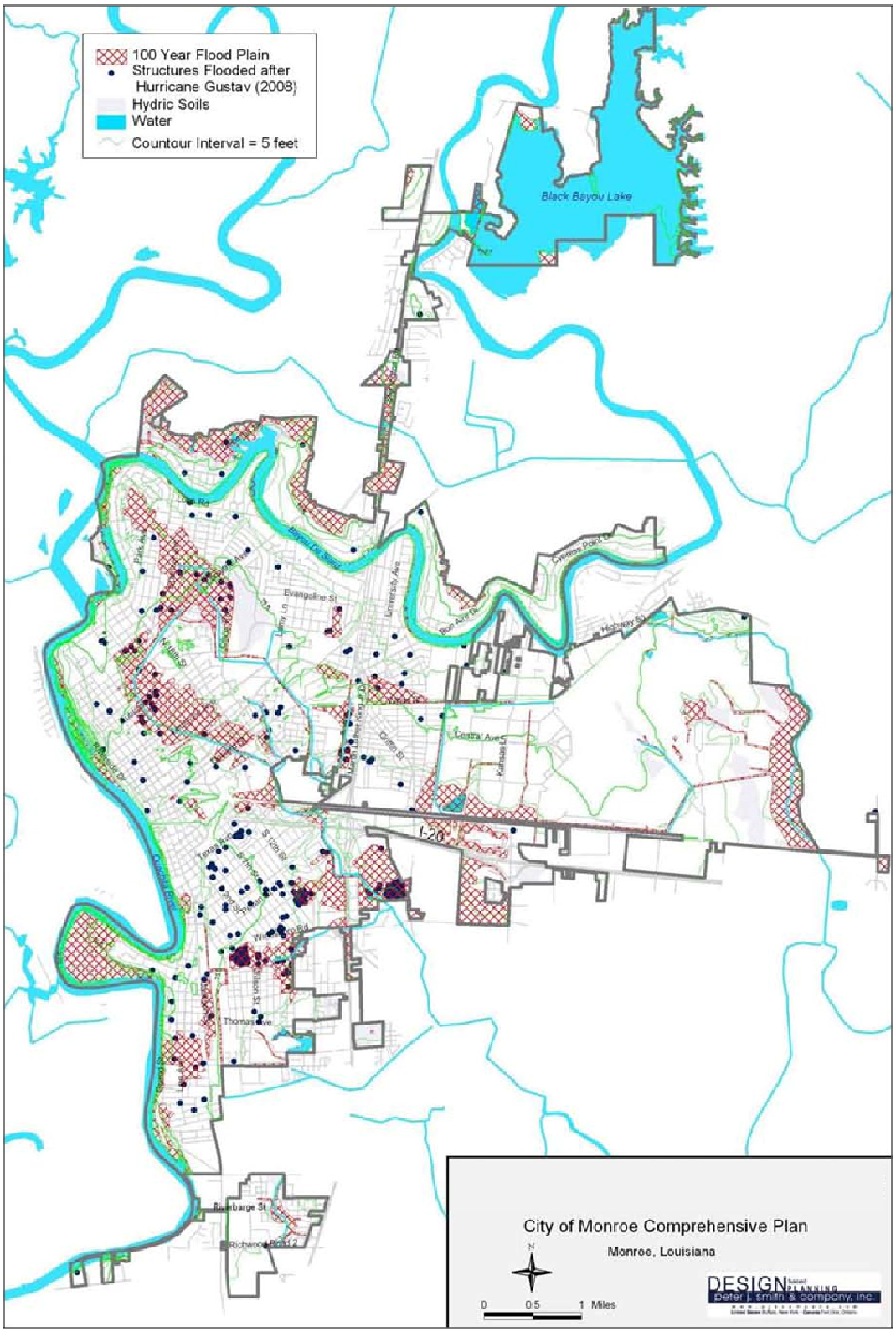

Figure 1. Structures Flooded by Hurricane Gustav

Table 4. Flood Events and Resulting Property Damage Costs in the City of Monroe (1995–2007)

Date	Property Damage
7/6/2007	$0
10/16/2006	$0
8/15/2005	$1 K
7/17/2004	$0
7/1/2004	$0
7/1/2004	$25 K
5/14/2003	$0
5/14/2003	$0
5/14/2003	$0
1/29/1999	$0
4/20/1995	$0

Source: National Climate Data Center, 2010.

In the City's recently completed Comprehensive Plan, flooding is addressed in Chapter 9.0, Environmental Resources. As documented in the Plan, 30% or approximately 6,000 acres of land within the Monroe area are located within the 100-year floodplain, with the majority of areas adjacent to or in proximity to the Ouachita River and Bayou Desiard. The remaining 14,000 acres, or 70% of land within the City, lies within the 500-year floodplain. The extent of flooding threat is also clearly reflected in the Presidential Major Declared Disasters listed in **Table 3**.

The Stormwater Control System Map (**Appendix C**) demonstrates the comprehensive work that has been done in the past by the City to mitigate flooding. A series of levees has been constructed within the City to hold or divert stormwater. Eighteen stormwater pumping stations have been strategically located throughout the flood areas to move large quantities of stormwater to the Ouachita River, Youngs Bayou, and Chavin Basin. The condition and operability of the pumps is critical when a significant rainfall event occurs because the Tensas Basin Levee District closes the floodgate structures that release water to the Ouachita River. If the pumps fail then flooding will occur within the City, especially in low-lying areas. A number of pump facilities are in critical need of replacement and/or built upgrading. Some were installed before WWII.

Another important initiative is about to begin that will have a direct affect on Monroe. It is known as the Upper Ouachita National Wildlife Refuge Mollicy Unit Restoration Project. The Mollicy Unit is located on the east side of the Ouachita River within the Upper Ouachita National Wildlife Refuge (UONWR) in north Louisiana. The Mollicy Unit is surrounded on three sides (west, north, and south) by a ring levee 30 feet high. It consists of 16,000-acres of Ouachita River floodplain. In 1991 the Ouachita River was at flood stage endangering the City of Monroe, located 20 miles downstream from the Mollicy Unit. The Mollicy levee was breeched in 1991. When that occurred it relieved pressure on the levee in Monroe where the river dropped eight inches in a 24-hour period. Although the U.S. Fish and Wildlife Service has owned the property for a number of years, only recently the USACE has begun work on a $4.5 million project to permanently breach the Mollicy Levee and reconnect it to the Ouachita floodplain to restore 25 square miles of fish and wildlife habitat.

4.1.2 High Wind

High wind, like flooding, is generated by thunderstorms and tropical cyclones. Both hazards are discussed in the following sections.

Thunderstorms that have winds 58 mph or more are classified as a *Severe* thunderstorm. A thunderstorm is also classified as *Severe* if it produces tornados or hail of 0.75 inches or more in diameter. It is assumed to be severe for reporting purposes if it causes property damage. Within thunderstorms, sometimes there are strong downbursts of winds (greater than 70 mph) known as straight-line winds. They are created by an area of significantly rain-cooled air that, after reaching ground level, spread out in all directions producing strong winds resulting in gusts as forceful as a tornado-causing tree and property damage. NCDC data indicate that since 1957, there have been 207 thunderstorms. Thunderstorms are far more prevalent in Monroe than tropical storms and hurricanes. In fact, by the time tropical storms and hurricanes have reached Monroe, their intensity has been significantly reduced since they no longer have the warm Gulf waters to draw energy.

Tropical Storms/Hurricanes (tropical cyclones) have a sustained surface speed (using the U.S. 1-minute average) that ranges from 39 mph to over 155 mph. Tropical cyclones with wind speeds from 39 mph to 73 mph are considered tropical storms; above 39 mph they are considered hurricanes. The Saffir-Simpson Hurricane Scale is used to determine a hurricane's intensity using a category 1–5 rating based on the hurricane's current wind speed (**Table 5**). This rating is used to estimate the potential property damage from wind and storm surge expected along the coast from a hurricane landfall.

Table 5. Saffir-Simpson Hurricane Scale

Category	Wind Speed* (mph)	Storm Surge (feet above normal sea level)	Expected Damage
1	74–95	4–5	**Minimal:** Damage is done primarily to shrubbery and trees, unanchored mobile homes are damaged, some signs are damaged, and no real damage is done to mobile homes.
2	96–110	6–8	**Moderate:** Some trees are toppled, some roof coverings are damaged, and major damage is done to mobile homes.
3	111–130	9–12	**Extensive:** Large trees are toppled, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131–155	13–18	**Extreme:** Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; some curtain walls fail.
5	>155	>18	**Catastrophic:** Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.

**Wind speeds use the U.S. 1-minute average.*

While all structures are susceptible to being damaged by high winds, mobile homes are especially susceptible. According to the National Hurricane Center, no mobile or manufactured home, no matter how new it is, can be a safe shelter from hurricane force winds. Within Monroe, mobile homes constitute a very small percentage of the total housing stock. According to the City's Comprehensive Plan, mobile homes constitute 2.1% of the total housing stock. There are several mobile home parks in proximity to ULM, while the other concentration of mobile home parks is located south of Interstate 20 and east of State Road 165.

Previous Occurrences of Thunderstorms/Straight-line Winds

Since 1993, there have been over 50 thunderstorms as presented in **Table 6**. Prior to 1996, the NCDC did not report wind speed or injury information; however, since that time there have been 38 thunderstorm events with winds in excess of 58 mph. While wind velocity for most thunderstorms after 1995 averaged approximately 69 mph, there have been several instances where the NCDC recorded winds in excess of 100 mph. Two storm events, one in May 1997 and a second in March 1999, had wind velocities that exceeded 100 mph. During the May 1997 event, wind gusts reached 115 mph and property damage amounted to approximately $3 million. Over 200 telephone poles were snapped leaving 45,000 homes without power. The area of damage was nearly 180 square miles, which covered much of the southern half of the Parish. In the city and surrounding communities, over 400 homes suffered structural damage. The damage was so severe that Ouachita Parish was put under a declaration of emergency by the Governor of Louisiana. The second storm event that occurred in March 1999 resulted in $175,000 of damage. There were four other instances where damage exceeded $100,000: September 1993 ($500,000), July 1994 ($500,000), February 1998 ($100,000), and April 2007 ($150,000).

Table 6. Thunderstorm Events and Resulting Property Damage Costs in the City of Monroe (1993–2010)

Date	Wind Speed (mph)	Injuries	Property Damage
5/19/2010	58	0	$0
8/3/2008	61	0	$0
8/3/2008	61	0	$0
8/3/2008	60	0	$0
6/8/2007	58	0	$0
6/8/2007	58	0	$35 K
5/3/2007	62	0	$0
5/3/2007	62	1	$0
4/25/2007	64	0	$150 K
5/4/2006	64	0	$0
5/4/2006	64	0	$50 K
3/9/2006	64	0	$0
3/9/2006	64	0	$0
11/15/2005	62	0	$0
8/19/2004	64	0	$0
6/2/2004	64	0	$0
7/17/2003	67	0	$40 K
5/14/2003	60	0	$0
5/14/2003	60	0	$0
11/24/2001	63	0	$0
10/13/2001	60	0	$0
8/18/2001	69	0	$0
8/16/2001	63	0	$45 K
8/31/2000	69	0	$0

Date	Wind Speed (mph)	Injuries	Property Damage
4/26/1999	75	0	$30 K
3/8/1999	69	0	$0
3/8/1999	75	0	$0
3/2/1999	104	2	$175 K
5/3/1998	69	0	$0
4/27/1998	63	0	$0
2/10/1998	81	0	$100 K
6/17/1997	69	0	$0
5/27/1997	115	0	$3.0 M
2/21/1997	69	0	$0
10/17/1996	75	0	$0
6/7/1996	69	0	$0
6/3/1996	79	0	$0
4/20/1996	81	0	$0
9/19/1995	N/A	0	$0
7/28/1995	N/A	0	$0
7/3/1995	N/A	0	$0
4/20/1995	N/A	0	$0
4/11/1995	N/A	0	$0
1/6/1995	N/A	0	$0
11/5/1994	N/A	0	$1 K
7/26/1994	N/A	0	$1 K
7/7/1994	N/A	0	$500 K
6/10/1994	N/A	0	$1 K
4/12/1994	N/A	0	$5 K
9/1/1993	N/A	0	$500 K

N/A = Wind speed data not recorded.
Source: National Climatic Data Center, 2010.

4.1.3 Tornado

A tornado is a high wind event generated by a thunderstorm and is defined as a violently rotating column of air extending from the base of a thunderstorm to the ground. A condensation funnel does not need to reach to the ground for a tornado to be present; a debris cloud beneath a thunderstorm is all that is needed to confirm the presence of a tornado, even in the total absence of a condensation funnel. The Fujita Scale, comprising seven levels of intensity (F0-F6), is used to measure tornado strength as described in **Table 7**. When using the Fujita Scale, wind speed is inferred from an analysis of wind damage.

Table 7. Fujita Scale

F-Scale	Tornado Intensity	Wind Speed (mph)	Damage Type
F0	Gale	40–72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards
F1	Moderate	73–112	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.
F2	Significant	113–157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	Severe	158–206	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	Devastating	207–260	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible	261–318	Strong-frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures significantly damaged.
F6	Inconceivable	319–379	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 winds that would surround the F6 winds. Missiles, such as cars and refrigerators, would cause serious secondary damage that could not be directly identified as F6 damage. If this level of tornado is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Monroe is located within an area that is prone to tornados. There is an area extending from Texas to Georgia commonly called Dixie Alley (shown in **Figure 2**). According a tornado study conducted by Michael Frates of the University of Akron, (http://news.discovery.com/earth/redefining-tornado-alleys.html) historical patterns of tornado outbreaks were analyzed and it was found that the frequency of tornados in an area within Dixie Alley occurred at a slightly higher rate than those recorded in an area commonly known as Tornado Alley.

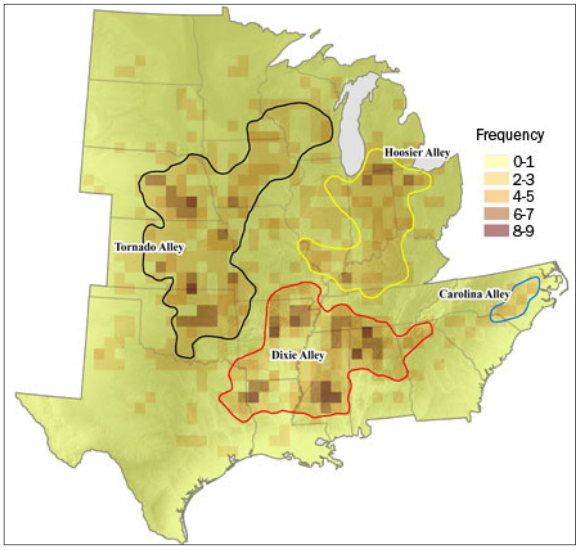

Figure 2. Tornado Alleys

Previous Occurrences of Tornados

According to NCDC data, Ouachita Parish has experienced 34 tornados since 1951 (**Table 8**). The City of Monroe has seen only five tornados during that period. The most damaging was a Level F2 tornado that occurred in December 1983. Monroe sustained $2.5 million in damage as a result of that tornado.

Table 8. Tornado Events (1951–2009)

Date	Fujita Scale*	Deaths	Injuries	Property Damage
4/09/2009	F2	0	0	$500 K
3/27/2009	F0	0	0	$5 K
11/23/2001	F0	0	0	$0 K
1/22/1999	F0	0	0	$0 K
11/24/1996	F0	0	0	$0 K
4/22/1995	F0	0	0	$0 K
4/22/1995	F1	0	0	$60 K
3/30/1993	F1	0	0	$500 K
4/19/1992	F1	0	0	$0 K
4/19/1992	F1	0	0	$0 K
6/27/1989	F1	0	0	$250 K
6/27/1989	F1	0	0	$0 K
6/27/1989	F1	0	0	$0 K
3/18/1986	F2	0	0	$250 K
4/05/1985	F1	0	0	$0 K
5/07/1984	F0	0	0	$25 K
12/02/1983	F2	0	10	$2.5 M
4/01/1983	F4	0	0	$2.5 M
4/19/1982	F0	0	0	$0 K
5/07/1978	F1	0	0	$0 K
3/11/1977	F1	0	0	$3 K
4/29/1975	F1	0	0	$3 K
6/15/1974	F0	0	0	$0 K
6/07/1974	F1	0	0	$25 K
3/28/1974	F1	0	4	$25 K
3/11/1968	F0	0	0	$0 K
2/01/1968	F3	0	0	$3 K
7/20/1965	F1	0	0	$250 K
6/21/1963	F0	0	0	$0 K
6/21/1963	F1	0	0	$0 K
2/23/1962	F0	0	0	$0 K
10/02/1956	F0	0	0	$0 K
4/30/1954	F2	0	1	$250 K
4/21/1951	F0	0	1	$25 K

Source: National Climatic Data Center, 2010.
** Refer to **Table 7** for details on the Fujita Scale.*

The other tornados that have touched down in Monroe were either a Level F0 or F1. Historically, tornados have not caused major damage in the City. Of the 34 tornados that struck either the Parish and/or the City of Monroe, thirteen F0's, fifteen F1's, four F2's, one F3, and one F4 level tornados. There have been no tornados reported to the NCDC since the 2004 HMP was prepared.

National Weather Service in Shreveport, Louisiana, provided the following description of a typical tornado for north Louisiana based on data covering the timeframe from 1680 to 1991 (**Table 9**).

Table 9. Typical North Louisiana Tornado Data from 1680–1991

Typical tornado for the region		Level F2 characterized as a "Significant Tornado"
Fujita Scale wind speeds		113 – 157 mph
Damage characteristics		Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
Direction		From the northwest
Path length	Average	5.66 miles
	Median	2.19 miles
Path width	Average	167 yards
	Median	99 yards

Source: Grazulis, Thomas P. 1993. Significant Tornadoes 1680-1991: Chronology and Analysis of Events. Environmental Films.

Tornados can create considerable damage to older structures; particularly those built before the establishment of design criteria ordinances. The City of Monroe adopted an ordinance approximately 30 years ago requiring all new construction be designed with a 90-mph minimum wind load resistance. This ordinance serves to protect all newer structures against major wind damage except in the most extreme circumstances where winds much greater than 90 mph can overwhelm most structures built to practical design standards. Historically, damage has generally been restricted to fallen trees, roof damage, downed power lines, and power outages. Some of the older homes and mobile homes could sustain more substantial damage.

Property damage and threats to personal safety are of concern because of the history of tornados in the region. Such events are unpredictable both in location and intensity. Pre-planning and the provisions to deal with the aftermath are essential to minimizing the damage to property and the threat to human health and safety.

The City has established a number of controls to reduce the probability of damage from tornados and to address the consequences of the damage that can occur. Some of these controls include the following:

- Adopt building codes that protect most structures against damage for all but the most severe wind events within the City. Design criteria for wind loads greater than 100 mph are not considered appropriate for the situation.

- Establish disaster shelters throughout the City for use in the event portions of the City are not inhabitable. These are public buildings with facilities essential to housing displaced citizens for an extended period of time.

- Maintain a transit bus system that can provide citywide transportation for the public and be made available during times of disaster.

- Maintain robust potable water and sewage systems designed to withstand the effects of most natural disasters indigenous to this area and continue to function at acceptable levels.

- Maintain capable city services to provide the manpower and equipment to remove debris and make streets functional for emergency vehicles in a timely manner.

- Maintain training of Fire Department and Police Department personnel and continue to upgrade skills required to provide an efficient and appropriate response to natural and man-made disasters.

The 2004 HMP noted the following issues that were the City's greatest challenge:

- Provide reliable early warning to enable the citizens of Monroe to find safety (since implemented);
- Provide a safe place where displaced citizens can go and be appropriately cared for until they can safely return home;
- Ensure plans are in place to restore lost services in an effective and timely manner; and
- Ensure adequate training for City personal assigned to respond to the needs of the public.

4.1.4 Drought

Drought can be defined on the basis of the degree of dryness (in comparison to "normal" or average amount) and the duration of the dry period. The drought's impact may include direct effects on the local economic, agricultural, and hydrological (rivers, reservoirs, and water tables) resources or may be the cause of secondary effects such as wildfires.

Extended dry conditions during the summer months can have significant economic impact on the region since the area is largely agricultural. Significant damage to the agricultural industry in the surrounding area can create an economic burden on the City.

Previous Occurrences of Drought

Monroe has no history of drought where the circumstances have created significant property damage within the City and where the condition posed an imminent threat to the health and safety of the citizens. It is acknowledged that the Sparta Aquifer that serves most of the region is under tremendous stress and is having a growing negative effect on the quality of life in the region. The City potable water supply comes from Bayou Desiard, Bayou Bartholomew, and the Ouachita River.

In the 2004 HMP it was acknowledged that the Sparta Aquifer was an extremely important regional source of groundwater for northern Louisiana and southeast Arkansas. There were two primary locations where significant drawdown of the aquifer had been occurring for more than 60 years — Hodge, Arkansas and Monroe, Louisiana. As documented in the Sparta Aquifer Recovery Study (2007), the massive drawdown was attributable in large part to three major water users, Chemtura Central Plant, Lion Oil, and El Dorado Chemical. The study contained various findings. In some areas the overdraft was causing upwelling (upward movement of water from underlying aquifers) and lateral migration of high-salinity (salt) water. The study was initiated in 2002. During 2004, the three major firms converted drawing water from the Sparta Aquifer to the Ouachita River. Based on an extensive monitoring program carried out through 2007, the water demand placed on the Sparta Aquifer has been significantly reduced from 7.6 billion gallons in the period 2003–2004 to 5.4 billion gallons by 2007. This is extremely

important to the future industrial growth of the region and has significant benefit to agriculture, which is a major economic driver of the regional economy.

4.1.5 Wildfire

Wildfire events are a natural part of Louisiana's ecology. Wildfires become a concern especially where the man-made environment is built in areas where the natural vegetation creates a fire prone situation. Due to its urban setting, the wildfire threat does not emanate so much within the City of Monroe, but in the unincorporated areas surrounding it.

Previous Occurrences of Wildfire

According to NCDC storm records, Ouachita Parish has had no reported wildfire events since 1950. The City of Monroe does not have large tracts of undeveloped land containing fire prone vegetation. However, should Ouachita Parish develop a Community Wildfire Protection Plan in accordance with the U.S. Department of Interior, Healthy Forest Initiative, the City does have an interest in being involved in the development of the plan since there instances (e.g., high winds containing firebrands or burning embers) where wildfire from outside the city could impact the its residents.

4.1.6 Extreme Heat

Temperatures that hover 10 degrees or more above the average high temperature for a region and last for several weeks are defined as extreme heat. Extremely hot weather can have a direct impact on the health and safety of the citizenry, particularly for the elderly and handicapped individuals who live alone and whose living conditions make them most vulnerable. According to the 2000 U.S. Census, 12.8% of Monroe's population was 65 years of age and older. This can be particularly true when the resources of individuals are not sufficient to provide a living environment adequate to deal with the effects of extreme heat. The difficulties are generally isolated to a small number of individuals and the conditions are not considered to fall under the definition of a disaster.

Previous Occurrences of Extreme Heat

According to NCDC records, there were only two reported incidents of excessive heat. Both incidents occurred in 2000. In one instance, a man living in Monroe died of heat stroke.

4.1.7 Severe Winter Storm

According to FEMA, a severe winter storm is one that drops four or more inches of snow during a 12-hour period, or six or more inches during a 24-hour period. Many factors influence the form of precipitation, including atmospheric temperatures and ground conditions which make the form difficult to predict, and it may alternate between rain and snow. An ice storm occurs when freezing rain falls from clouds and freezes immediately upon impact.

Previous Occurrences of Severe Winter Storms

The City of Monroe has experienced cold weather-related disasters in the form of ice storms resulting in three Presidential Major Disasters Declarations, one in 1998 and two in 2000. In addition, the National Weather Service office in Shreveport documented northern Louisiana Cold Weather Events from 1959 to 2009, and found that virtually all of the winter storms occurred in December, January, and February with just under half of the storms occurring in January. Only three occurred in November or March. The results are illustrated in **Figure 3**.

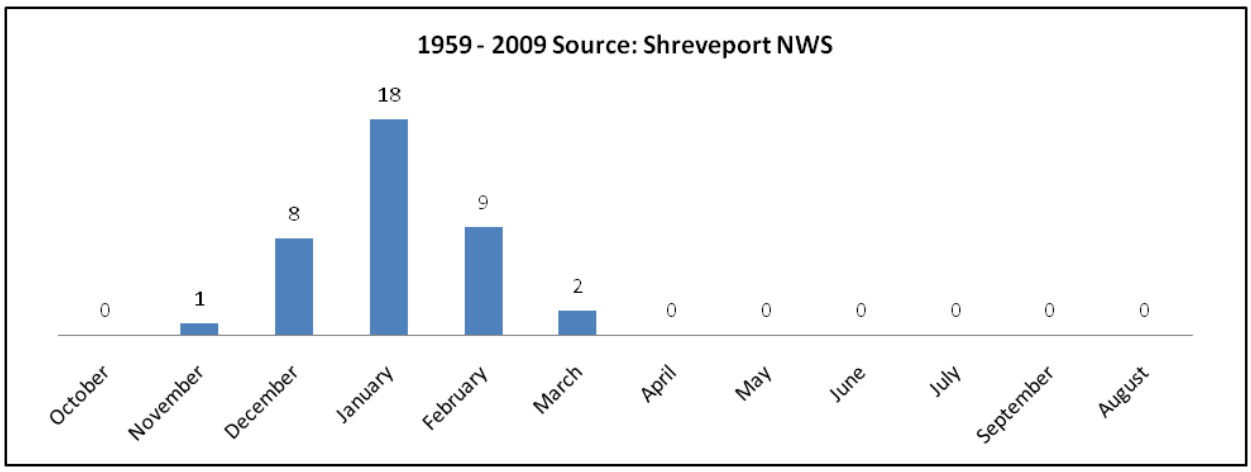

Figure 3. North Louisiana Cold Weather Events

Historically, these storms have proven to be very disruptive, primarily causing damage to trees and downed power lines and creating a major loss of electrical power throughout the City (**Table 10**). The debris and live downed power lines disrupt flow of traffic. Ice storms create icing conditions on the roads and bridges that generate numerous traffic accidents. Only minor structural damage has ever occurred as a result of winter storms. The major costs associated with the storms were labor for debris cleanup as well as law enforcement and fire service needed to maintain a safe environment for the citizens of Monroe while the power lines are raised and power restored.

Table 10. Winter Weather/Ice Storms and Resulting Property Damage Costs in the City of Monroe (1994–2010)

Date	Type	Deaths	Property Damage
2/11/2010	Winter weather/heavy snow	0	N/A
2/19/2006	Winter weather/mix	0	$0
12/24/2000	Ice storm	0	$106 M
1/26/2000	Ice storm	0	$0
12/22/1998	Ice storm	1	$1 M
1/12/1998	Ice storm	0	$0
1/6/1997	Ice storm	0	$0
2/3/1996	Ice storm	0	$30 K
2/10/1994	Ice storm	0	$50 M

Source: National Climatic Data Center, 2010.
N/A = Property damage data not recorded.

These storms have tested the City's ability to respond and minimize the effect on the ability to maintain and reestablish City services. The Monroe Public Works Fire and Police Departments have repeatedly demonstrated their ability to respond effectively and swiftly to severe winter storms. Entergy Corporation has demonstrated its ability to respond to the need and restore power in acceptable manner. This hazard is considered an ongoing concern and the City must be diligent in its maintenance of a municipal capability to deal with the consequences of such storms.

4.1.8 Lightning

By definition, all thunderstorms contain lightning. Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through the air, it heats the air rapidly to a temperature of about 50,000 degrees Fahrenheit, about five times hotter than the surface of the sun. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to a normal temperature. This rapid expansion and contraction of air causes a shock wave that we hear as thunder (this shock wave can damage walls and break glass).

Previous Occurrences of Lightning

Although common to the area, lightning events associated with thunderstorms do not represent a significant hazard to the citizens of Monroe. Since 1995, there have been nine lightning events recorded by the NCDC (**Table 11**).

Table 11. Lightning Events and Resulting Property Damage in the City of Monroe (1995–2009)

Date	Property Damage
7/28/2009	$175 K
1/8/2008	$2 K
6/19/2004	$50 K
7/31/2003	$0
5/17/2003	$0
7/25/2002	$0
8/16/2001	$8 K
6/17/2000	$240 K
3/5/1995	$0

Source: National Climatic Data Center, 2010.

Though several lightening events have caused property damage, no deaths, injuries, or crop damage occurred as a result. The lightning that occurred in 2000 created $240,000 of property damage. Lightning started a fire that destroyed the Riverside Missionary Baptist Church in Monroe, taking with it 97 years of history. The church was originally constructed on November 8, 1903. The three most recent lightning events resulted in $227,000 in fire damage to individual residences.

4.1.9 Hail Storm

A hail storm is a severe thunderstorm that drops chunks of ice along with or instead of rain. Hail develops in the upper atmosphere as ice crystals that are bounced about by high velocity updraft winds; the ice crystals accumulate frozen droplets and fall after developing enough weight that the updrafts can no longer support them. The size of hail stones varies and are a direct consequence of the severity and size of the thunderstorm – the higher the temperatures at the earth's surface, the greater the strength of the updrafts and the amount of time hailstones are suspended. The greater the time that hail is suspended, the greater the size of the hailstones. To be defined as hail, falling ice must be roughly round in shape and have at least a 0.2 inch diameter. Sleet, in contrast, consists of raindrops that freeze on the way down.

Previous Occurrences of Hail Storms

Hail storms are an ongoing event in the City. Since 1993, there have been 31 events just within the City (**Table 12**). Fortunately, according to the NCDC storm database, there have been no reported deaths, injuries, or property damage.

Table 12. Hail Storm Events and Resulting Property Damage Costs in the City of Monroe (1993–2006)

Date	Diameter (in.)	Property Damage
5/8/2006	0.75	$0
4/7/2006	1.00	$0
4/7/2006	1.00	$0
5/24/2005	0.75	$0
4/29/2005	1.00	$0
3/13/2005	1.75	$0
3/13/2005	1.00	$0
3/13/2005	1.00	$0
7/18/2003	0.75	$0
5/14/2003	1.00	$0
5/7/2003	1.75	$0
5/7/2003	2.50	$0
5/3/2003	1.00	$0
4/24/2003	0.88	$0
4/6/2003	0.88	$0
4/6/2003	0.75	$0
4/6/2003	0.88	$0
5/5/2000	1.00	$0
4/5/2000	1.00	$0
4/1/2000	0.75	$0
5/29/1998	0.88	$0
3/7/1998	0.75	$0
6/26/1997	0.75	$0
4/22/1997	2.00	$0
1/4/1997	0.88	$0
4/14/1996	0.50	$0
2/19/1996	0.75	$0
4/20/1995	2.00	$0
2/27/1995	1.25	$0
1/27/1995	0.75	$0
3/30/1993	1.00	$0

Source: National Climatic Data Center, 2010.

Historically within the city, the diameter of hail has ranged from 0.5 to 1 inch, although, there were several events where the size exceeded 2 inches in diameter. This hazard primarily creates damage to the roofs of structures, trees, and particularly automobiles. While this hazard may cause damage, it does not constitute a major threat to the health and safety of the citizens. Being an urban center, the City of Monroe is more vulnerable to hail damage to roofs and automobiles.

4.1.10 Earthquake

An earthquake is a sudden motion or trembling of the earth caused by an abrupt release of stored energy in the rocks beneath the earth's surface. The energy released results in vibrations known as seismic waves that are responsible for the trembling and shaking of the ground during an earthquake. Ground motion is expressed as peak ground acceleration (PGA). Typical effects of earthquake magnitudes are described in the Richter Scale (**Table 13**).

Table 13. Richter Scale

Richter Scale Number	Number of Earthquakes Per Year*	Typical Effects of this Magnitude
<3.4	800,000	Detected only by seismometers
3.5 – 4.2	30,000	Just about noticeable indoors
4.3 – 4.8	4,800	Most people notice them: windows rattle
4.9 – 5.4	1,400	Everyone notices them: dishes may break and open doors swing
5.5 – 6.1	500	Slight damage to buildings: plaster cracks and bricks fall
6.2 – 6.9	100	Much damage to buildings: chimneys fall; and houses move on foundations
7.0 – 7.3	15	Serious damage: bridges twist; walls fracture; and buildings may collapse
7.4 – 7.9	4	Great damage: most buildings collapse
>8.0	One every 5 to 10 years	Total damage: surface waves seen and objects thrown in the air

** Number of earthquakes per year based on worldwide occurrence. (Source: U.S. Geological Survey.)*

There have been no earthquake occurrences within the City of Monroe. No loss estimations were conducted for an earthquake event because of the City of Monroe's location in Zone IV of the New Madrid Seismic Zone; which is outside of the damage zone. The City of Monroe can expect to encounter as high as a 3.5 to 4.2 magnitude earthquake. These events would be noticeable indoors, but no damage would be observed.

The USGS National indicates that the entire geographic area of the City of Monroe is located in Zone IV of the New Madrid Seismic Zone. In addition, the USGS indicates that The City of Monroe is not vulnerable to damages from an earthquake event. Earthquakes are therefore considered a *Low Risk* to the City of Monroe. Earthquake events will no longer be profiled by the City of Monroe. The MHMSC applied an all-hazards analysis to the City of Monroe. The MHMSC determined that there is no variation in earthquake exposure, probability, and impact for the City of Monroe.

4.2 TECHNOLOGICAL HAZARDS

4.2.1 Hazardous Materials – Fixed Facilities and Transportation Systems

Through man's actions, chemical spills and airborne toxic fumes occur accidentally or sometimes intentionally where hazardous materials are involved and the health and safety of the general population are placed in jeopardy. In terms of Monroe, a hazardous materials incident can occur either at a fixed location such as a manufacturing plant or along transportation routes either delivering raw material needed to produce manufactured products or chemical products produced in Monroe and being shipped to end users.

Fixed Facilities

As documented in the 2008 State HMP, there are 12 manufacturing plants located in Ouachita Parish that manufacture, store, process, or otherwise handle hazardous materials. Four of the companies are located within the City of Monroe (**Table 14**).

Table 14. Population at Risk From Facilities Located in the City of Monroe That Handle Hazardous Materials

Facility	Population at High Risk		
	Total Population	Elderly	Low Income
Central Oil & Supply Corporation: Bulk Facility 2300 Booth Street Monroe, LA 71201-8368	948	116	192
Coca Cola Bottling Company 1300 Martin Luther King Jr. Drive Monroe, LA 71202-3706	841	78	142
Nexair, L.L.C. 2707 Newcombe Street operations Monroe, LA 71201	643	99	137
Steel Fabricators of Monroe, Inc. 2101 Booth Street Monroe, LA 71201	45	7	8
Total	2,477	300	479

Source: Louisiana State Hazard Mitigation Plan, 2008.

These facilities use a wide variety of chemicals in the production of their products. Therefore, they potentially have an impact on residents living in the surrounding neighborhoods. There are 2,477 people living within a 1-mile radius of the various facilities. However, spills and leaks emanating from these sources typically cause little or no property damage but can generate a significant hazard to the health and welfare of the public in the immediate vicinity of the event. The Northeast Louisiana Chapter of the Red Cross provides public educational programs concerning chemical emergencies as one of their efforts to keep the general public informed and aware of such hazards.

In addition to private sector businesses, the City maintains an inventory of approximately 15 tons of chlorine gas in one-ton containers and 140,000 pounds of anhydrous ammonia in certified containment at the central water treatment facility. A documented Process Safety Management Program (PSMP) is rigorously enforced to control its operation and protect the facility from unauthorized access. An emergency response plan, incorporated in the PSMP, conforms to State and Federal regulations. The PSMP is considered appropriate for the operation and protection of the chemical storage facility.

Transportation Systems

As described in the State HMP, accidental hazardous materials releases occur while chemicals are either being transported along the city's transportation facilities or while being moved about in one of the rail switching yards. A number of state roads pass through Monroe. They include the following: LA 139; LA 15 (South 2nd Street and Winnsboro Road); US Highway 165; LA594 (Millhaven Road) and LA840-6 (North 18th Street, Forsythe Avenue, and Forsythe Bypass).

Also, rail line service for freight movement is prevalent and predominant within the City of Monroe and specifically within the downtown area. There are three active rail lines that go through the downtown area and extend beyond the city limits. The Arkansas, Louisiana, Mississippi (AL&M) railroad generally cuts through the center of the city in a north-south direction. The Union Pacific railroad traverses the City in a north-south direction south of I-20; after it passes I-20, the rail line then continues in an east-west direction north of I-20. The Kansas City Southern Railway (KCS) runs east-west parallel to Desiard Street and Millhaven Road and then crosses the Ouachita River. A switching yard is operated in the downtown area of Monroe by KCS.

These rail lines have nine at-grade crossings all occurring within the downtown Monroe area. The only grade-separated crossing is provided by the Lea Joyner Memorial Expressway. According to the Downtown Monroe Traffic and Parking Study, June 2003, the KCS operates approximately 23 trains per day within the downtown area all at varying times. **Figure 4** shows a map of the City of Monroe's various transportation systems and routes.

Table 15 documents incidents where hazardous material was spilled either along the roadway right-of-way or in one of the rail switching yards. Trains pass through the City numerous times each day. Tractor-trailer rigs pass continually through the City along Interstate 20 and along the other interconnected highways. Barges deliver a variety of goods to the City on the Ouachita River. All of these vehicles transport a wide variety of products including a number of hazardous chemicals. Although the hazard exists, historically there have been minor mishaps with each of these carriers involving hazardous materials with minimal impact on the population of Monroe. While it is common knowledge locally that hazardous materials pass through Monroe daily, there is no documentation of how much or type of hazardous material that passes through the City. Having better knowledge of what is passing through the City will enable the Public Safety Department to better protect the City's residents from accidental spills and be better prepared to deal with such a disaster event should it occur.

Table 15. Hazardous Material Railroad Incidents

Approximate Date	Incident	Outcome	Street/Location	Container	Product
July 2006	Reported leaking rail car	Venting CO_2 car	Millhaven Road at Kansas ln.	Tank car	Refrigerated CO_2
Oct. 2005	Reported leaking rail car	No cars on scene, white substance between train tracks	Railroad tracks at South Grand Street	Not at scene	Crushed limestone
1998 – 2004	Leaking train car	Leaking fuel tank on train engine	Tracks behind Civic Center Arena	Locomotive fuel tank	Diesel
1998 – 2004	Leaking train car	Gasket of protective dome leaking	Tracks just east of 700 block, Desiard Street	Tank car	Cresols
Nov. 2001	Leaking tank car	Leaking tank car	Dixie Street at Railroad Avenue	Tank car	Aromatic hydrocarbons
Apr. 2001	Reported leak	No leak found	Millhaven Road	Tank car	Sodium hydroxide solution
May 2000	Derail	3 cars jump track still upright	Tracks north of Forsythe Avenue between Fire Station #6 and Oliver Road	Tank car	Anhyrous Ammonia
May 2000	Derail	3 cars jump track still upright	Tracks north of Forsythe Avenue between Fire Station #6 and Oliver Road	Tank car	Nitropropane
Jan. 1959	Train derailment	Tank car explosion with 8 killed and 75 injured	Approximately 6.5 miles south of Monroe – U.S. Highway 165	Tank cars	propylene, diacetone alcohol, vinyl acetate, glycol

Source: Monroe Fire Department, 2010.

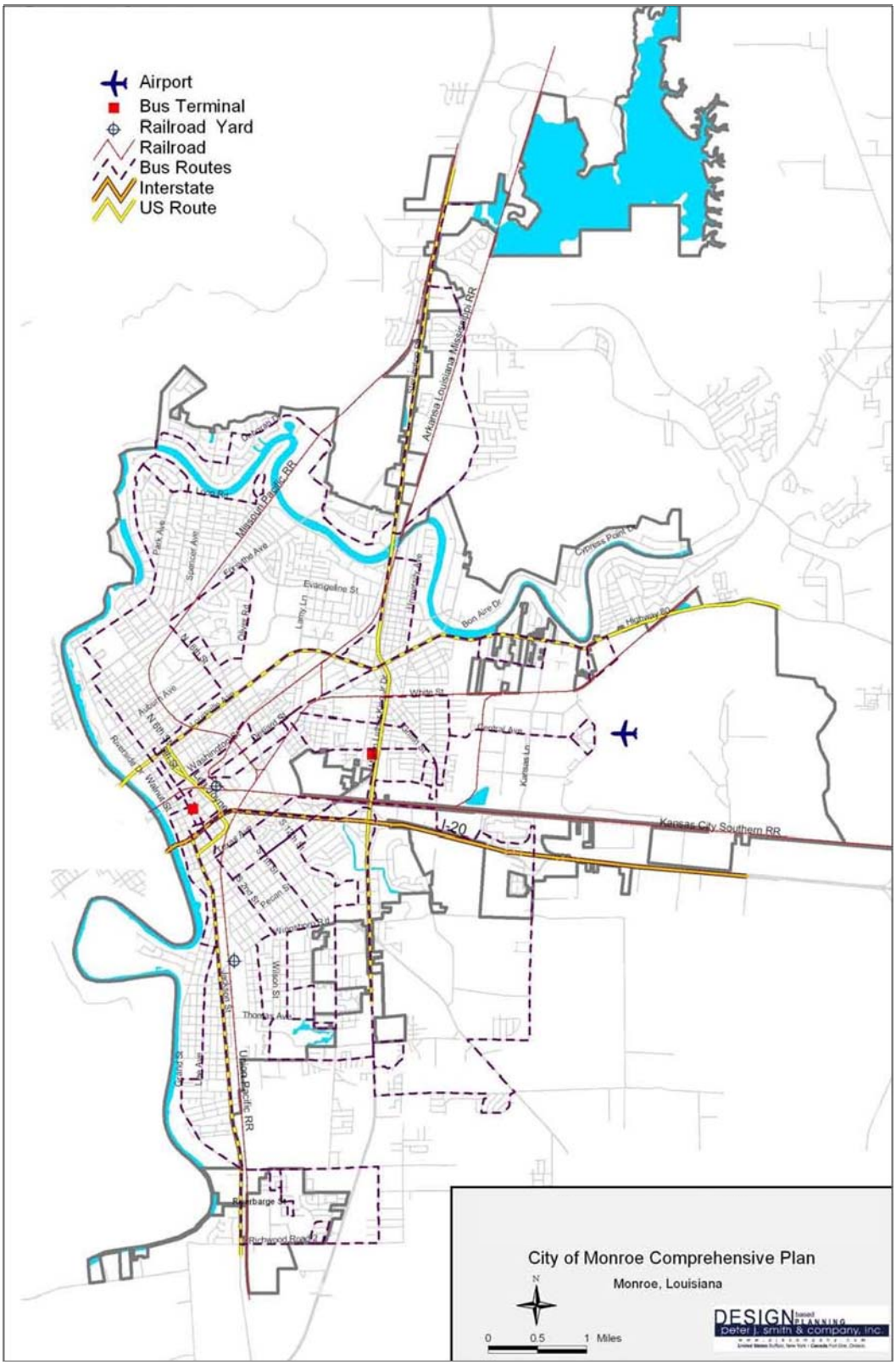

Figure 4. City of Monroe Transportation Systems and Routes

It is the primary responsibility of the local, state, and federal emergency response organizations to respond to leaks and spills contain the danger and protect the public. The City has well trained equipped personnel in both the Fire and Police Departments to manage these types of events. They also have access to Parish, state, and federal hazard and emergency response teams to quickly supplement their numbers in the event of a major incident.

4.2.2 Levee Failure

Levees and floodwalls are flood control barriers constructed of earth, concrete, or other materials. Levees are distinguished from other flood barriers such as berms by their size and extent. Unlike berms, these structures protect significant areas of residential, commercial, or industrial development, at a minimum, a neighborhood, or small community. Levee failure involves overtopping, and breaching during flood and non-flood events.

The City of Monroe is entirely within the Ouachita River floodplain. Thirty percent or approximately 6,000 acres of land within the Monroe area is located within the 100-year floodplain with the majority of areas adjacent to or near the Ouachita River and Bayou Desiard. The remaining 14,000 acres or 70% of land within the City lies within the 500-year floodplain.

Being located in a floodplain, the City is totally dependent on its levee system to protect it from the Ouachita River floodwaters. There are two significant levee systems that protect the City of Monroe from major flooding: 1) the Ouachita River levee system and 2) the smaller levees within the City that protect people and property from localized storms.

The Tensas Basin Levee Board, appointed by the LA DOTD, maintains the Ouachita River levee system. It has responsibility for minor maintenance (such as cutting grass, removal of weeds, local drainage, and minor repairs of the main river levees). All major maintenance is the responsibility of the USACE. The City works with the Board to address issues associated with the levee system including those times when river rises to flood levels, and works closely with the District staff coordinating the closure of the drainage discharge points in the City and the City activating their pumping facilities. The City of Monroe Public Works Department is responsible for the integrity and maintenance of the smaller levees installed within the City to control stormwater runoff.

Previous Occurrences of Levee Failure

As reported in 1987 in the local Monroe newspaper, the News Star World, “in 1927 the Ouachita River flooded with vengeance on cities without levees in Monroe and West Monroe.” The river was more than 10 feet above flood stage elevation of 40 feet, and covered nearly all land between the Ouachita River the Mississippi River. In 1932, the river flooded once again. John Stringer, Executive Director of the Tensas Basin Levee District, indicated that according to old photographs of the 1932 flood, there were levees of limited height through Monroe. The Flood Control Act of 1928 gave the USACE the authority to begin construction on the present day levee and floodwall system through Monroe. The permanent floodwall through Monroe was 8,700 feet in length. An additional 1,750 feet of levee was added in May, 1977. That section includes a 1,420-foot folding wall in 10-foot panels that filled a gap that previously required temporary earth-filled timber cribs (mud boxes) on South Grand Street during high river stages. The levee and floodwall system in the immediate vicinity of the town affords approximately 3 feet of freeboard above the maximum flood of record, 81.8 feet North American Vertical Datum (NAVD), which occurred on May 4, 1991. (FEMA specifies that for levees to be certified for flood insurance purposes, they must have a minimum of a 3-foot freeboard above the 1% annual chance flooding to be considered a compliant flood protection structure). These

panels have to be erected prior to significant flood events. When not being used as a floodwall, they serve as a sidewalk in the downtown Monroe. Prior to the construction of the 1,750-foot wall in 1977, an earthen levee was required in downtown to protect the City. According to USACE, the earthen levee and floodwall through Monroe provides protection against an event assumed to occur every 167 years. As of the date of this update plan, the TBLB has observed no weak points in the levee protecting the City. Major maintenance and reconstruction responsibility for the Ouachita River Basin levee rests with the USACE while the TBLB is responsible for minor maintenance (e.g., cutting grass, removal of weeds, local drainage, and minor repairs of the main river levee) as well as maintaining 399.30 miles of channel for flood control purposes.

Since Hurricanes Katrina and Rita, FEMA and the USACE have revised levee and floodplain guidelines. Doing so expanded 100-year floodplains and increased height requirements for levees. Changing the guidelines has caused many levees to lose certification. De-accreditation of the Ouachita River Basin Levee will change flood-control maps, which are used to make decisions about planning, zoning, development, and more. Where the lines are drawn determines whether land may be used for farming, residential construction, or commercial development. Important to all property owners are maps used to determine who would be required to carry federal flood insurance. Presently, the TBLB is engaged in discussions with the USACE to ensure that the levee along the Ouachita River that borders the City of Monroe remains certified.

4.2.3 Dam Failure

Dams are water storage, control, or diversion barriers that impound water upstream in reservoirs. Dam failure occurs when there is a collapse or breach in the structure. The greater a dam's storage volume is, the more significant flooding would be downstream.

Within the City there are two dam structures, the Bayou Desiard Dam and the Country Club Lake Dam. Both dams are located on the north side of Monroe. According to the City Engineering Department both dams are monitored frequently and are structurally sound, posing no threat to the community.

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5 REPETITIVE LOSS AREAS

Monroe has a long history of properties being repeatedly flooded. In the previous HMP prepared in 2004, the number of structures experiencing repetitive losses (RL) was reported as 104 and another 25 other properties were classified as severe repetitive loss (SRL) structures. While the previous plan indicated 280 RL properties, only 104 properties in the Appendix table, are identified along with the statement: "Revised January 2004 to reflect projected impact of improved drainage by levees and pumping stations since December 2000 record."

DEFINITIONS

Repetitive loss property: a property that has experienced two or more losses of at least $1,000 that has been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978.

Severe repetitive loss property: a property that meets one or more of the following requirements:

(a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

(b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

In the 2010 plan update, RL and SRL data based on information obtained from the GOHSEP there are 256 RL properties and 33 SRL properties. The vast majority of RL or SRL properties are located in the A Flood Zone, which generally mirrors the 100-year flood zone. Also, of the 256 RL properties, 232 are residential and the remaining 24 are nonresidential. Of the SRL properties, 30 are residential and 3 are listed as non-residential high-risk areas according to FEMA. Of the 256 RL properties, the number National Flood Insurance claims have declined since 2000. The recent 2010 data indicate that between 2000 and 2010, 47 RL properties filed insurance claims (building and contents) amounting to $1,943,305. During the same period, 32 properties classified as SRL filed insurance claims (building and contents) amounting to $2,973,845. The data can be found in **Appendix B**. Both RL and SRL properties are shown in **Figure 5**.

City staff has indicated that there has been a reduction in RL properties due to increased maintenance and construction of stormwater improvement projects over the past decade. Increased drainage capacity in its bayous and canals to enhance the flow of stormwater and reduce the incidence of flooding. Flooding now is more isolated therefore there is a need to undertake a drainage study to help identify projects to further mitigate local flooding.

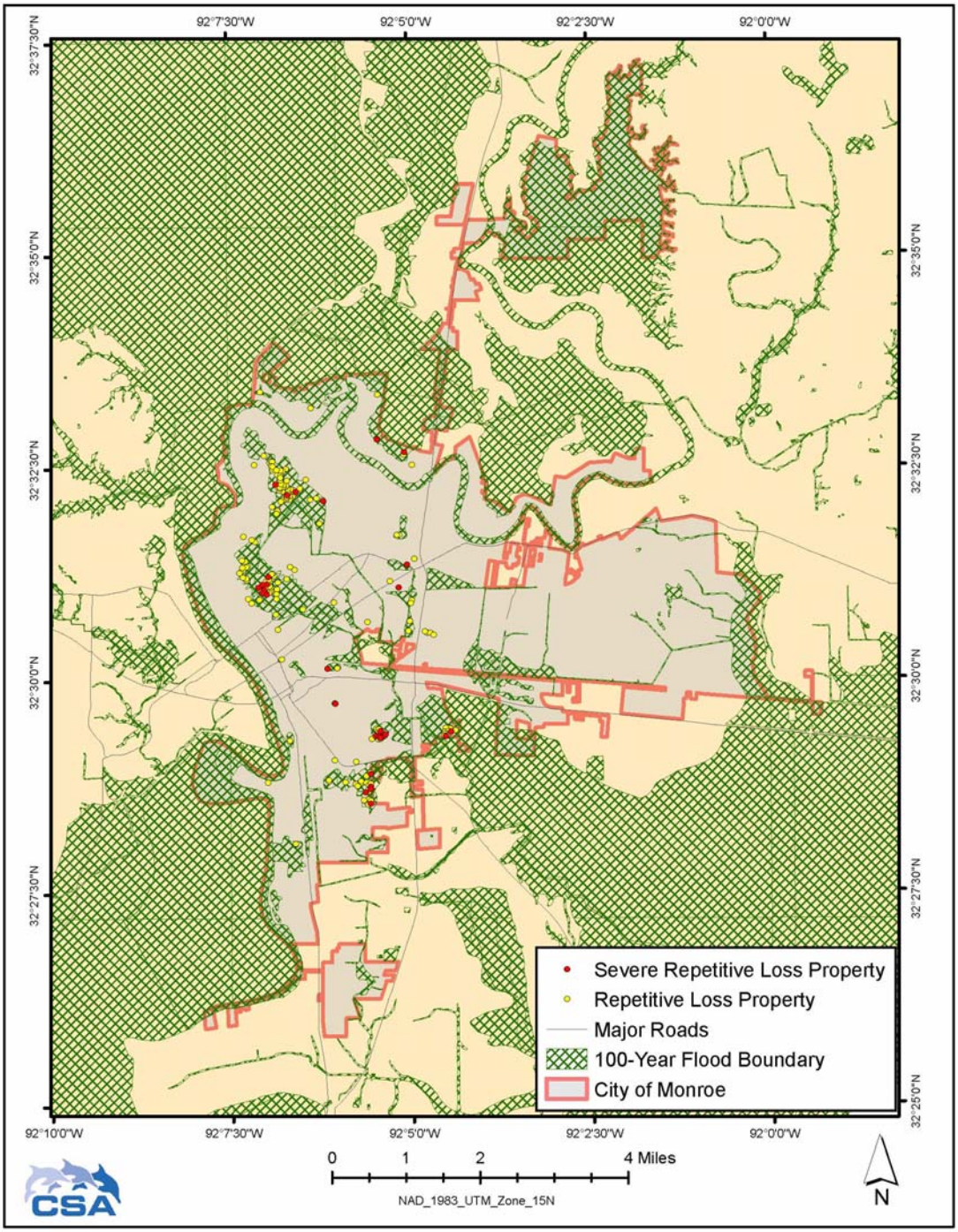

Figure 5. Flood-prone Areas and Repetitive Loss Properties

Much has been done to control the flow of stormwater and alleviate its effect on the City and its residents. The City has had a construction control code in place since 1979, which was updated in its entirety in 1994, and documented in Chapter 13 Drainage and Flood Control" of the City Code under Ordinance No. 9423. The ordinance, which addresses minimum surface elevations for new construction, is designed to ensure all new structures are elevated to specific heights above the established base flood elevations. This code has minimized the chance of flooding for new construction.

6 HAZARD VULNERABILITY

Federal Register 44 CFR § 201.6(c)(2)(i) defines the requirements for establishing vulnerability. The Regulation states that risk assessment shall include the following:

- An overview of the type and location of all natural hazards that can affect the area, historical information, and the probability of future events occurring using maps where possible.
- Overview and analysis of the vulnerability described in terms of greatest number of areas most threatened and vulnerable to damage and loss associated with the hazard event. Included are publically-owned critical facilities (e.g., City Hall, Public Safety Complex, fire stations, Ouachita River levee, schools, sewer, water, stormwater facilities, facilities located on the ULM campus).

The potential risk associated with each hazard to City of Monroe was determined as a function of two factors: 1) the probability of a natural or technological hazard will occur and 2) the hazard's potential magnitude of the impact. The probability of occurrence was determined by the number of years with a recorded hazard event divided by the total years of recorded data. Magnitude of impact for each hazard was determined by the average damage incurred by all historical events, but if no data was available magnitude of impact was estimated in dollar losses by the HMT and consultant's expertise. The hazard's risk level was assigned a value of *Low* (probability of occurrence is less than 10% or the magnitude of impact is less than $5,000), *Medium* (probability of occurrence is between 11% and 30% or the magnitude of impact is between $5,001 and $100,000), or *High* (probability of occurrence is greater than 30% or the magnitude of impact is greater than $100,000). Refer to **Table 16** for the probability of occurrence, magnitude of impact, and risk ratings for each identified hazard event.

Probability: Percentage of occurrence per year.

Impact: Average dollar value of historical damages or estimated damages.

Risk: *Low* (probability of occurrence is less than 10% or impact is less than $5,000), *Medium* (probability of occurrence = 11% – 30% or impact = $5,001 – $100,000), and *High* (probability of occurrence is more than 30% or impact is more than $100,000).

Table 16. Hazard Risk Rating Assessment

Hazard Events Resulting in Incidents	Probability of Occurrence	Magnitude of Impact	Risk Rating
Natural			
Flood	1%	$747,800	High
Wind – Thunderstorm/Hurricane	1%	$544,000	Medium
Tornado	57.6%	$211,735	High
Drought	<1%*	$0	Low
Extreme Heat	<1%*	$0	Low
Severe Winter Storm (Ice Storm)	71.4%	$9,814,375	High
Lightning	52.0%	$52,777	Low
Hail Storm	<1%*	$0	Low
Earthquakes	<1%*	$0	Low

Hazard Events Resulting in Incidents	Probability of Occurrence	Magnitude of Impact	Risk Rating
Technological			
Hazardous Materials	<1%*	Estimated people impacted – 2,477	High
Levees	<1%*	Estimated people impacted - 15,945	High
Dams	<1%*	$0	Low

**<1% for probability occurrence is defined as no previous occurrences to date.*

Conducting hazard vulnerability for the City of Monroe was more challenging than preparing one for a parish. With the exceptions of flood and wind where FEMA's HAZUS model has been used to generate damage estimates, other data sources have been used to create the Hazard Risk Rating table for Monroe. These other data and information sources included the 2008 Louisiana Hazard Mitigation Plan, National Climatic Data Center Storm Event data base, Table 23, Path of No. 1: Heavy Damage Scenario (tornado), and input from the Monroe Public Works Department.

U.S. Census information is used to develop HAZUS data. For this planning effort, the HAZUS data boundaries did not correspond exactly with the City limit boundary since a number of the census blocks overlapped both the city and parish boundaries; therefore, in order to run the HAZUS model the consultant made a decision whether to include or exclude census blocks on a case-by-case basis.

Besides using HAZUS to analyze the impacts of flood and wind, vulnerability analysis for other hazards were prepared using the best available data. While there was a limitation of hazard data specific to Monroe, Ouachita Parish level sufficed in a number of instances, because a hazard such as a winter ice storm is not location-specific but has impacts jurisdiction-wide. For the purposes of this plan, it is assumed the hazard impact would equally affect all local governments in Ouachita Parish.

6.1 NATURAL HAZARDS VULNERABILITY

6.1.1 Flood

FEMA's HAZUS flood model, under the probabilistic scenario, was utilized to estimate the level of damages by geographical area for 100- and 500-year flood events within the City of Monroe (**Tables 17** and **18**). Damages are categorized in terms of three levels of damage: *Slight*, *Moderate*, and *Substantial*. The definition of each is as follows: Slight = 1% to 10% structural damage; *Moderate* = 11% to 50% structural damage; and *Substantial* = 51% to 100%. The HAZUS flood model estimates damages in terms of structural damage, population displacement, shelter demand, and debris production. The HAZUS flood model methodology, limitations and outputs are provided in **Appendix F** of this report.

The HAZUS flood model's geographical size of the region is 29 square miles and contains 1,757 census blocks. The area contains 21,708 buildings worth approximately $3,927 million dollars (2006 dollars). Approximately 89.71% of the buildings are associated with residential housing. The total population for the study area is 53,390 persons.

Table 17. Structures Within Flood Areas in HAZUS Model Probabilistic 100-year Return Period

Occupancy	Level of Damage by Number of Structures			Total Damaged Structures
	Slight	Moderate	Substantial	
Agriculture	0	0	0	0
Commercial	8	8	0	19
Education	0	0	0	0
Government	1	0	0	1
Industrial	0	0	0	0
Religion	0	0	0	0
Residential*	0	206	0	223
Total	9	214	0	243

** Residential damaged structures constitute 1% of total structures.*
Slight = 1%–10% structural damage.
Moderate = 11%–50% structural damage.
Substantial = 51%–100% structural damage.
Source: HAZUS-MH: Flood Event Report.

Table 18. Structures Within Flood Areas in HAZUS Model Probabilistic 500-Year Return Period

Occupancy	Level of Damage by Number of Structures			Total Damaged Structures
	Slight	Moderate	Substantial	
Agriculture	0	0	0	0
Commercial	11	15	0	19
Education	0	0	0	0
Government	1	0	0	1
Industrial	0	0	0	0
Religion	0	0	0	0
Residential*	0	223	0	223
Total	12	238	0	243

** Residential damaged structures constitute 1% of total structures.*
Slight = 1%–10% structural damage.
Moderate = 11%–50% structural damage.
Substantial = 51%–100% structural damage.
Source: HAZUS-MH: Flood Event Report.

Flooding within the City of Monroe is location-specific to flood prone areas. All damage estimates generated by the HAZUS flood model are within flood prone areas. **Figures 6** and **7** graphically display the geographical location of building losses and all flood prone areas. The majority of NFIP's historical repetitive loss and severe repetitive loss properties were estimated to be within the HAZUS flood model's generated flood prone areas.

The total estimated economic losses for 100- and 500-year flood events are $77.690 million and $90.960 million, respectively (**Tables 19** and **20**). Estimated damage to residential buildings for 100- and 500-year flood events is considerably higher ($13.370 million and $15.120 million, respectively) compared to commercial buildings ($8.830 million and $9.800 million, respectively). Commercial contents loss is significantly higher for both 100- and 500-year flood events ($29.530 million and $33.010 million, respectively) compared to residential content losses ($11.170 million and $12.950 million, respectively).

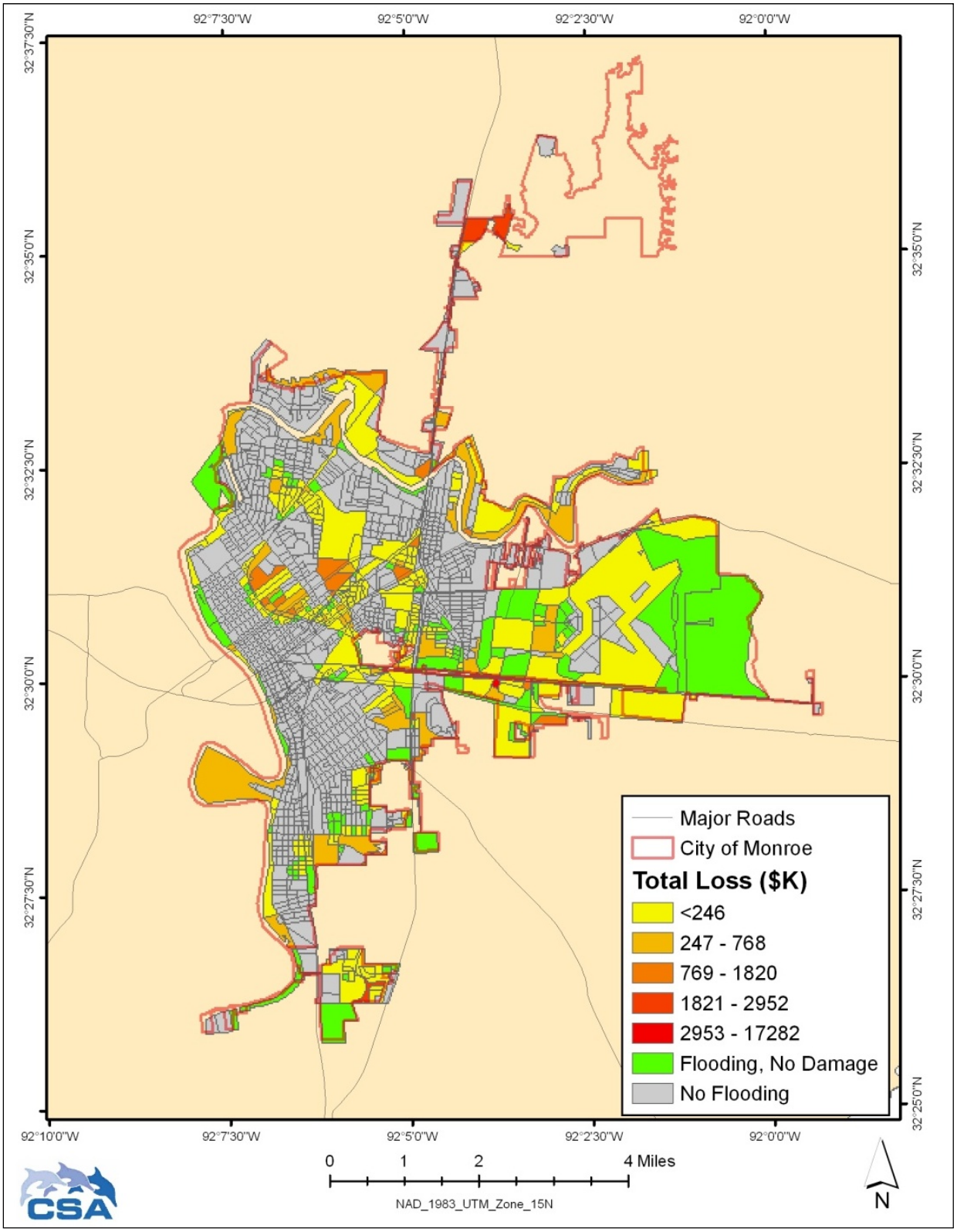

Figure 6. Geographic Location of Building Losses from Flood as Estimated by Hazus Model

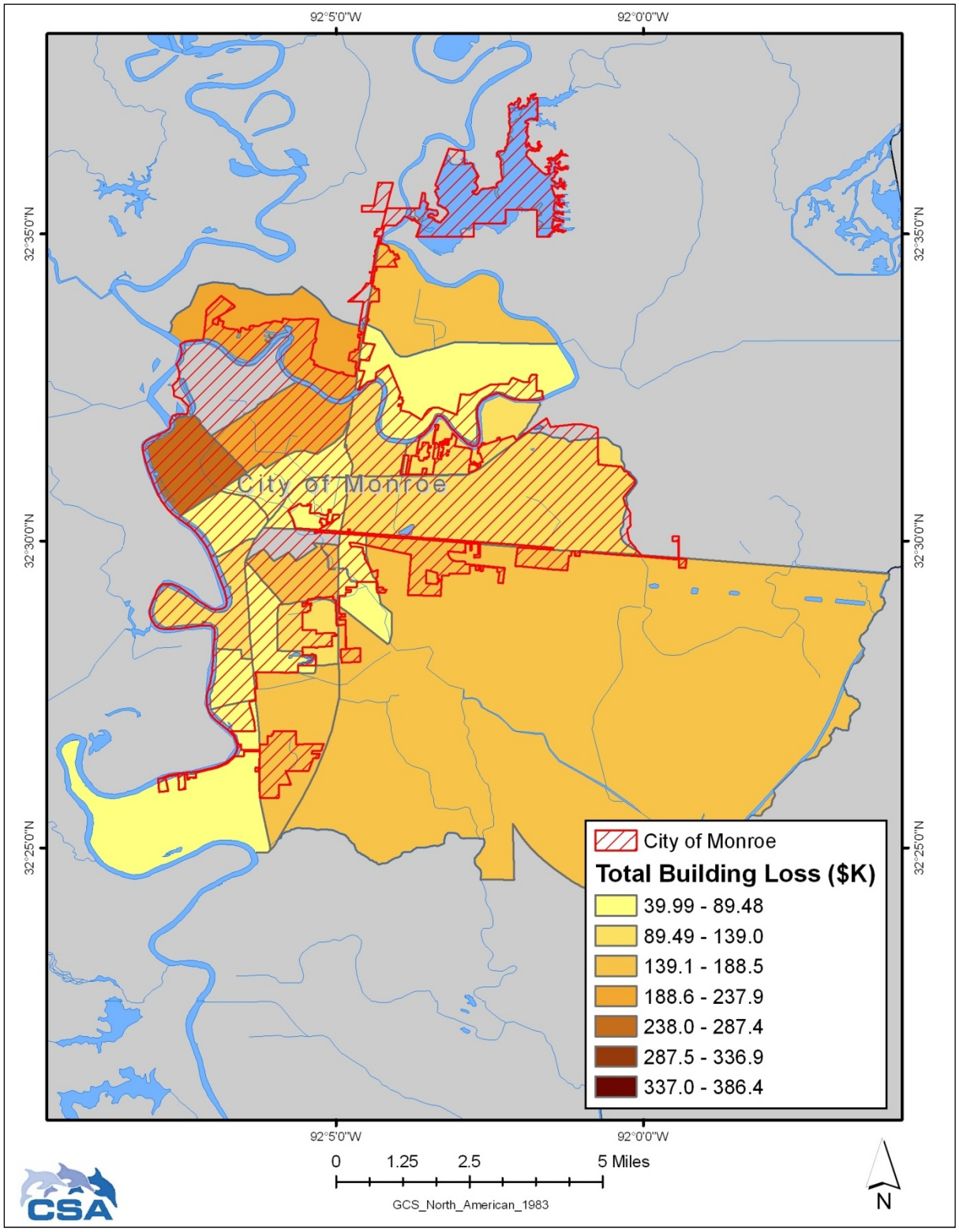

Figure 7. Building Economic Loss for the Census Tracts in and Around the City of Monroe, Louisiana, for a 100-Year Return Period for High Wind as Estimated by HAZUS

Table 19. 100-Year Flood Building-Related Economic Loss Estimates

Area	Residential	Commercial	Industrial	Other	Total
Building Loss					
Building	$13,370 K	$8,830 K	$1,180 K	$810 K	$24,190 K
Contents	$11,170 K	$29,530 K	$3,280 K	$4,610 K	$48,590 K
Inventory	$0	$1,210 K	$780 K	$20 K	$2,010 K
Subtotal	$24,540 K	$39,570 K	$5,240 K	$5,440 K	$74,790 K
Business Interruption					
Income	$10 K	$490 K	$0	$30 K	$530 K
Relocation	$120 K	$160 K	$0	$0	$280 K
Wages	$30 K	$540 K	$0	$1,520 K	$2,090 K
Subtotal	$160 K	$1,190 K	$0	$1,550 K	$2,900 K
Total Economic Loss	**$24,700** K	**$40,760** K	**$5,240** K	**$6,990** K	**$77,690** K

Source: HAZUS-MH: Flood Event Report.

Table 20. 500-Year Flood Building-Related Economic Loss Estimates

Area	Residential	Commercial	Industrial	Other	Total
Building Loss					
Building	$15,120 K	$9,800 K	$1,940 K	$910 K	$27,770 K
Contents	$12,950 K	$33,010 K	$6,420 K	$5,190 K	$57,570 K
Inventory	$0	$1,320 K	$1,420 K	$20 K	$2,760 K
Subtotal	$28,070 K	$44,130 K	$9,780 K	$6,120 K	$88,100 K
Business Interruption					
Income	$10 K	$560 K	$0	$30 K	$600 K
Relocation	$130 K	$170 K	$0	$0	$300 K
Wages	$30 K	$610 K	$0	$1,320 K	$1,960 K
Subtotal	$170 K	$1,340 K	$0	$1,350 K	$2,860 K
Total Economic Loss	**$28,240** K	**$45,470** K	**$9,780** K	**$7,470** K	**$90,960** K

Source: HAZUS-MH: Flood Event Report.

The HAZUS flood model estimates the amount of debris generated by 100-year and 500-year floods would total of 3,803 and 4,194 tons; respectively. Finishes from damaged buildings would amount to 93% of the total produced debris. If the debris tonnage is converted into an estimated number of truckloads (at 25 tons per truck), the 100-year flood would require 152 truckloads and the 500-year flood would require 168 truckloads to remove the debris generate by each flood event. Debris generation can restrict transportation accessibility and reduce the level of service of critical facilities and infrastructure.

The HAZUS flood model estimates the number of households expected to be displaced from the 100-year and 500-year floods would amount to 1,785 and 1,901, respectively. Displacement rates include households evacuated from within or near inundated areas. Of the displaced population, 4,253 (100-year) and 4,545 (500-year) will seek temporary shelter in public facilities. A shelter plan must be reviewed or completed to measure the City of Monroe's shelter capacity for this displaced population.

The magnitude of flood the City could experience ranges between 8.3 to 22.8 feet flood depths. Based on estimated losses, the history of flood in Monroe, and the opinion of the MHMSC, flood is assigned a *Substantial Risk* rating.

6.1.2 High Wind

FEMA's HAZUS estimation model is utilized to determine the potential impacts of severe storm events and events on the City of Monroe's structural assets and population. Within a 50-year to 1,000-year return period (interval of time for a storm event) the HAZUS model estimates damages to the City of Monroe's buildings and its displacement of the population. The HAZUS model categorizes damage as either *Minor*, *Moderate*, *Severe*, or *Destruction*. The HAZUS model calculates damages and population displacement under FEMA's probabilistic hurricane scenario (most probable). The geographical size of the study area is 91.34 square miles and contains 22 census tracts. In the study area, there are 25,178 households that contain a total population of 68,972 people. HAZUS estimates that there are 27,771 buildings, with a total building replacement value, excluding contents, of $4,702 million dollars (2002 dollars) in the study area. Methodologies and limitations of the HAZUS model are provided in **Appendix F** of this report.

HAZUS estimates that residential structures are disproportionately affected by high winds associated with hurricane events. Residential buildings account for 92% of the total number of buildings estimated damage. The majority of residential buildings will receive *Minor* (92%) or *Moderate* damage (8%). Nine damaged buildings will receive *Severe* or *Destructive* damage (**Table 21**). The 500-year and 1,000-year return periods account for the majority of buildings damaged (91%). These return periods have a lower probability of occurrence, but substantial damages to residential buildings within the City of Monroe can occur during these return periods.

Table 21. Estimated Number of Residential Buildings Damaged From High Winds

Return Period (years)	Minor	Moderate	Severe	Destruction	Total
50	14	0	0	0	14
100	72	2	0	0	73
200	302	12	0	0	314
500	1,371	98	0	0	1,469
1,000	2,638	260	4	5	2,908
Total	4,397	372	4	5	4,779
Percent Total Damaged	92%	8%	<0.1%	<0.1%	--

Source: HAZUS-MH: Flood Event Report.

HAZUS estimates a total of 400 nonresidential structures will be damaged by high winds (**Table 22**). Nonresidential buildings account 8% of the total number of buildings damaged. The majority of nonresidential buildings will receive *Minor* (86%) or *Moderate* damage (13%). Two damaged buildings will receive *Severe* damage (**Table 22**). The 500-year and 1,000-year return period account for the majority of buildings damaged (86%). These return periods have a lower probability of occurrence, but substantial damages to nonresidential buildings within the City of Monroe can occur during these return periods (**Figure 6**).

Table 22. Estimated Number of Nonresidential Buildings Damaged From High Winds

Return Period (years)	Minor	Moderate	Severe	Destruction	Total
50	8	0	0	0	8
100	14	0	0	0	14
200	32	1	0	0	33
500	101	14	0	0	115
1,000	188	38	2	0	228
Total	343	53	3	0	400
Percent Total Damaged	86%	13%	0.5%	0%	--

Source: HAZUS-MH: Flood Event Report.

HAZUS estimates significant economic losses, property damage, and business interruption associated with the production of high winds from severe events. In **Table 23**, Total Capital Stock Damage includes residential and nonresidential loss. Residential properties are disproportionately affected by high winds from severe storms. HAZUS estimates that residential properties can incur a total of $48,115,000, for all return periods, in high wind damages; which accounts for 85% of the total property damage for the City of Monroe. Nonresidential properties incur $6,285,000 in high wind damages, 15% of total property damage. Losses associated with business interruption account for a total of $5,849,000 over all return periods. These losses could cripple the City of Monroe's economy. The annualization, estimated cost per year, of property losses and business interruption is $212,000 and $35,000, respectively.

Table 23. Estimated Economic Loss of Residential From High Winds

Return Period (years)	Residential	Total Capital Stock Damage	Business Interruption Losses
50	$506 K	$516 K	$0 K
100	$2,584 K	$2,763 K	$6 K
200	$5,833 K	$6,221 K	$164 K
500	$14,818 K	$16,510 K	$1,786 K
1,000	$24,374 K	$28,390 K	$3,893 K
Total	$48,115 K	$54,400 K	$5,849 K

Source: HAZUS-MH: Flood Event Report.

HAZUS estimates the number of people that are expected to be displaced from their homes and those that will require short-term shelter is relatively low. Of the total City of Monroe population, 68,972, only seven people were displaced from their households due to hurricane winds. Of the displaced population, one person will seek temporary shelter in public shelter facilities.

Detailed loss categories, including land use type and structure material, are attached in **Appendix F**. Severe storms are not location-specific and affect the City of Monroe equally.

The HAZUS data indicates that the City of Monroe is at a *Low Risk* from damages associated with high wind events.

6.1.3 Tornado

A tornado represents a threat capable of creating serious damage in the City of Monroe. The path of a tornado is unpredictable therefore all structures in the City are subject to damage.

Information was sought from the National Weather Service to determine historically what could be expected from tornados common to this region. This information was used to create a scenario within the City that depicts potential occurrences. The results obtained from that depiction were used to project some meaningful measure of vulnerability.

Two tornado paths were selected based on National Weather Service information and superimposed on a map of the City. No preliminary assessment of property values or property occupancy was made before randomly drawing a line across the City. One path was selected to pass through the widest populated portion of the City and maintain ground contact for the average time documented in the historical records. A second path was chosen to demonstrate the effect of the median length of time the tornado would be expected to maintain ground contact and pass through a less populated area with modestly priced buildings. It was projected that real-life damages would lie somewhere in between the numbers generated by the two scenarios.

Appendix H, **Figure H-2** shows the paths, location, and direction of two hurricane scenarios. The residential areas, businesses, and industries that fell within the two paths are coincidental. In real life, some of the business and residences in the path may be destroyed or left untouched. Potential peripheral damage was not included. Sites along the path were selected to identify the types of structures and businesses involved but no effort was made to account for each individual structure in the paths. The assessment represents a best estimate at potential damages based on the type of damage typical from a Level F2 tornado.

U.S. Census numbers show that there are approximately 2.5 people in the average household. This number was used to determine occupancy for the residences. Estimates were made of the occupancy for the business identified in the tornado paths. These estimates were combined to calculate the total estimate of number of people involved in the event.

The tornado's path width was based on National Weather Service information and was estimated to extend to the approximate width of one city block. The most damaging route contains a range of structures including up-scale residences, commercial businesses, industrial sites, and the regional airport.

Values of specific residences and commercial businesses in the selected paths were determined from the Parish Tax Assessor's Office data and used to represent typical structures in the area of concern. The value of the contents was calculated using the FEMA guidelines. The buildings located in the areas numbered along the path were used as representative of the property value at that location. It was estimated that 10 homes would be destroyed at each residential location. Property values were established for specific businesses in the commercial and industrial districts as well as the airport. The number of vehicles and people are estimates that could vary considerably based on a number of factors. The aircraft value was a best estimate based on the type of a craft hangar at the Monroe Regional Airport and flying out of the facility.

The estimates from the calculations are provided in detail in **Tables 24** and **25** and graphically shown in **Appendix H**.

Table 24. Path No. 1: Heavy Damage Scenario (Average Level F2 Tornado Path Length)

Type of Structure	Number of Structures, Vehicles	Number of People	Value of Structure and Contents
Residential	66	165	$8,460.4 K
Commercial	9	180	$18,960.0 K
Industrial (warehouse)	1	100	$11,400.0 K
Government property (airport)	1	125	$3,070.0 K
Aircraft and other vehicles	-	75	$10,000.0 K
Total Estimate of people	-	645	-
Total Estimate of loss	-	-	$51,890.4 K

Table 25. Path No. 2: Minimal Damage Scenario (Median Level F2 Tornado Path Length)

Type of Structure	Number of Structures, Vehicles	Number of People	Value of Structure and Contents
Residential	50	125	$760 K
Commercial	0	-	0
Industrial	0	-	0
Government property	0	-	0
Vehicles and other property	20	30	$200 K
Total estimate of people	-	150	-
Total estimate of loss	-	-	$960 K

Note: These losses are best estimates based on historical events and are given to illustrate two potential scenarios for tornado events in the City. The estimates are intended to provide a basis for visualizing the potential and prioritizing mitigation plans. These are only estimates; and damages and number of people exposed could change substantially with changes in location and characteristics of the tornado.

Tornados of the F4 classification are a very rare event for the entire State of Louisiana. Tornados are random events and predicting their occurrence is very problematic. The National Weather Service, who provided the information for this study, refrained from such predictions. If the past is a true reflection of the future, then one could conclude that based on regional history and the National Weather Service that a Level F2 tornado should occur every 4 years. The same data would suggest that the City of Monroe would experience a tornado once every 10 years. It should be sufficient to conclude that the area is susceptible and preparation for such an event is necessary.

The State HMP gives tornados a *Medium Risk* rating; however, in the opinion of the MHMSC, due to the amount of damage the City could sustain, especially if the tornado traveled the track identified as Path No.1 (**Table 24**) tornados are assigned *High Risk*.

6.1.4 Drought

Drought was a concern noted in the original plan; however, it was recognized that drought impacted the agricultural areas of the parish versus the City of Monroe. No loss estimation was calculated since the MHMSC concluded that drought was a *Low Risk* because the City draws its

potable water supply from the Bayou Desiard, Bayou Bartholomew, and the Ouachita River. Being a low risk hazard, wildfire will no longer be profiled.

6.1.5 Wildfire

Historically the City has never experienced a wildfire incident; although, it does not mean that during a period of severe drought, low humidity, high winds, and a source of fire ignition (e.g., lightning strike, arson, sparks from train) that a wildfire could not occur. While the city is vulnerable to wildfire, based on its history, this hazard is considered a *Low Risk*. Being a low risk hazard, wildfire will no longer be profiled.

6.1.6 Extreme Heat

According to Weather Underground data, summer temperatures range generally from the low 90s to mid 90s. Although summer temperatures in Monroe. According to the City Comprehensive Plan the highest temperatures occur generally from June through September with 95 degrees as the highest average and 82 degrees as the overall average during the summer season. No specific data regarding dollar loss due to extreme heat was available. The MHMSC has determined that extreme heat is considered *Low Risk*. Being a low risk hazard, extreme heat will no longer be profiled.

6.1.7 Severe Winter Storm

In determining Monroe's level of risk, it was assumed that the City's potential for a severe winter storm event was the same as for Ouachita Parish. In assigning level of risk the City is in agreement with the criteria as set out in the State HMP as described below.

Severe winter storm risk rating is based on the following criteria:

- *High Risk* is assigned if the jurisdiction has had more than four historical severe winter storms;
- *Medium Risk* is assigned if the jurisdiction has less than four but greater than one;
- *Low Risk* is assigned if the jurisdiction with no historical incidents.

Between 1994 and 2000, severe winter weather resulted in total damage of $1,570,300,000 or an annual average loss of $26,171,666. The 2010 storm data has not been reported to date. Employing the risk rating criteria above, the MHMSC has assigned severe winter storms with a *High Risk* rating.

6.1.8 Lightning

The average loss from lightning strikes since 1995 is $31,666. The MHMSC determined that dollar loss resulting from lightning relative to other major hazards (i.e., flood, wind, winter weather/ice storms, hazardous materials) lightning constituted *Low Risk*. Being a low risk hazard, lightning will no longer be profiled.

6.1.9 Hail Storm

While the NCDC has documented 31 hailstorm events (**Section 4.1.9**) since 1993, no property damage was reported. It is assumed that there could always be property damage if the size of the hail was of sufficient size to damage cars and buildings; however, since there hasn't been

any reported damage over the past 17 years, the MHMSC has assigned a *Low Risk* for hail storms. Being a low risk hazard, hailstorms will no longer be profiled.

No loss estimations were conducted because of the low level of risk based on loss data and the opinion of the MHMSC.

6.1.10 Earthquakes

No loss estimations were conducted for an earthquake event, because Monroe, while situated within the New Madrid Seismic Zone, it is on the outer fringe of the potential damage zone. Even the historic earthquake that struck New Madrid, Missouri, any impact in Louisiana was minimal. Based on historic record, the MHMSC determined that earthquakes were a *Low Risk* level. Being a low risk hazard, earthquakes will no longer be profiled.

6.2 TECHNOLOGICAL HAZARDS VULNERABILITY

6.2.1 Hazardous Materials

As described earlier, there are a number of businesses in Monroe that either use hazardous chemicals to produce products they manufacture or generate hazard waste as a result of their operations. The State has developed the following ranking methodology to establish whether particular local jurisdiction's risk to hazardous materials was *Low*, *Medium*, or *High*. The criteria were based on a population's exposure to hazardous materials. Populations were counted more than once where radii that surround a hazardous materials facility overlap, indicating that these populations are exposed to more than one facility. The MHMSC agrees with the methodology. The risk criteria for *Low*, *Medium*, or *High* ratings were based on population at risk within 1-mile radius of the fixed facility. The three levels of rating are:

- Assigning *High Risk* to parishes with affected population of greater than or equal to one thousand;
- Assigning *Medium Risk* to parishes with affected population is less than one thousand but greater than or equal to ninety; and
- Assigning *Low Risk* to parishes with losses less than ninety.

In Monroe, 2,477 people live within a 1-mile radius of one of the facilities listed in **Table 14**, Hazardous Materials – Fixed Facilities; therefore, the MHMSC has assigned this hazard a *High Risk* rating.

6.2.2 Levee Failure

According to the State HMP the vulnerability risk for Ouachita Parish was rated as high, because an estimated 15,945 people were at risk since they were resided adjacent to the levees. Thirty percent of the land in Monroe is within the 100-year flood zone. As depicted in **Figure 5**, repetitive loss properties are for the most part located within the 100-year flood zone. The State HMP assumed that any area adjacent to levee could be flooded. It estimated that 15,945 people could be potentially flooded if the levee along the Ouachita River was breached. Since the vast majority of the Ouachita River floodplain is located on the eastern side of the river, the MHMSC ranked levee failure as *High Risk*.

6.2.3 Dam Failure

As reported earlier, the two dams are well maintained and are monitoring frequently. Therefore, the MHMSC has assigned a *Low Risk* rating to dam failure.

6.3 COMMUNITY INFRASTRUCTURE VULNERABILITY

FEMA defines critical facilities as those structures and functions that are "essential to the health and welfare of the whole population and are especially important following hazardous events. The potential consequences of losing them are so great that they should be carefully inventoried. Consider the structure, contents, and effect of loss of services in the selection."

A careful examination was made of the various publicly owned facilities within the City expected to play a critical role in the response to a disaster. The disaster could be flood, tornado, or any incident that created a major threat to property and to the health and safety of the public. A list of critical facilities has been updated is found in **Appendix D**. In addition to assessing the vulnerability of the physical development of the city, the plan addresses a number of public facilities deemed essential to the City. They include stormwater, potable water supply, wastewater, fire-fighting facilities, educational facilities, and solid waste/landfills.

6.3.1 Stormwater Systems

The City completed an update of its Comprehensive Plan in 2008. That effort included conducting a series of public workshops. City residents were surveyed asking their opinion about a host of topics, stormwater being one. The residents identified stormwater/drainage as a key issue the City needed to place a high priority on addressing. Being situated on the Ouachita River and built on its floodplain, the City has historically been impacted as a result of major storm events. The 1927 flood might be termed the "flood of floods" for Monroe. As a result of that event, a levee was built along the city's western boundary that borders the river. It has been enhanced over the years as other flooding events have occurred. The first levee that was completed in 1932 was basically a dirt-berm levee. Following the 1957-58 floods, a walled levee, that extends today nearly the entire length of the City's western boundary, was constructed. These improvements along with increased attention given to clearing debris and vegetation in the levees and drainage corridors, has significantly reduced the magnitude of flood that occur in the past. However, flooding still occurs in areas where development is in low-lying areas, the majority of instances within the 100-year flood zone. Future growth in these areas should be discouraged, land use intensity and density of development reduced or at a minimum capped at present day limits. The City does have a drainage ordinance; however, even with that in place flooding still occurs just not as widespread as has been experienced historically. Most recently, flooding occurred as a result of Hurricane Gustav in 2008 (see **Figure 1**).

There are a number of areas around the City where localized flooding occurs due to undersized drainage culverts and ditches. Expanding or enlarging those drainage facilities would increase their capacities enabling them to handle the increased stormwater flows resulting from heavy rains. Some areas where this condition exists includes the East and West Rimes neighborhood, the area around the intersection of Indian Mound Boulevard and Pargold Boulevard, the Glenmar/Auburn neighborhood near the AL&M Railroad Line, and around the Winnsboro Road area that intersects with Alabama and Georgia Streets (R. Watkins, Drainage Supervisor, July 14, 2010, personal communication). A drainage study needs to be undertaken to identify where these areas are, improvements needed, the cost of making the improvements and the potential funding.

Normally, most stormwater drains by gravity flow from the city into the Ouachita River; however, during heavy rain events where the river exceeds 35" the floodgates are closed and stormwater buildup within the City now must be pumped over the levee into the river. The City has strategically installed eighteen (18) high capacity stormwater pumping stations in and around the 100- year flood zone. The pumps move large quantities of stormwater from the flood-prone areas to the Ouachita River and Bayou Desiard reducing significantly the opportunity for flooding. Many of these pumps are old. Some were installed back during WWII (R. Paulus, May 18, 2010, personal communication). Besides the need to repair or replace pumps, another key issue is power. Without power the pumps cannot be operated. The City has filed for a grant application with FEMA to allow them construct a number of improvements to upgrade key pumping stations. These improvements are been packaged and the City has submitted the application to GOHFEP and FEMA seeking HMGP funding (R. Paulus, City Engineer, March 17, 2010, personal communication). In addition, there are two other important projects needed to reduce the City's vulnerability to flood the Calypso Street stormwater station and Phillips Lake Drainage Project (C. Westrum, Sewer Manager, March 17, 2010, personal communication). The Calypso Street project is especially important since this pump keeps downtown Monroe "dry." The parish courthouse, St. Francis Hospital, city hall and the civic center are all located in downtown.

Numerous other properties lying in the 100-year flood zone throughout the City remain vulnerable because of backwater from Bayou LaFourche and Young Bayou. LaFourche Canal which lies south of the City is the major conduit for stormwater flowing from the City. Its ability to transport stormwater from Youngs Bayou and other sources in the City is hampered when the canal is at or above flood stage. Some means is needed to effectively control the backwater from Bayou LaFourche while ensuring stormwater can be effectively removed from the City.

Debris and vegetation collects in the canals and bayous impeding the natural flow of stormwater water from the City. The canals and bayous need reassessing to ensure the system is adequately maintained and optimized in its ability to transport stormwater.

Water is incessant in its ability to undermine and overwhelm even the best efforts, so it is essential for the City to be diligent in its work to continually improve flood control. Moving stormwater from the City is a major concern and predictably, some degree of flooding within the City occurs annually even though significant measures have been taken to control sheet flooding during heavy downpours. The structures on the target list are the most susceptible. Progress has been made; however, much more is required to gain control over flooding.

6.3.2 Potable Water System

In the process of examining potential damages from flood and tornados, a thorough examination of the potable water was made to estimate the extent of the damage that could be expected. The water plant has never been flooded. The base elevation of the main plant is 77.17 ft. The basement elevation is 65.08 ft, but contains no critical equipment.

The water system is dependent to the greatest degree on the booster stations located at numerous places throughout the City and the water treatment plant. There are two elevated tanks but they only represent about a four-hour supply of potable water under reduced use imposed during emergencies. Two primary vulnerabilities to the primary potable water system exist:

1. The location of the water treatment chemicals in a metal building atop the main treatment facility is not constructed to withstand the brunt force of a Level F2 tornado. The main water treatment building is heavily constructed and the damage to it is projected to be minor (windows, etc.). The metal chemical storage building would most likely experience heavy damage with a high probability for the loss of the building and chemicals. The loss would shut the plant down since it cannot function without the chemicals.
2. Originally, the water treatment plant was constructed with two electrical power feeds so that if one should fail, the other could be brought on line. The current provider of electrical power has eliminated one of the feeds making the plant dependent on a one-source power system. Major damage to the single power source could render the plant inoperable for an extended time.

6.3.3 Sewage Handling and Treatment Facility

The City sewage system was evaluated for susceptibility to damage from floods and tornados. Floods and heavy rain pose the greatest threat to the sewage system. The sewer system is old and has been in need of serious repair or replacement. The City was placed under a Consent Order by the U.S. EPA in 1997. A study was prepared to assess the ability of the existing trunk sewer system, major pump stations, and the wastewater plant and their ability to convey and treat wet weather flows that occur during rainfall events. Much of the collection system predates WWII. Due to the age of the system, there have been significant issues relative to infiltration and inflows (I/I) and loss of capacity through sediment, roots, and grease accumulations. These conditions have impeded sewerage flow to the wastewater plant and have created significant backups where the I/I becomes ponded thus potentially leading to a potential public health issue due to the contamination of the ponded water. The system rehabilitation program began in 2001. When completed 150 miles of sanitary sewer will be been rehabilitated. The project is being financed through a bond issue.

Besides its wastewater treatment plant, the City operates 73 sewer lift stations. The sewer department has one portable generator built in the 60s or 70s that is capable of running ONE of the smaller lift stations, and that can be spotty from time to time. That leaves 72 sewer lift stations nonfunctional during times when the there is the greatest need.

Previously the City sewage system was evaluated for susceptibility to damage from a Level F2 tornado. The sewage treatment plant, lift stations and other components that make up the system were also considered. It was concluded that the system is largely protected from high winds by the very nature of its construction. Most of the facility is underground or protected by well-built concrete and brick structures above ground. The most serious threat would be from flying debris. Regardless, the threat to the system is projected to be minor even in event of an F2 tornado and service could be maintained or restored in a reasonable timeframe.

As the sewage system is updated it remains vulnerable to the electrical power required to keep the treatment plant and the lift stations in service.

6.3.4 Other Critical Facilities

Besides the stormwater, potable water, and sewerage system, there are a number of other public/private facilities that support critically essential services either prior to, during, or during the recovery phases of a disaster event. They include: public safety (e.g., fire services, hazardous materials), schools, solid waste/landfill, and hospitals).

Fire Department

The City has nine fire stations. The Monroe Fire Department maintains a medical emergency response capability and sends an emergency medical technician (EMT) each time they dispatch Fire Department equipment. The City also maintains a contract with a medical transportation provider to transport the injured to the local hospitals. The use of EMTs assures there will be medical assistance available to send to the scene to manage the situation until the injured can be transported to a local hospital. The City capability is reinforced by the presence of other similar operations in the region that can be called on for assistance in times of dire emergency. The Fire Department also is responsible for responding to hazardous materials incidents such as chemical spills, train derailment, and freight truck accidents. While the City knows that there is a significant amount of and variety of hazardous type materials that are transported through the city via rail, truck, and vans, the city has never completed a commodity flows study that would assist in better defining the types of hazardous products pass through the city.

Fire Station

There are nine fire stations located throughout the city (**Table 25**). Station #2 is a part of the Public Safety Complex where the Monroe Fire Department is headquartered and where there has been no incident of a fire station being compromised due to a disaster event. There is a need to evaluate the structural integrity of each station in order to ensure that fire service can be dispatched from any of its stations during a major disaster event.

Table 26. Fire Stations in the City of Monroe

Fire Station	Location
#1	508 Olive Street
#2	1810 Martin Luther King Jr. Drive
#3	3702 Barbados Boulevard
#4	300 Forest Avenue
#5	3110 Breard Street
#6	2001 Forsyth Avenue
#7	5601 Transport Avenue
#8	1204 Richwood Road
#9	1015 Inabinet Boulevard

Source: City of Monroe Fire Department.

Educational Facilities

Within the City there are 18 school facilities operated by the Monroe School District. These facilities have served as emergency shelters. Should there be a need to use school facilities, a decision on which schools to open as a shelter(s), the city would coordinate with the Monroe City Schools. In the past, however, the Monroe Civic Center has been the city's primary shelter facility.

It is important that the schools could potentially serve as primary public shelters that are "hardened" as well as meet the requirements out in ARC 4496 *Standards for Hurricane Evacuation Shelters*. Tornados are a hazard that is especially dangerous not only in terms of damage that might be inflicted on school buildings, but probably more importantly the serious risk to the students, faculty and school staff. Having a plan in place prior any disaster event and

making sure the plan is exercised can go a long way towards ensuring the safety of the school population. A listing of the schools is found in the **Appendix E**.

Also, in Monroe there are two higher-level educational institutions, ULM, and the Delta Community College.

Solid Waste

While the City Public Works Department provides sanitation services for residents of the City of Monroe. Following a hurricane or major flood event or possible a major winter storm a significant amount of debris may be generated. It is incumbent that such events should be pre-planned to ensure that there are adequate sites available for storage of temporary debris. Also, a number of cities have pre-arranged agreements with contract debris haulers so at the time of a disaster they are able to quickly begin the cleanup phase. Another issue has been the issue of hauling waste debris from private property. Jefferson Parish has enacted an ordinance a Right-Of-Entry/Hold Harmless Agreement for Assistance with Private Property Debris Removal.

Hospitals

While the area hospitals are privately owned, they need to be accounted for in the HMP. Five hospitals are located in the City of Monroe and provide services to residents: St. Francis Medical Center, St. Francis North Monroe Medical Center, P & S Surgical Hospital, Monroe Surgical Hospital, and E.A Conway Medical Center. In addition to the five hospitals in the City of Monroe, residents also have access to Glenwood Regional Medical Center, which is located in the nearby City of West Monroe. Clinic services are available at the Ouachita Parish Health Unit at 1650 Desiard Street. Certainly Hurricane Katrina was not necessarily a typical hurricane; hospitals in New Orleans were devastated. While the magnitude of such a storm may not extend as far inland as Monroe, it does emphasize the need that our medical establishments need to make sure they can operate in trying conditions where hazards such as floods, tornados, and straight-line winds create a situation where medical needs become severe due to the disaster event.

6.3.5 Historical Sites

There are 21 properties listed on the National Register of Historic Places. These cultural resources are irreplaceable. While there may be higher priority mitigation projects, other places have taken steps to protect their historical heritage. In Fernandina Beach, Florida, a study was undertaken to catalogue each historical structure so should a major wind event occur and a historic structure receive significant damage, the organization and/or owner of the structure has sufficient information that the historic structure can be restored.

6.4 COMMUNITY DEVELOPMENT TRENDS AND INSTITUTIONAL ASSESSMENT

According to the U.S. Census report, 2009 *Annual Estimates of the Resident*, the City of Monroe has experienced a very slow decline in population from 53,013 in 2000 to 51,215 as of July 1, 2008. However, with an estimated 2000 jobs being created due to the opening of the V-Vehicles plant and the expansion of the Gardner Denver-Thomas pump manufacturing plant, it is anticipated that this may usher in new era of economic expansion. Also, the updated Comprehensive Plan contains a vision that sees a revitalized downtown focused on taking

advantage of the natural beauty of the Ouachita River as well as the many bayous in and around the City. The Plan also emphasizes the importance of the ULM and the Louisiana Delta Community College to the community's overall quality of life and economic diversity of Monroe. Finally, it recognizes the unique identity and value that its historic and cultural resources provide the city as it seeks to enhance its tourism base. Twenty-one historic properties are listed on the National Register of Historic Places. As the City seeks to implement its vision for the future, it is important that it incorporates the principle of resiliency into its Comprehensive Plan thereby enabling quicker recovery from a disaster event. Of the 15,118 acres of land within Monroe, 4,571 acres (30.2%) are in residential use. 24.6% or 3,724 acres still remain in vacant use. A major portion of the residential properties are situated within the 100-year floodplain. It is not surprising that the vast majority of repetitive loss and severe repetitive loss properties are residential. In those areas that are prone to flooding, the City should revisit its Comprehensive Plan and study the planned densities and intensities of its uses in the hazard risk areas, and either reduce the densities and intensities or make sure that structural steps are taken to reduce the flood potential to these properties. Sooner or later there will be a major rain event as experienced in Nashville in 2010. Monroe's past history tells you that it can happen – 1927, 1932, 1991. The key is to be ready, to plan smart, and have a strategy in place so that it can recover quickly, and have measures in place so that redevelopment is done in a way that achieves long-term resiliency.

A discussion of relevant plans, regulations, and programs is found in **Section 8**.

7 HAZARD MITIGATON STRATEGY

7.1 MITIGATION STRATEGY DEVELOPMENT

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The hazard mitigation strategy begins with a description of the Parish's mitigation goals and objectives. The goals are broad concepts, which taken together provide a framework for carrying out the plan's intent to mitigate the previously identified risks and are expressed in a manner that reflects the City's values and culture. For each goal there are a series of objectives in the form of specific actions, each designed to carry out an element of the overall intent expressed in the goal.

The goals and objectives are followed by a series of specific projects, which are intended to implement the actions expressed in the objectives and form the core of the HMP. At a minimum, each project contains a brief description, an approximate cost, the name of the sponsoring agency and contact information, a benefit/cost review, and a proposed timeframe for implementation. Some of the larger projects involving construction are further developed to include all of the engineering and cost elements necessary to complete a federal grant application when funding becomes available.

Because funding is so limited and the opportunity to take advantage of it is often short, it is important that projects be prioritized prior to funding becoming available. Since the majority of federal funding is provided in the aftermath of a disaster, agreement on funding priorities during the pre-disaster "blue sky" period can help resist the pressure to select projects based on short term and often political needs at the expense of the community's long-term goals. The method adopted by the MHMSC provides a clear vision and strategy for the needs of the City. The individual Committee members used the following criteria to prioritize and rank future mitigation activities: 1) prudent use of available resources, 2) compliance with the U.S. EPA sewage system mandate, 3) project feasibility, and 4) optimization of cost-to-public benefit. The measures were discussed in detail after which each member of the MHMSC was given an equal and independent vote in the ranking process.

7.2 GOALS AND OBJECTIVES

When the 2004 HMP was prepared, the MHMSC and its consultant decided to restrict its mitigation efforts to two hazards — flood and tornados. For flood hazards, six goals were developed along with an objective and measure for each. For tornado hazards, four goals were developed along with an objective and measure for each.

Also, in reviewing the goals contained in the 2004 HMP, it was felt that many were not really broad policy statements as defined in the FEMA 2008 Guidance document but as written were more like objectives – "defining strategies or implementation steps to attain identified goals." The goals and objectives therefore have been revised to reflect FEMA guidance.

In the revised set of goals and objectives, all goals, objectives, and measures listed in the 2004 HMP have been taken into account in this plan update. The only goals or objectives that were accomplished were those that were the achieved since 2004 such as Goal 3 – *Provide appropriate on-site command and control capabilities*. This was realized when the city purchased its new mobile command center. As indicated at the beginning of this HMP, goals focus on minimizing damage to property and protecting the health and safety of the citizens of Monroe. No goals have been established where only emergency response is involved. Such needs have been left to the appropriate emergency response organizations.

Goals: Are general guidelines that explain what you want to achieve. They are usually broad policy statements, long term in nature.

Objectives: Define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Actions: Are specific projects or initiatives to be implemented in achieving goals and objectives.

Source: FEMA Local Mullti- Hazard Mitigation Planning Guidance, July 1, 2008

Goal 1: Protect Life and Property

Objective 1.1 Identify “at risk” populations’ issues and needs relating to emergency events.
Objective 1.2 Continue to participate in the NFIP and improve CRS rating.
Objective 1.3 Address repetitive loss and severe repetitive loss structures.
Objective 1.4 Achieve Ouachita River floodwall recertification.
Objective 1.5 Retrofit critical facilities to become more disaster resilient.
Objective 1.6 Protect the health of the community by reducing sewer line infiltration/inflow.
Objective 1.7 Promote the integration of “safe room” concept in all new construction and rehabilitation.
Objective 1.8 Enforce buffering standards for all trees, cable lines, power lines, and other wind-vulnerable infrastructure.
Objective 1.9 Invest in structural projects that reduce damage risk to properties and infrastructure.
Objective 1.10 Reduce isolated localized flooding on the southeast boundary of the city.
Objective 1.11 Evaluate the disaster resiliency of historical structures.

Goal 2: Ensure Emergency Services

Objective 2.1 Alert the community of all potential imminent emergency events.
Objective 2.2 Provide dependable electrical power is available to critical facilities during times of emergency.
Objective 2.3 Increase fire service area protection.
Objective 2.4 Establish a high level of emergency response services for all hazard risks.

Goal 3: Increase Public Preparedness

Objective 3.1 Increase youth awareness of emergency events and mitigation efforts.
Objective 3.2 Heighten community awareness of disaster risk.
Objective 3.3 Publicize and encourage the adoption of appropriate hazard mitigation policies and programs.
Objective 3.4 Inform the community of public and private insurance programs.

Goal 4: Establish and Strengthen Partnerships for Implementation

Objective 4.1 Establish and maintain lasting governmental partnerships with Ouachita Parish, relevant State of Louisiana agencies (e.g., GOHSEP, Louisiana Recovery Authority (LRA), LA DOTD, and FEMA.

Objective 4.2 Find opportunities to work with private organizations (e.g., Monroe Chamber of Commerce, University of Louisiana at Monroe) for the common good of mitigating disaster risk throughout Monroe.

Goal 5: Preserve or Restore Natural Resources

Objective 5.1 Enhance the bayous as natural resource assets while at the same time maintaining their ability to transport stormwater.

Objective 5.2 Ensure an adequate level of service for all drainage systems.

Goal 6: Promote a Resilient Economy

Objective 6.1 Increase public awareness of public and private insurance programs.

Objective 6.2 Encourage businesses to have continuity plans and employees to have family emergency plans.

7.3 MITIGATION ACTION CATEGORIES

FEMA has identified six broad categories of mitigation actions: 1) prevention, 2) property protection, 3) public education and awareness, 4) natural resource protection, 5) emergency services, and 6) structural projects. All six mitigation action categories are included in the City of Monroe HMP. The following definitions were included in the FEMA How to Guide 3: Developing the Mitigation Plan (FEMA 386-3, 2008).

1. **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
2. **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
4. **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, steam corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
5. **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

6. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

7.4 STATUS OF 2004 HMP MITIGATION ACTIONS

The 2004 HMP included 10 hazard mitigation projects. During the update process, the progress of each project was discussed and is described in **Table 27** below. The MHMSC reviewed each project and indicated whether those not completed or in limbo due to funding limitations should be included in the 2010 HMP Update. **Section 7.6.1** lists those projects carried over into the new HMP.

Table 27. Status of Previous HMP Mitigation Actions

Mitigation Action (Measure)		Completed	Ongoing	Deleted	Deferred	Unchanged	Status Description
Project Title	**Description**						
Bayou Laforche Levee & pumps	Construct proposed levee with gates along the southeast boundaries of the City and install pumping stations.	√					Plans are completed.
Backup/Redundant Systems	Provide backup or redundancy in the electrical power to critical city services including primary power stations, primary emergency shelters, potable water, sewage systems, and emergency responder facilities.		√				Have applied for three generators. Not funded to date.
Repair, Upgrade City Sewer System	Repair, upgrade, or replace the defective components in the City sewer system that allows stormwater to flood the system and cause an overflow of raw sewage.		√				This $100M action is mandated by EPA and is currently underway. City estimates that the project is 60% complete.
Audible Warning System	Install and maintain a system that will provide an audible means of emergency warning so those at-risk citizens have adequate time to take effective protective measures.	√					System has been installed and is now functional.

Mitigation Action (Measure)		Completed	Ongoing	Deleted	Deferred	Unchanged	Status Description
Project Title	**Description**						
Strengthen Chemical Storage Building	Improve structural integrity of the chemical storage building at the water treatment plant, including its ability to withstand wind loads of at least 100 mph.				√		Not upgraded yet. City is accumulating revenue from increased water rates to fund project. The current storage building is a metal siding covered structure that is not capable of withstanding any significant wind load. A new $250K structure will be built to code and protected to ensure the water treatment function stays on line.
Upgrade Mobile Command Center	Upgrade mobile command center to incorporate the capabilities needed to provide adequate communication to rapidly gather information and control the emergency response activities at the site.	√					Command Center has been completed; however, City indicated that system is only 80% effective because it doesn't yet have system wide interoperability.
Clean Debris in Bayous	Clean debris and otherwise improve the ability of the bayous within the City to more effectively transport stormwater from the City.		√				While City does clean debris from bayous, due to underfunding, progress has been limited. Suggestion by 2010 MHMSC is to develop a strong public education program to reach the public and raise awareness of problem and what residents can do to eliminate problem.
Bayou Maintenance Program	Develop, install, and maintain a sustainable bayou and canal maintenance program.			√			Due to lack of funding, maintenance program has not been implemented to date. Action still remains valid.
Update FIRM	Update the FIRM with new hydraulic studies, establish with FEMA the at-risk structures, and take whatever action is appropriate to remove or minimize the remaining potential for property loss.		√				Updated FIRM maps have been completed. Presently under public scrutiny. This Action is now incorporated into Action 20, City-wide Drainage Study.

EPA = Environmental Protection Agency; FEMA = Federal Emergency Management Agency; FIRM = Flood Insurance Rate Map.
Source: 2004 HMP and 2010 MHMSC input.

7.5 DESCRIPTIVE CRITERIA FOR MITIGATION ACTIONS

Implementing appropriate mitigation actions allows the City of Monroe to successfully achieve its mitigation goals and objectives. MHMSC members have participated in identifying and analyzing a comprehensive range of mitigation actions.

As described in **Table 27**, the following criteria was used by the MHMSC to evaluate and prioritize each mitigation action: 1) HMP objective addressed, 2) Mitigation action category, 3) cost, 4) funding source(s), 5) lead departments, 6) timeline, 7) benefit, 8) life of measure, and 9) community reaction. Evaluation criteria for mitigation actions are described in more detail in **Table 28**.

Table 28. Comprehensive Evaluation Criteria for Mitigation Actions

Criteria	Measure
1. Hazard(s) Addressed	Measure type of hazard
2. Objective(s) Addressed	What mitigation objective does the measure address?
3. Mitigation Action Category	What mitigation action category does the measure constitute?
4. Estimated Cost of Measure	How much will the mitigation action cost to implement?
5. Funding Source(s) and Situation	Local budget.
	State and federal grants (specific grant programs, if identified).
	Additional grant source (specific grant programs, if identified).
	No potential funding source can be readily identified.
6. Lead Department(s)	The department(s) implementation the mitigation action.
7. Timeline	**Achieved:** Action has already been achieved by the City of Monroe.
	In-progress: Measures are activities, which the City of Monroe already implementing.
	Short Term: Measures are activities, capable of implementing within one to two years.
	Long Term: Measures may require new or additional resources or authorities, and may take between one and five years to implement.
8. Benefit	Jurisdiction wide benefits or location specific benefits.
9. Life of Measure	Lifespan of benefits.
10. Community Reaction	The proposal is likely to be endorsed by the entire community.
	The proposal would benefit those affected, with no adverse reaction from others.
	The proposal would be somewhat controversial.
	The proposal would be strongly opposed by most.
	The proposal would be strongly opposed by nearly all.

7.6 MITIGATION ACTIONS

During the development of the 2004 HMP, the MHMSC decided that implementing actions would be developed only for flood and tornados. However, it "acknowledged that other related topics might be considered in the goals when such issues are pertinent." The MHMSC and its consultant reassessed hazards in the 2010 HMP Update and have identified additional hazards that are worthy of consideration. They include: high wind – tropical storms/hurricanes, hazardous materials – fixed facilities and transportation systems, and winter weather/ice storms. The MHMSC concluded that hail, extreme heat, drought, lightning, and earthquakes were *Low*

Risk hazards and would not be addressed this time. However, these hazards may be revisited when such issues are pertinent.

The 2010 HMP Update contains 25 Actions. Each of these mitigation actions is described in more detail in **Sections 7.6.1** and **7.6.2**. **Table 29** relates the Actions to hazards. Some Actions are applicable to all hazards therefore they are listed under the All-Hazards category.

Table 29. Actions by Hazard Type for City of Monroe

Hazard	Action Number and Title	
All – Hazards	**Action #1**	Auxiliary Power Sources for Critical Infrastructure
	Action #6	School-based Multi-Hazard Education Program
	Action #12	Mitigation Planning Coordination
	Action #13	Comprehensive Plan Revision
	Action #14	Zoning Ordinance Revision
	Action #18	Structural Assessment of Fire Stations
	Action #19	ULM Emergency Management Plan
Flood	**Action #2**	Sewer System Rehabilitation
	Action #4	Storage Capacity Enhancement of Bayous and Drainage Canals
	Action #5	Debris Reduction Public Outreach Program
	Action #7	Recertification of Floodwall Levee
	Action #9	Community Rating System (CRS) Strategy
	Action #10	Hazard Mitigation Plan for Historic Structures
	Action #11	Transportation Evacuation Study
	Action #15	Calypso Street Stormwater Station Reconstruction
	Action #16	Phillips Lake Drainage Project
	Action #17	Storm Drainage Pump Stations Upgrades
	Action #18	Structural Assessment of Fire Stations
	Action #20	Citywide Drainage Study
	Action #21	Storm Drain Cleanup Program
	Action #24	Airport Canal Erosion Project
	Action #25	Long-Term Post-Disaster Redevelopment Plan
High wind – Thunderstorms, Tropical Storms/Hurricanes	**Action #3**	New Chemical Storage Building
	Action #10	Hazard Mitigation Plan for Historic Structures
	Action #11	Transportation Evacuation Study
High Wind – Tornados	**Action #3**	New Chemical Storage Building
	Action #10	Hazard Mitigation Plan for Historic Structures
	Action #25	Long-Term Post-Disaster Redevelopment Plan
Levee Failure	**Action #7**	Recertification of Floodwall Levee
Severe Winter Weather/Ice Storms	**Action #22**	Weatherization Assistance Program
	Action #23	Weatherization/Hazardous Materials Education Program
Hazardous Materials – Fixed Facilities/Transportation Systems	**Action #8**	Commodity Flows Study
	Action #23	Weatherization/Hazardous Materials Education Program

ULM = University of Louisiana at Monroe.

7.6.1 Projects/Initiatives from 2004 HMP

Action 1: Auxilary Power Sources for Critical Infrastructure

Provide portable generators and backup or redundancy in electric power to critical city services including primary power stations, primary emergency shelters, potable water, sewage systems (73 sewer lift stations), and emergency responder facilities.

- Secure emergency generators.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 1.5, 2.2
  - **Mitigation Action Category(s):** Emergency Services
  - **Estimated Cost of Measure:** $ 5,000,000
  - **Funding Source(s) and Situation:** Local Revenues
  - **Lead Departments(s):** Monroe Public Works Department
  - **Timeline:** Long term
  - **Benefit:** Citywide
  - **Life of Measure:** Ongoing
  - **Community Reaction:** Ensuring that the City has adequate power during disaster events is strongly supported by the entire community

Action 2: Sewer System Rehabilitation

This $100 million action was mandated by the USEPA in 1999. It is currently well underway. It provides for safe transport of sewage from the city and prevents the danger of diseases that result from raw sewage that percolates to the surface once the ground is saturated after heavy downpours. This project is approximately 60% complete.

- Continue sewer line rehabilitation program.

  Hazard(s) Addressed: Flood

  - **Objective(s) Addressed:** 1.6
  - **Mitigation Action Category(s):** Prevention; Emergency Services
  - **Estimated Cost of Measure:** $100,000,000
  - **Funding Source and Situation:** Sewer User Fees, Infrastructure Sales Tax, State Revolving Loan; and LA Department of Environmental Quality
  - **Lead Departments(s):** Monroe Project Management Division, Infrastructure Program
  - **Timeline:** Long term
  - **Benefit:** Citywide
  - **Life of Measure:** 50 years
  - **Community Reaction:** The proposal is endorsed by the entire community

Action 3: New Chemical Storage Building

The structural integrity of the existing metal-sided covered chemical storage building located at the water treatment plant is not capable of withstanding wind loads of at least 100 mph needed to significantly reduce the potential of chemical spills potentially resulting from damage to the chemical storage building.

- Construct new chemical storage building that meets 100-mph wind load.

  Hazard(s) Addressed: High Wind – Thunderstorm; Tropical Storms/Hurricanes

  - **Objective(s) Addressed:** 1.5, 1.9
  - **Mitigation Action Category(s):** Prevention
  - **Estimated Cost of Measure:** $250,000
  - **Funding Source(s) and Situation:** Local revenues
  - **Lead Departments(s):** Monroe Public Works Department
  - **Timeline:** Short term
  - **Benefit:** Citywide

- **Life of Measure:** 50 years
- **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 4: Storage Capacity Enhancement of Bayous and Drainage Canals

Historically, debris has created a major problem impeding the flow of stormwater in the drainage canals thus reducing storage capacity especially those located in the 100-year flood zones.

- Through the combined efforts of the Public Works and Engineering Departments, develop and implement a sustainable bayou and canal program that either enhances or restores the capacities of the bayous and drainage canals. Other than general revenue, another funding alternative could be for the city to establish special stormwater taxing districts for areas within the 100-year flood zones.

  Hazard(s) Addressed: Flood

  - **Objective(s) Addressed:** 5.1, 5.2, 1.10
  - **Mitigation Action Category(s):** Prevention; Natural Resource Protection
  - **Estimated Cost of Measure:** $30,000
  - **Funding Source(s) and Situation:** Hazard Mitigation Grant Program (HMGP), Local revenues; special taxing district revenue
  - **Lead Departments(s):** Monroe Public Works Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** 50 years
  - **Community Reaction:** The proposal is likely to be supported by the community

Action 5: Debris Reduction Public Outreach Program

- Develop a public outreach program focused on debris reduction in the City's drainage canals. Working through the Beautification Department, pattern a program following its annual fall volunteer cleanup along Bayou Desiard and the Ouachita River.

  Hazard(s) Addressed: Flood

  - **Objective(s) Addressed:**1.5, 1.9
  - **Mitigation Action Category(s):** Prevention; Natural Resource Protection
  - **Estimated Cost of Measure:** $5,000
  - **Funding Source(s) and Situation:** Louisiana Litter Abatement Grant
  - **Lead Departments(s):** Monroe Beautification Department; Monroe Public Works Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** Ongoing
  - **Community Reaction:** It is expected that the proposed project would have the support of the public

7.6.2 New Projects/Initiatives Resulting from 2010 HMP Update

Action 6: School-based Multi-Hazard Education Program

Disaster and emergency preparedness education for the City of Monroe's youth population is an important tool to reduce hazard vulnerability in Monroe. Monroe City Schools shall integrate a multi-hazard education program into all grade levels. The Red Cross program "Masters of

Disaster" is a useful model to establish a curriculum-based education program for City of Monroe schools.

- Incorporate a multi-hazard education program into all City of Monroe school curriculums.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 3.1, 3.2
  - **Mitigation Action Category(s):** Public Education and Awareness
  - **Estimated Cost of Measure:** $30.80 per student
  - **Funding Source(s) and Situation:** No Cost – American Red Cross Supplies Materials
  - **Lead Departments(s):** Monroe City Schools
  - **Timeline:** Short term
  - **Benefit:** City-wide
  - **Life of Measure:** Ongoing
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 7: Recertification of Floodwall Levee

The Tensas Basin Levee Board is actively pursuing recertifying the floodwall along the Ouachita River. Recertification is absolutely essential to ensure that City of Monroe homeowners' NFIP flood insurance premiums remain at current levels.

- The Monroe City Council will provide the TBLB with a formal letter strongly supporting the recertification of the floodwall along the Ouachita River.

  Hazard(s) Addressed: Levee Failure; Flood

  - **Objective(s) Addressed:** 1.4
  - **Mitigation Action Category(s):** Prevention
  - **Estimated Cost of Measure:** No cost
  - **Funding Source(s) and Situation:** None needed
  - **Lead Departments(s):** Planning and Urban Development Department; City Council
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** Until recertification is achieved
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 8: Commodity Flows Study

- Conduct a transportation chemical commodity flows study.

  Hazard(s) Addressed: Hazardous Materials – Fixed Facilities/Transportation Facilities

  - **Objective(s) Addressed:** 3.1
  - **Mitigation Action Category(s):** Prevention
  - **Estimated Cost of Measure:** $75,000
  - **Funding Source(s) and Situation:** U.S. Department of Transportation and LA DOTD - Hazardous Materials Emergency Preparedness Grant
  - **Lead Departments(s):** Monroe Fire Department; Ouachita Local Emergency Planning Committee
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** Perpetual
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 9: Community Rating System (CRS) Strategy

The City of Monroe participates in the CRS program. If the City can improve on its current CRS rating of 9, it can provide its residents with lower NFIP flood insurance premiums.

- Develop strategy that identifies actions the city can take to enhance its CRS rating.

  Hazard(s) Addressed: Flood

  - **Objective(s) Addressed:** 1.2, 1.3, 1.5, 3.2, 3.3, 3.4
  - **Mitigation Action Category:** Prevention; Property Protection; Public Education and Awareness
  - **Cost of Measure:** $2,500 to $10,000
  - **Funding Source and Situation:** Local revenues, HMGP
  - **Lead Departments(s):** Planning and Urban Development Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** Ongoing
  - **Community Reaction:** The proposal is very likely to be endorsed by the entire community

Action 10: Hazard Mitigation Plan for Historic Structures

The city has 21 structures on the National Register of Historic Places. Should a major disaster event occur in Monroe, it is likely that one or more of the historic structures could suffer significant damage. This effort should be coordinated with the Louisiana Historic Preservation Division, which has lead authority for historic preservation in the state.

- Conduct a study that includes a highly detailed structural inventory of historic buildings within the City that are listed on the National Register of Historic Places, an analysis of the vulnerability of each structure to high winds and flood, and a recommended actions needed to be taken to create more resilient historic structures.

  Hazard(s) Addressed: Flood; High Wind – Thunderstorms; Tropical Storms/Hurricanes; High Winds – Tornados

  - **Objective(s) Addressed:** 1.11
  - **Mitigation Action Category:** Prevention; Property Protection
  - **Cost of Measure:** $75,000
  - **Funding Source and Situation:** HMGP
  - **Lead Departments(s):** Planning and Urban Development Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** Ongoing
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 11: Transportation Evacuation Study

Working with the North Delta Regional Planning and Development District, identify those roadway links that frequently flood, impeding or jeopardizing evacuation during flood events. The City needs to coordinate this planning effort with Ouachita Parish Office of Homeland Security and Emergency Preparedness. The results of the study should be integrated into the North Delta Long-Range Transportation Plan and Transportation Improvement Program.

Hazard(s) Addressed: Flood; High Wind – Thunderstorms; Tropical Storms/Hurricanes; High Winds – Tornados

- **Objective(s) Addressed:** 1.5, 1.9, 4.1
- **Mitigation Action Category:** Prevention; Property Protection; Public Education and Awareness
- **Cost of Measure:** $50,000
- **Funding Source and Situation:** Federal Highway Administration /MPO; HMGP
- **Lead Departments(s):** Monroe Planning and Urban Development Department; North Delta Regional Planning and Development District
- **Timeline:** Short term
- **Benefit:** Citywide
- **Life of Measure:** Perpetual
- **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 12: Mitigation Planning Coordination

The City of Monroe shall coordinate its mitigation planning with surrounding parishes, cities, and towns. Such coordination includes maintaining involvement in the Region 8 Emergency Management and Homeland Security District. This provides opportunities for the city to work with its neighboring parishes and cities to create coalitions on issues of disaster preparedness and mitigation. For example, the city can coordinate on planning issues with the North Delta Regional Development and Planning District on evacuation matters or formulate a regional emergency management strategy. It is imperative that the city be active in the planning activities of Ouachita Parish, especially relating to projects such as its local HMP Update.

- Attend all relevant disaster mitigation seminars and meetings with various regional, parish, or municipal organizations.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 3.2, 3.3, 4.1, 4.2
  - **Mitigation Action Category(s):** Prevention; Public Education and Awareness
  - **Cost of Action:** $5,000
  - **Funding Source(s) and Situation:** Local Revenues
  - **Lead Department(s):** Monroe Fire Department; Planning and Urban Development Department
  - **Timeline:** Short-term
  - **Benefit:** Citywide
  - **Life of Action:** Ongoing
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 13: Comprehensive Plan Revision

While the City Comprehensive Plan was completed in 2008, the city planning staff needs to review the new Comprehensive Plan from the perspective of a hazard planner. In addition, the City has indicated that with the completion of the new Comprehensive Plan, it intends to review zoning ordinances and make appropriate changes.

- Review and upgrade the existing Comprehensive Plan to incorporate hazard considerations.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 3.3, 4.1, 4.2, 6.1, 6.2
  - **Mitigation Action Category(s):** Prevention; Public Education and Awareness

- **Cost of Action:** $50,000
- **Funding Source(s) and Situation:** LA Community Resiliency Grant
- **Lead Department(s):** Planning and Urban Development Department
- **Timeline:** Short term
- **Benefit:** Citywide
- **Life of Action:** Ongoing
- **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 14: Zoning Ordinance Revision

- **Action 15:** Review and update existing Zoning Ordinance to incorporate hazard considerations.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 1.2, 1.7, 1.8, 3.3, 5.2
  - **Mitigation Action Category(s):** Prevention; Public Education and Awareness
  - **Cost of Action:** $100,000
  - **Funding Source(s) and Situation:** LA Community Resiliency Grant
  - **Lead Department(s):** Planning and Urban Development Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Action:** Ongoing
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 15: Calypso Street Stormwater Station Reconstruction

The Calypso Street stormwater station presents a flood danger to the City of Monroe when the Ouachita River is at or above 48.5 feet. This particular pump station protects against the flooding of downtown, the parish courthouse, St. Francis Hospital, City Hall, and the Convention Center. The top of the levee is at 53.5 feet, which means that the station would flood the City five feet before the river reaches the top of the levee floodwall. As of today, the station is also compromised by visible cracks, leaving the pumps in jeopardy of total collapse.

- Elevate floor of pump station, modify piping, and replace all three pumps and controls.

  Hazard(s) Addressed: Levee Failure; Flood

  - **Objective(s) Addressed:** 1.5, 1.9
  - **Mitigation Action Category(s):** Prevention; Structural Project
  - **Cost of Action:** $750,000
  - **Funding Source(s) and Situation:** HMGP; Local Revenues
  - **Lead Department(s):** Public Works Department
  - **Timeline:** S**hort term**
  - **Benefit:** Citywide
  - **Life of Action:** 50 years
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 16: Phillips Lake Drainage Project

All storm water from the surrounding subdivisions flows into Phillips Lake. When the Ouachita River is low, any excess water in Phillips Lake gravity flows into the Ouachita River through a Tensas Basin flap-gated drain. The flap gate is closed when the Ouachita River is at or above 35 feet. There is no path for stormwater drainage after the flap gate is closed. Once the flap gate is closed, Phillips Lake serves as a drainage retention pond and is totally cut off from the

river. There is no way to remove excess water in the lake. The lake has already risen to 12 to 18 inches from the top of stormwater drain catch basin level two times this year; one severe rain event can cause flooding in houses.

- Modify existing Marquette Street pump station, build small pump station in lake, install suction line, and put in various piping changes.

  Hazard(s) Addressed: Flood

  - **Objective(s) Addressed:** 1.5, 1.9
  - **Mitigation Action Category(s):** Prevention; Structural Project
  - **Cost of Action:** $750,000
  - **Funding Source(s) and Situation:** Local Revenues; Louisiana Community Resiliency Grant
  - **Lead Department(s):** Public Works Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Action:** 50 years
  - **Community Reaction:** The proposal is likely to be endorsed by the neighborhoods whose stormwater drains into Phillips Lake.

Action 17: Storm Drainage Pump Stations Upgrades

Normally stormwater drains from the city into the Ouachita River by gravity flow; however, when the Ouachita River is at or above 354 feet, the Tensas Basin flap gates are closed. To keep the city from flooding once the floodgates are closed requires a series of pumps to be activated to pump water from inside the city over the levee on the western side of the city into the Ouachita River. Therefore, it is absolutely critical that the pumps be functional at the time flood conditions prevail. Most pump stations were built between 1960 through 1977. Many need upgrading and parts replacements.

- Modify and upgrade nine pump stations; purchase portable diesel generators.

  Hazard(s) Addressed: Flood; Levee Failure

  - **Objective(s) Addressed:** 1.5, 1.9, 1.10
  - **Mitigation Action Category(s):** Prevention; Structural Project
  - **Cost of Action:** $750,000
  - **Funding Source(s) and Situation:** HMGP; Local Revenues
  - **Lead Department(s):** Public Works Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Action:** 50 years
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 18: Structural Assessment of Fire Stations

The City operates nine fire stations. It is imperative that these stations always remain able to function and reliably respond regardless of weather or disaster event. This project involves assessing the structural integrity of each fire station and recommending structural modifications, if needed. The list of proposed improvements would be priced and funding sought to implement the structural improvements.

- Conduct fire station structural assessment study.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 1.5, 1.9
  - **Mitigation Action Category(s):** Emergency Services, Structural Project
  - **Cost of Action:** $250,000
  - **Funding Source(s) and Situation:** Local Revenues
  - **Lead Department(s):** Monroe Fire Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Action:** 50 years
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 19: ULM Emergency Management Plan

The University of Louisiana at Monroe (ULM) has a growing student body of over 8,000 and a support staff that exceeds 2,500, with a main campus that covers 238 acres. In light of recent violent crimes, natural disasters, and other emergencies or crises that have occurred on other campuses around the United States, ULM plans to establish a comprehensive Emergency Management Plan (CEMP) that will address the four functional areas of emergency management: 1) prevention-mitigation, 2) preparedness, 3) response, and 4) recovery. To carry out this initiative, all emergency planning responsibilities will be placed under the ULM Police Department. The CEMP will incorporate training in emergency management for faculty, staff, and students. It will also contain a training component for ULM Police Department staff and include coordination with the Ouachita Parish, Office of Emergency Preparedness.

- Develop and implement a Comprehensive Emergency Management Plan involving both campus and community stakeholders.

  Hazard(s) Addressed: All Hazards

  - **Objective(s) Addressed:** 1.1, 1.5, 1.9, 1.10, 2.4, 3.1, 3.3, 4.1
  - **Mitigation Action Category(s):** Prevention
  - **Estimated Cost of Measure:** $536,000
  - **Funding Source(s) and Situation:** U.S. Department of Education Institutions of Higher Education for Emergency Management Planning grant
  - **Lead Departments(s):** ULM Police Department
  - **Timeline:** Short term
  - **Benefit:** ULM campus and surrounding community
  - **Life of Measure:** 5 years (updated every 5 years)
  - **Community Reaction:** The proposal is strongly supported by the University and would have the support of the community as well

Action 20: Citywide Drainage Study

The city is located in a floodplain and is protected from the Ouachita River by a floodwall levee structure that requires a series of pump stations to operate when the River reaches 38 feet and the floodgates are closed by the Tensas Basin Levee Board. The City also has a number of isolated areas that experience localized flooding during times of heavy rain. Many of these areas include structures that have experienced repetitive losses, which occur in large part due to undersized drainage culverts and ditches. Expanding or enlarging those drainage facilities would increase their capacities, enabling them to handle the increased stormwater flows. A

citywide drainage study needs to be undertaken to identify where these areas are, what improvements are needed, the cost of making the improvements, a prioritization of the improvements, and potential funding.

- Conduct a citywide drainage study.

  Hazard(s) Addressed: Flood; High Wind – Thunderstorms; Tropical Storms/Hurricanes

  - **Objective(s) Addressed:** 1.1, 1.3, 1.9, 1.10, 2.4, 3.1, 3.3, 4.1
  - **Mitigation Action Category(s):** Prevention
  - **Estimated Cost of Measure:** $150,000
  - **Funding Source(s) and Situation:** HMGP
  - **Lead Departments(s):** Monroe Engineering Department; Public Works Department
  - **Timeline:** Long term
  - **Benefit:** Citywide
  - **Life of Measure:** 50 years
  - **Community Reaction:** The proposal would have the support of the community

Action 21: Storm Drainage Cleanup Program

Citizens have expressed that many of the City's storm drains become clogged with vegetative debris following heavy rains, inhibiting stormwater flow and resulting in localized flooding. The Public Works Department, through its Drainage Division, is responsible for maintaining the stormwater drainage system. However, with limited staff and resources, its primary focus is to maintain the drainage swales so that they remain free of debris, and clean out drainage culverts and pipes.

Within the Public Works Department is the Beautification Division, which administers the Keep Monroe Beautiful program. The City is affiliated with the national Keep America Beautiful program whose mission is on "engaging individuals to take greater responsibility for improving their community environments." The Division administers several programs that support the mission of the KAB. Some of the programs the City has initiated include: Water Sweep, Great American Cleanup, and Waste in Place Curriculum. The City proposes to initiate a program whereby citizens or neighborhoods create Storm Drain Teams. Teams are responsible for monitoring and removing debris from storm drain outlets. The City will work with the media outlets publicize the efforts of citizen volunteers as well as post their efforts on the City hazard mitigation web page. Sponsorship from local business and civic organizations will be sought.

- Create a storm drain cleanup program.

  Hazard(s) Addressed: Flood

  - **Objective(s) Addressed:** 1.2, 1.10, 3.1, 3.3, 4.1
  - **Mitigation Action Category(s):** Prevention
  - **Estimated Cost of Measure:** $5,000**Funding Source(s) and Situation:** Local Revenues
  - **Lead Departments(s):** Public Works Department, Beautification Department
  - **Timeline:** Short term
  - **Benefit:** Citywide
  - **Life of Measure:** Ongoing
  - **Community Reaction:** The proposal is supported by the City and would have the support of the community as well

Action 22: Weatherization Assistance Program

The City has been extremely active in housing rehabilitation. Nearly 60% of the housing stock is over 40 years old. Thirty-two percent of the city residents are below the poverty line. A large percentage of those living below the poverty line live in the older homes that a subject to air leakage causing problems during cold weather.

- Weatherize homes of low-income households to sustain winter storms.

  Hazard Addressed: Severe Winter Weather/Ice Storms

  - **Objective(s) Addressed:** 1.1, 3.4
  - **Mitigation Category:** Structural Projects
  - **Cost of Measure:** $2,000,000 to 3,000,000
  - **Funding Source and Situation:** Louisiana Housing Finance Agency/Louisiana Community Action Agency
  - **Lead Department (s):** Monroe Department of Planning and Development
  - **Timeline:** Long term
  - **Benefit:** All Participating Jurisdictions
  - **Life of Measure:** Life of Structure
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 23: Weatherization/Hazardous Materials Education Program

- Develop a weatherization education program.

  Hazard Addressed: Severe Winter Weather/Ice Storms

  - **Objective(s) Addressed:** 3.3, 3.3
  - **Mitigation Category:** Public Education and Awareness
  - **Cost of Measure:** $25,000 to $50,000
  - **Funding Source and Situation:** Louisiana Housing Finance Agency/Louisiana Community Action Agency
  - **Lead Department(s):** Monroe Planning and Development; Ouachita Parish Health Unit
  - **Timeline:** Long term
  - **Benefit:** Citywide
  - **Life of Measure:** Perpetual
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

Action 24: Airport Canal Erosion Project

The banks of the Airport Canal between White Street and Elm Street have continually eroded for a number of years. This segment of the drainage canal is 2,200 feet in length. The area adjacent to the west side of the Airport Canal consists of single-family residences from Owl Street to White Street. A senior citizens housing complex and a public housing apartment are situated between Owl and Elm Streets. For a number of years, the City Public Works Department has tried repeatedly to stem the erosion along the canal unsuccessfully. The erosion issue reduces the capacity of the Airport Canal. Another significant potential impact is the collapse of two homes immediately adjacent to the canal. If this situation goes unattended it definitely appears other homes may be placed at risk. A permanent solution is being sought either purchase of the two homes and/or the hardening of drainage canal by lining it with a Gunite construction drainage membrane material.

- Construct a Gunite drainage membrane in the Airport Canal from White Street to Owl Street.

  Hazard(s) Addressed: Flooding

  - **Objective(s) Addressed:** 1.5, 1.9
  - **Mitigation Action Category(s):** Prevention, Structural Project
  - **Cost of Action:** $450,000
  - **Funding Source(s) and Situation:** HMGP
  - **Lead Department(s):** Public Works Department
  - **Timeline:** Short-term
  - **Benefit:** Sherrouse Street neighborhood
  - **Life of Action:** 50 years
  - **Community Reaction:** The proposal is likely to be endorsed by the Sherrouse neighborhood.

Action 25: Long-Term Post-Disaster Redevelopment Plan

Tornadoes and a major breach in the levee along the Ouachita River would be catastrophic to the City of Monroe. Where such devastating events have occurred, Greenburg, Kansas and Yazoo, Mississippi recovering and rebuilding back take not months but years. Having a plan in place provides the community a tool to organize its buildback effort sooner and provides a community an opportunity to build back smarter, greener, more sustainable, and more resilient.

- Prepare a long-term post disaster redevelopment plan

  Hazard Addressed: All-Hazards

  - **Objective(s) Addressed:**
  - **Mitigation Category:**
  - **Cost of Measure:** $100,000
  - **Funding Source and Situation:** HMGP
  - **Lead Department(s):** Monroe Planning and Urban Development
  - **Timeline:** Long term
  - **Benefit:** Citywide
  - **Life of Measure:** Until Revised or Updated
  - **Community Reaction:** The proposal is likely to be endorsed by the entire community

7.7 EVALUATION CRITERIA FOR MITIGATION ACTIONS

Each action is prioritized in the order in which it will be implemented by the City of Monroe. The prioritization process relies upon Monroe's identified risks and vulnerabilities. The ranking criteria used to prioritize projects in the 2010 HMP Update built on those set out in the 2004 HMP. The new ranking criteria has also been shaped by FEMA's STAPLEE methodology that incorporates a variety of aspects the community. The following selection criteria were used by the MHMSC prioritize the projects for the 2010 HMP Update:

1. Protect health and safety of residents;
2. State or federal mandate;
3. Leads to community resilience;
4. Has Strong Support within the community;
5. Supports the environmental;
6. Provides long-term benefits; and
7. Funding available.

The Project Prioritization form was developed that incorporated the selected criteria (**Appendix I**). This form was distributed to the MHMSC members for ranking. Each member was given 10 votes. They were instructed to rank their top projects. They did not necessarily have to select 10 projects because they were given the option to cast two votes for projects of their choice. All Project Prioritization Forms were returned and their scores aggregated which resulted in a MHMSC ranking of HMP projects. A final meeting of the MHMSC was held September 16, 2010 for the members to review the prioritization of projects, consider the comments made at the public meeting in June 2010 and comments of GOHSEP and FEMA, and make any additions or modifications deemed appropriate.

7.8 PROJECT PRIORITIZATION LIST

After the review of STAPLEE scores, survey results, and discussion, the MHMSC ranked the potential mitigation actions, with special attention paid to the mitigation action's cost-benefit review, its ability to be implemented, and the extent to which it would mitigate one or multiple relevant hazards. The MHMSC combined these rankings into one prioritized list shown on **Table 30**. All necessary changes were made to the hazard mitigation action prioritization list.

Table 30. Actions by Hazard Type for City of Monroe

Project Priority*	Action Number	Mitigation Actions†	Funding
1	15	Calypso Street Stormwater Station Reconstruction	HMGP
2	17	Storm Drainage Pump Stations Upgrades	HMGP
3	7	Recertification of Floodwall Levee	None Needed
4	13	Comprehensive Plan Revision	LA Community Resiliency Grant
5	1	Auxiliary Power Sources for Critical Infrastructure	Local Revenues
6	4	Storage Capacity Enhancement of Bayous and Drainage Canals	HMGP
7	2	Sewer System Rehabilitation	Sewer User Fees, Infrastructure Sales Tax, State Revolving Loan; and LA Department of Environmental Quality
8	9	Community Rating System (CRS) Strategy	Local Revenues
9	24	Airport Canal Erosion Project	HMGP
10	11	Transportation Evacuation Study	Federal Highway Administration /MPO
11	12	Mitigation Planning Coordination	Local Revenue
12	5	Debris Reduction Public Outreach Program	Louisiana Litter Abatement Grant
13	3	New Chemical Storage Building	Local Revenues
14	16	Phillips Lake Drainage Project	Louisiana Community Resiliency Grant
15	23	Weatherization/Hazardous Materials Education Program	Louisiana Housing Finance Agency
16	6	School-based Multi-Hazard Education Program	No cost – American Red Cross supplies materials
17	8	Commodity Flows Study	U.S. Dept of Transportation Hazardous Materials Emergency Preparedness Grant
18	10	Hazard Mitigation Plan for Historic Structures	HMGP
19	14	Zoning Ordinance Revision	Louisiana Community Resiliency Grant
20	25	Long-Term Post Disaster Redevelopment Plan	HMGP
21	18	Structural Assessment of Fire Stations	Local Revenues
22	19	ULM Emergency Management Plan	U.S. Department of Education
23	20	Citywide Drainage Study	HMGP
24	21	Storm Drain Cleanup Program	Local Revenues
25	22	Weatherization Assistance Program	Louisiana Housing Finance Agency

*† Refer to **Sections 7.6.1** and **7.6.2** for details on each mitigation action.*

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8 PLAN MAINTENANCE PROCESS

This section will address the City's plan maintenance process. In accordance with 44 CFR § 201.6(c)(4), the method and schedule of monitoring, evaluating, and updating the plan will be presented in the City of Monroe's 2010 HMP Update. This section will also discuss of how the mitigation strategies will be incorporated into the existing planning mechanisms (i.e., comprehensive plan, zoning code). In addition, how continued public participation will be achieved throughout the plan maintenance process will be addressed.

8.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

8.1.1 Assessment of Past Plan Maintenance Process

As described in the 2004 Plan, the Director of Planning and Urban Development for the City of Monroe was responsible for managing the HMP. The Director was charged with the responsibility of working with other key city staff such as the Fire Chief, Public Works Director, Engineering Director, and Sewer Manager to maintain focus on the HMP goals and progress toward attaining the goals. Approximately two years ago, a new Director was hired.

The Plan indicated that the MHMSC would meet as needed, but no less than annually for a full review of the HMP goals and progress toward attaining those goals. The MHMSC did not meet annually, however, in part due to a personnel change in the Director's position. However, even though the MHMSC did not convene annually, the City was active in implementing several of the actions set out in the Plan (see **Table 27**, Status of Previous HMP Mitigation Actions). In addition to the actions achieved, the following significant activities took place as well:

1. Annual preparation of a CRS report that documents a program change such as completion of a previously identified activity and/or addition of new activities undertaken in the previous year.
2. FIRM updates for Ouachita Parish. This is activity is being accomplished as part of FEMA's nationwide Flood Map Modernization program. This project is not completed. The preliminary FIRM information is currently being reviewed by the City and its residents.
3. Participation in the Louisiana Pilot Hazard Planning Program.
4. Update of the City's website, which now contains links that provide residents information about hurricane preparedness, flood hazards, and swine flu.
5. Preparation of a Flood Management Report by the City Planning and Urban Development Department.

8.1.2 2010 – 2015 Plan Maintenance Process

The Director of the Planning and Urban Development Department will continue to assume primary responsibility for administering the HMP and ensuring that the City Council is fully aware of the activities. Their representative will coordinate closely with other key stakeholders (e.g., American Red Cross, Executive Director of the Tensas Basin Levee Board, Monroe School Board, and Monroe Chamber of Commerce) with the assistance of the MHMSC. The

Director of Planning and Urban Development will document the implementation progress of each project and/or initiative. For projects where little or no progress is being achieved, the Director will document the reasons why progress in not being achieved and provide solutions to help overcome the obstacles.

The MHMSC will meet as needed but no less than annually for a full review of the goals and objectives of the HMP. The first annual review will occur one year after the HMP is approved by FEMA. At the time of the review, mitigation strategies will be evaluated for effectiveness and updated as needed. Each goal and objective will be analyzed to determine their relevance to changes occurring within the City as well as changes in State and Federal policy. The Committee will review the risk assessment portion of the plan for needed updates. The individual department heads assigned to the various implementation plans will report on the status of the work, including any difficulties encountered. Priorities will be reassessed and changes made as needed to maintain progress toward achieving each goal. A report to the City Council will be prepared and presented for their consideration. To avoid the Plan going out of compliance, the City will initiate the update process in Year 4 of the five-year cycle.

8.2 INCORPORATION INTO EXISTING PLANNING MECHANISMS

8.2.1 Comprehensive Plan

In 2008, the City of Monroe completed its award-winning Comprehensive Plan. Through the comprehensive planning process, the city defined its vision for the future. This process engaged the entire community. The plan process involved an inventory and analysis phase and a public input program. The Comprehensive Plan contains five goal areas: 1) Government and Civic Discourse; 2) Education and Opportunity; 3) Vitality and Revitalization; 4) Safety, Security, and Livability; and 5) Rivers and Bayous. The need for increased preparedness for man-made and natural disasters was an objective under Goal 4; Safety, Security, and Livability. Also, Goal 5, River and Bayous, recognized the need to incorporate flood protection. In its land use analysis, the plan addresses the existing land use pattern build-out potential and future land use; however, there is no analysis of land use as seen from a hazards perspective. Even though a large portion (30%) of Monroe is situated within the 100-year flood zone, the remaining 70% is located within the 500-year flood zone. Monroe is situated on a flood plain adjacent to the Ouachita River. The city recognizes both the benefits and risks that come with the territory. It is suggested that the City revisit and incorporate the full realm of hazard concerns as articulated in the city's HMP. Hazards such as floods and tornados will occur in the future. The question is only when. The City's "blueprint for the future," its comprehensive plan should not only focus on becoming a more vibrant community through economic development and redevelopment, but accomplish it in a manner that makes it more sustainable and disaster-resistant and able to quickly recover from disaster events.

8.2.2 Zoning Ordinance

The city has a Zoning Code that was originally adopted in 1960 and has been amended frequently over the years. The one mention of hazards is found in Article IV Supplementary Regulations, Section 37-136 which addresses "areas subject to inundation." This is cross-referenced to flood hazard areas that are addressed in Chapter 13, Drainage and Flood Control, City of Monroe Code. The recently completed Comprehensive Plan recommends that the Zoning Ordinance be updated in its entirety. As stated in the Comprehensive Plan, "The purpose of the zoning is fundamentally to preserve the health, safety, and general welfare of the community." It is recommended that any update of the code take into consideration the impacts

of hazards and incorporate appropriate provisions in the new zoning ordinance. The city has applied for a Community Resiliency Grant with the LRA to assist them in that effort.

8.2.3 Subdivision Ordinance

The City has had a subdivision ordinance since 1960. The intent of the ordinance is to ensure that a proposed subdivision's street pattern is coordinated with all other existing or planned streets and in harmony with its surrounding environment so as to create conditions favorable to health, safety, convenience, or prosperity. The one section of the Subdivision Ordinance that addresses flooding is found in Article V, Design Standards, Section 32-71 (c) land subject to periodic flooding. The ordinance does provide the planning commission with the authority to deny platting land for residential occupancy if it deems the land uninhabitable. To ensure transparency in the subdivision platting approval process, it is suggested that the city require the 100-year flood zone boundary to be graphically delineated on the Sketch Plan and General Subdivision Plan. In addition, it is recommended that at the time the city updates its zoning ordinance, it reevaluates its Subdivision Ordinance to ensure that the two ordinances are coordinated to avoid conflicting provisions.

8.2.4 Drainage and Flood Control

In 1994, the city adopted Ordinance 9423, Drainage and Flood Control. This is the city's primary regulatory tool to manage development in the flood plain. The purpose of the ordinance is to reduce flood losses through a variety of means. Some provisions include prohibiting uses that cause excessive increase in flood height or velocity; controlling the alteration of the natural flood plain; controlling filling, grading, and dredging; and preventing installation of flood barriers that may unnaturally divert floodwaters to other lands.

8.2.5 National Flood Insurance Program

The U.S. Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the Federal Government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

The City of Monroe has been affiliated with the NFIP program since 1974. FEMA has prepared Flood Insurance Rate Maps (FIRM) for all participating local governments. These maps denote "flood zones" which are geographical areas that historically have flooded. From time to time, the FIRMs are updated most recently in 1994. FEMA through its Map Modernization Initiative is in the process of updating flood maps nationwide. As of August 2009, FEMA completed a Preliminary Digitial FIRM (DFIRM) study for Ouachita Parish. It is currently undergoing a public review process. During this process, questions have been raised regarding the accuracy of the map data. No resolution has been reached as of July 2010; therefore the City is still using the 1994 FIRM maps to determine flood elevations until the new DFIRM maps are adopted.

As discussed in **Section 4.2.2**, for levee to be certified by FEMA for flood insurance purposes, they must have a minimum of 3-foot freeboard above the 1-percent-annual-chance flooding to be considered as compliant flood protection structures. Certifying the levee floodwall system is without question one of the most significant issues from a flood insurance perspective for Monroe citizens. Losing certification would jeopardize homeownership for many residents because the annual cost of flood insurance would become prohibitive for homeowners. The Tensas Basin Levee Board is negotiating with FEMA to re-certify the floodwall. Formal support (resolution) from the Monroe City Council would be extremely helpful to TBLB efforts.

8.2.6 Community Rating System

The NFIP's CRS was implemented in 1990 by FEMA as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote the awareness of flood insurance. There are 10 CRS classes: Class 1, the best rating, requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction. The CRS recognizes 18 creditable activities, organized under four categories numbered 300 Public Information Activities; 400 Mapping & Regulatory Activities; 500 Flood Damage Reduction Activities; and 600 Flood Preparedness Activities. Information on the CRS program is covered in the CRS Coordinator's Manual, which is available from FEMA.

The City currently has a CRS rating of 9 and can take steps to improve its rating.

8.3 CONTINUED PUBLIC INVOLVEMENT

A link to access the HMP will be provided on the Department of Planning and Urban Development Community web page. The Director of Planning and Urban Development will keep the media (e.g., local television, newspaper) informed as projects and initiatives are being implemented. The results from the annual review will be presented to the City Council at a scheduled meeting. Prior to the meeting, a public notice will be placed in the local newspaper inviting the general public to participate in the discussion.

A formal report will be issued following each annual review detailing progress and subsequent plans to achieve the mitigation goals.

The HMP will be reassessed in 5-year intervals by the MHMSC and reissued with updated goals, objectives, and measures. The revised HMP will be resubmitted to the GOHSEP and FEMA for approval.

Appendices

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Appendix A

PUBLIC WORKSHOP NOTICE

MONROE PRESS RELEASE

PUBLIC WORKSHOP SIGN-IN SHEET

STEERING COMMITTEE MEETING AGENDAS

STEERING COMMITTEE SIGN-IN SHEETS

THE MONROE NEWS STAR ARTICLE ON PUBLIC WORKSHOP

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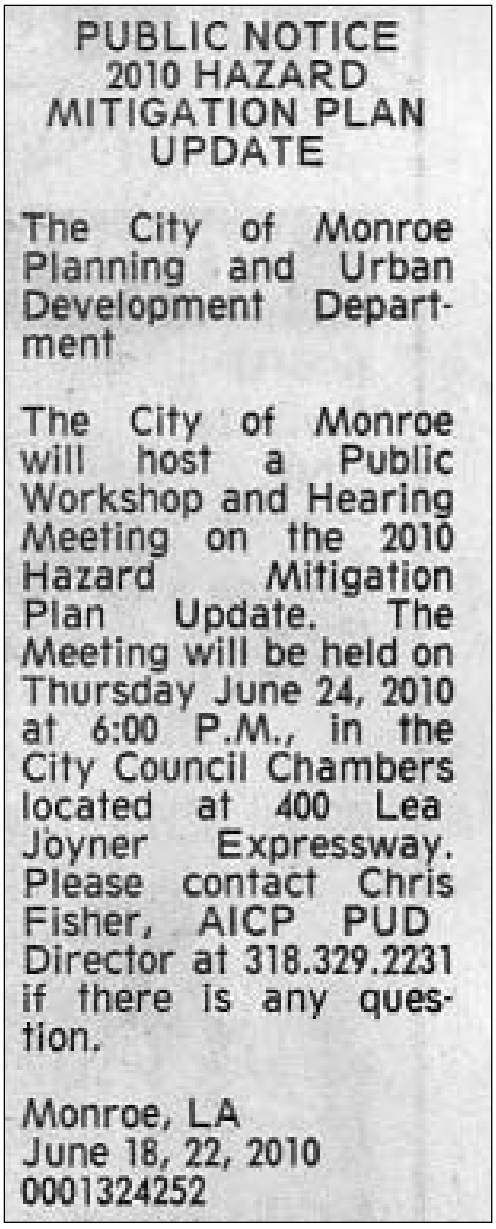

PUBLIC NOTICE
2010 HAZARD MITIGATION PLAN UPDATE

The City of Monroe Planning and Urban Development Department

The City of Monroe will host a Public Workshop and Hearing Meeting on the 2010 Hazard Mitigation Plan Update. The Meeting will be held on Thursday June 24, 2010 at 6:00 P.M., in the City Council Chambers located at 400 Lea Joyner Expressway. Please contact Chris Fisher, AICP PUD Director at 318.329.2231 if there is any question.

Monroe, LA
June 18, 22, 2010
0001324252

Figure A-1. Public Workshop Notice

Date: June 23, 2010
To: All Media
Contact: Rod Washington, Public Relations/Media Coordinator @ 329-2551

Hazard Mitigation Plan Update Public Meeting

Mayor Jamie Mayo and the Monroe City Council are pleased to join the City of Monroe Planning & Urban Development Department to announce the following:

What: City of Monroe PUD Hazard Mitigation Plan Update Workshop and Public Hearing

When: 6 pm Thursday, June 24

Where: Monroe City Council Chamber, 400 Lea Joyner Expressway

Purpose: Representatives from the City of Monroe Planning & Urban Development Department, Consultants CSA International, Inc. and other city departments invite the public to participate in a discussion regarding the City of Monroe 5-year hazard mitigation plan. This plan helps qualify our city for possible federal assistance from FEMA during times of Presidential disaster declarations.

City of Monroe Planning & Urban Development Director Chris Fisher comments, "Public input is very important because our citizens know first-hand what type of plans we need to be working on to help protect their neighborhoods, schools and businesses. We encourage our residents to come out and take part in this planning session."

For further information, please contact Chris Fisher at 318.329.2231.

"MONROE...ONE CITY, ONE FUTURE!"
We are MONROE PROUD!
5 time winner of the Louisiana Municipal Association Community Achievement Award
(2002, 2003, 2006, 2007, 2008)
Visit our city website: www.monroela.us

Rod Washington
Public Relations/Media Coordinator
City of Monroe
(318) 329-2551 PHONE
(318) 329-3300 FAX
Email: rod.washington@ci.monroe.la.us

Attendance Sheet for Public Hearing.

City of Monroe
Monroe City Hall
PLEASE PRINT
Sign In

Date: 06.24.2010

~~Time In:~~	Name:	Visiting Who:	Dept:	Time Out:
1	John W Lolley	387-3049		
2	Ann Armintor	387-2760		
3	Brad Armintor	387-2760		
4	Charles Weston	city of Monroe	ENGINEERING	
5	Jennie Bryant	city of Monroe	FIRE DEPT.	
6	Travis Davis	3254480		
7	Karen Walton			
8	Linda Walters	CSA	Consultant.	
9	Tom Atteberry	city of Monroe	PLANNING	
10	Chris Fisher	city of Monroe	Planning.	
11	Stanley Atte	CITY OF	MONROE	Comm. DEVELOPMENT
12	STACY TEMPLE	NewsStar of Monroe	(stemple@thenewsstar.com	
13	CARRIE Robinette	state Emergency	carrie.robinette@la.gov.	
14	Jeffery Hickacorn	FEMA.	Baton Rouge.	

AGENDA

MONROE HAZARD MITIGATION STEERING COMMITTEE (HMSC)

Public Safety Center
Conference Room
1810 Martin Luther King Blvd. (165 South)
Monroe, Louisiana

March 17, 2010
2:00 – 4:00 p.m.

1Pt	Welcome *Chris Fisher, Director* *Planning & Urban Development Department*	*2:00 pm.*
2Pt	Introductions *Chris Fisher*	*2:05 p.m.*
3.	Meeting Objectives *Lincoln Walther, FAICP, CSA International, Inc.*	*2:10 p.m.*
4.	Project Overview *Lincoln Walther*	*2:20 p.m.*
5.	Review Plan Update Requirements *Lincoln Walther* • Section 1 – Prerequisites • Section 2 - Planning Process • Section 3 – Risk Analysis	*2:40 p.m.*
6.	Discussion of Hazards (Major Parish Concerns) *Lincoln Walther*	*3:00 p.m.*
7.	Discuss Status of Existing Mitigation/Measures *Lincoln Walther*	3:25 p.m.
8.	Other Comments and Next Meeting *Chris Fisher*	*3:50 p.m.*
9.	Adjournment	*4:00 p.m.*

AGENDA

MONROE HAZARD MITIGATION STEERING COMMITTEE (HMSC)

Public Safety Center
Conference Room
1810 Martin Luther King Blvd. (165 South)
Monroe, Louisiana

May 26, 2010
11:00 a.m. – 12:30 p.m.

1Pt	Welcome *Chris Fisher, Director* *Planning & Urban Development Department*	*11:00 a.m.*
2Pt	Introductions *Chris Fisher*	*11:05 a.m.*
3.	Meeting Objectives *Lincoln Walther, FAICP, CSA International, Inc.*	*11:15 a.m.*
4.	Risk Assessment *Lincoln Walther*	*11:20 a.m.*
5.	Hazard Mitigation Options *Lincoln Walther*	*11:50 a.m.*
8.	Ahead - Feed back on Draft Plan *Chris Fisher*	*12:20 a.m.*
9.	Adjournment	*12:30 p.m.*

AGENDA

MONROE HAZARD MITIGATION STEERING COMMITTEE (HMSC)

Public Safety Center
Conference Room
1810 Martin Luther King Blvd. (165 South)
Monroe, Louisiana

September 16, 2010
10:00 a.m. – 11:30 a.m.

1.	Welcome *Chris Fisher, Director* *Planning & Urban Development Department*	*10:00 a.m.*
2.	Introductions *Chris Fisher*	*10:05 a.m.*
3.	Review of Where We Have Been *Lincoln Walther, FAICP, CSA International, Inc.*	*10:15 a.m.*
4.	Review of Projects *Lincoln Walther*	*10:20 a.m.*
5.	Adjournment	*11:30 p.m.*

Sign-In Sheet

Hazard Mitigation Update Kick Off Meeting
Steering Committee

March 17, 2010

PLEASE PRINT INFORMATION!!

NAME	ORGANIZATION	PHONE NUMBER	E MAIL ADDRESS
Jeffrey LaCour	FEMA-Planning	504-762-2307	JEFFREY.LACOUR@DHS.GOV
Carrie Robinette	GOHSEP-Planning	225-267-2550	carrie.robinette@la.gov
Patty Sanchez	GOHSEP/JLWA	225-267-2578	patty.sanchez@associates.dhs.gov
Mike Andrus	City of Monroe	318-329-2255	michael.andrus@ci.monroe.la.us
Charles Westrom	City of Monroe Public Works	318-329-3363	charles.westrom@ci.monroe.LA.us
Jimmie Bryant	City of Monroe Fire Dept	318-329-2472	jimmie.bryant@ci.monroe.la.us
Chris Fisher	City of Monroe planning & Devel.	318-329-2231	chris.fisher@ci.monroe.la.us
Greg Yoos	City of Monroe Purchasing	318-329-3295	gregyoos@ci.monroe.la.us
Toney Gibson	city of monroe purchasing	318-329-2297	toney.gibson@ci.monroe.la.us
L. Carroll Babb	NELA Chapter American Red Cross	318-323-5141	disaster@nelaredcross.org
Joanne Poret	City of Monroe PDZ	318-329-2335	joanne.poret@ci.monroe.la.us
TOM ATTEBERRY	"	318 329-2334	tom.atteberry@ci.monroe.la.us

Sign-In Sheet

Hazard Mitigation Update Kick Off Meeting
Steering Committee

March 17, 2010

PLEASE PRINT INFORMATION!!

NAME	ORGANIZATION	PHONE NUMBER	E MAIL ADDRESS
TaRonda Goodin	City of Moore - Sewer Dept	329-2392	Taronda.Goodin@ci.moore.ok.us

Sign-In Sheet

Hazard Mitigation Update Kick Off Meeting
Steering Committee

May 26, 2010

PLEASE PRINT INFORMATION!!

NAME	ORGANIZATION	PHONE NUMBER	E MAIL ADDRESS
Joanne Poret	City of Monroe/PZ	329-2335	joanne.poret@ci.monroe.la.us
Lori Reneau	Monroe Chamber	807-4022	lreneau@monroe.org
Patty Sanchez	GOHSEP/JFO-WA.	225-267-2578	patty.sanchez@associates.dhs.gov
Brenda Cooper	GOHSEP	225-267-2523	brenda.cooper@la.gov
Harvey Kincaid	FEMA	504 762 2136	Harvey.Kincaid@DHS.gov
JOHN STRINGER	TENSAS BASIN LEVEE DISTRICT	318-323-1130	JOHNSTRINGER@BELLSOUTH.NET
TOM JANWAY	COM	318-329-2820	TOM.JANWAY@CI.MONROE.LA.US
L. Carroll Bobo	NELA Chapter American Red Cross	318-323-5141	disaster@nolaredcross.org
Larry Ellerman	Univ. of Louisiana-Monroe	318 342 5350	ellerman@ulm.edu
Sallie Sutherland	Monroe City School System	318 388 3747	vickie.irwin@mcschools.net Sallie.sutherland@mcschools.net
Jimmie Bryant	City of Monroe	(318) 329-2472	jimmie.bryant@ci.monroe.la.us
Chris Fisher	City of Monroe	318-329-2231	chris.fisher@ci.monroe.la.us

Sign-In Sheet

Hazard Mitigation Update Kick Off Meeting
Steering Committee

May 26, 2010

PLEASE PRINT INFORMATION!!

NAME	ORGANIZATION	PHONE NUMBER	E MAIL ADDRESS
Greg Yoes	COM	329-3295	greg.yoes@ci.marion.ia.us
Toney Gibson	COM	329-2293	toney.gibson@ci.marion.ia.us

Sign-In Sheet

Hazard Mitigation Committee Meeting

September 16, 2010

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NAME	ORGANIZATION	PHONE NUMBER	E MAIL ADDRESS
Greg Yoes	COM	329-3295	greg.yoes@ci.monroe.la.us
Tony Gibson	COM	329-2294	tony.gibson@ci.monroe.la.us
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Joanne Poret	COM	329-2335	joanne.poret@ci.monroe.la.us
JOHN STRINGER	TENSAS BASIN LEVEE	323-1130	JOHNSTRINGER@BELLSOUTH.NET
Carroll Babb	NELA Chapter Red Cross	323-5141	disaster@nelaredcross.org
Jimmie Bryant	Fire	329-2472	jimmie.bryant@ci.monroe.la.us
Vickie Irwin	Monroe City Schools	385-3747 ext 5201	Vickie.irwin@mcschools.net
Chris Fisher	City of Monroe	318-329-2231	chris.fisher@ci.monroe.la.us
Tom ATTEBERRY	"	318 329-2234	tom.atteberry@ci.monroe.la.us

Meeting focuses on final draft of mitigation plan

BY STACY TEMPLE • STEMPLE@THENEWSSTAR.COM • JUNE 25, 2010

A public meeting was held Thursday night to discuss the final draft of the city of Monroe's Multi-Hazard Mitigation Plan.

The plan was originally adopted in 2004, but the Federal Emergency Management Agency requires that all local mitigation plans be updated every five years. If the plan is not updated, the city will not be eligible for federal mitigation funds until the plan is reapproved. The purpose of the plan is to make the city of Monroe less vulnerable to natural and man-made hazards.

Lincoln Wahther, planning director with the consultant firm CSA International Inc., out of Florida, presented a draft of the plan to city workers and the public.

The draft highlights flooding, levee failures, severe thunderstorms, tornadoes and hailstorms as Monroe's biggest threats. Other possible threats include droughts, mosquito-bourne illnesses, chemical spills and terrorism.

"What if it happens? We need to be thinking about it now, not when the walls are coming down," Wahther said.

A steering committee of representatives from several city departments, including police and fire, helped draft the plan. Others entities represented on the committee includes University of Louisiana at Monroe Police Department, the Monroe School Board, the Office of Homeland Security and Emergency Preparedness and Tensas Basin Levee Board.

Wahther gathered information from participating agencies and updated the draft of the plan. Some of the things discussed at the meeting include how to weatherproof homes and businesses and how to make structures built in a hazardous area, such as a flood area, more secure.

According to the plan, Monroe has had 17 major disaster declarations since 1965. Most of the declarations stemmed from winter storms, tornadoes and flooding.

Appendix B

REPETITIVE LOSS AND
SEVERE REPETITIVE LOSS PROPERTIES

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Table B-1. City of Monroe Repetitive Losses

Property Locater	Occupancy	Most Recent Date of Loss	Total Building Payment ($)	Total Contents Payment ($)	Building Value ($)	Losses (1978-2008)
0022287	SINGLE FAMILY	09/03/2008	29,272	9,556	200,062	5
0181772	SINGLE FAMILY	09/03/2008	9,400	1,190	260,610	2
0062176	SINGLE FAMILY	09/03/2008	24,604	12,567	99,181	3
0022240	SINGLE FAMILY	09/03/2008	26,571	8,800	150,209	4
0012043	SINGLE FAMILY	09/03/2008	52,866	33,311	86,750	4
0220136	SINGLE FAMILY	09/02/2008	45,060	15,823	127,302	4
0220136	SINGLE FAMILY	09/02/2008	29,172	5,723	166,505	5
0220136	SINGLE FAMILY	09/02/2008	11,573	6,972	137,221	3
0052969	NON-RESIDENTIAL	09/02/2008	40,380	-	398,597	3
0012242	SINGLE FAMILY	09/02/2008	21,181	-	77,322	3
0062184	SINGLE FAMILY	09/02/2008	14,227	22,147	275,318	3
0177047	SINGLE FAMILY	09/02/2008	6,679	4,599	314,540	2
0062225	SINGLE FAMILY	09/02/2008	11,652	8,482	92,410	4
0022233	SINGLE FAMILY	09/02/2008	23,191	21,770	192,842	4
0040107	SINGLE FAMILY	09/02/2008	31,595	7,376	84,333	4
0108545	SINGLE FAMILY	09/02/2008	41,638	-	80,325	4
0062212	SINGLE FAMILY	09/02/2008	13,630	12,432	287,420	3
0179314	SINGLE FAMILY	09/02/2008	11,427	-	139,206	2
0062159	SINGLE FAMILY	09/02/2008	27,629	27,512	224,185	4
0177986	SINGLE FAMILY	09/02/2008	21,357	-	60,524	2
0177365	SINGLE FAMILY	09/02/2008	26,600	-	92,625	2
0180592	SINGLE FAMILY	09/02/2008	42,942	4,061	332,515	2
0001770	SINGLE FAMILY	09/02/2008	47,597	-	93,150	3
0039630	SINGLE FAMILY	09/02/2008	24,497	27,424	60,089	3
0128755	SINGLE FAMILY	09/02/2008	21,930	-	171,187	3
0012801	SINGLE FAMILY	09/02/2008	30,090	29,900	200,000	3
0039360	NON-RESIDENTIAL	09/02/2008	35,790	8,393	145,168	3
0010348	SINGLE FAMILY	09/02/2008	16,677	362	87,678	4
0181342	NON-RESIDENTIAL	09/02/2008	9,835	-	66,000	2
0006213	SINGLE FAMILY	09/02/2008	26,679	34,546	220,000	5
0006549	SINGLE FAMILY	09/02/2008	33,426	11,004	120,000	3
0007434	SINGLE FAMILY	09/02/2008	57,348	-	105,150	3
0012277	SINGLE FAMILY	09/02/2008	38,609	-	93,929	3
0012208	SINGLE FAMILY	09/02/2008	37,839	2,882	99,492	3
0062206	SINGLE FAMILY	09/02/2008	41,658	35,000	74,507	4
0006508	SINGLE FAMILY	09/02/2008	32,104	6,153	87,683	3
0062207	SINGLE FAMILY	09/02/2008	48,005	20,964	113,177	4
0022332	SINGLE FAMILY	09/02/2008	37,528	4,541	124,395	3

Property Locater	Occupancy	Most Recent Date of Loss	Total Building Payment ($)	Total Contents Payment ($)	Building Value ($)	Losses (1978-2008)
0011937	SINGLE FAMILY	09/02/2008	36,518	33,029	82,661	3
0052969	NON-RESIDENTIAL	09/02/2008	59,680	31,377	492,000	4
0039359	SINGLE FAMILY	09/01/2008	13,920	2,035	100,000	2
0178006	SINGLE FAMILY	09/01/2008	26,701	6,227	200,000	3
0062240	SINGLE FAMILY	09/01/2008	11,989	-	81,538	2
0007470	SINGLE FAMILY	09/01/2008	45,293	2,973	171,160	3
0013920	SINGLE FAMILY	09/01/2008	80,180	-	101,908	4
0004564	NON-RESIDENTIAL	06/29/2004	53,030	8,362	498,485	3
0117623	SINGLE FAMILY	09/02/2001	31,775	14,471	71,910	3
TOTAL			$1,461,343	$481,962	$7,541,269	151

Table B-2. City of Monroe Severe Repetitive Losses

Property Locater	Occupancy	Most Recent Date of Loss	Total Building Payment ($)	Total Contents Payment ($)	Building Value ($)	Losses (1978-2008)
0012218	SINGLE FAMILY	09/03/2008	79,510	31,195	100,000	5
0013931	SINGLE FAMILY	09/02/2008	98,135	28,792	133,889	6
0001515	SINGLE FAMILY	09/02/2008	69,919	15,419	184,108	4
0003334	SINGLE FAMILY	09/02/2008	72,168	25,886	381,979	6
0008095	SINGLE FAMILY	09/02/2008	53,355	26,515	140,775	4
0007608	SINGLE FAMILY	09/02/2008	78,458	44,282	136,888	7
0062152	SINGLE FAMILY	09/02/2008	45,346	7,004	150,593	6
0012734	SINGLE FAMILY	09/02/2008	61,353	34,832	125,000	6
0011725	SINGLE FAMILY	09/02/2008	47,094	17,964	101,800	5
0012276	SINGLE FAMILY	09/02/2008	215,616	52,159	206,761	7
0021220	SINGLE FAMILY	09/02/2008	82,093	35,065	120,111	4
0011795	SINGLE FAMILY	09/02/2008	134,457	14,112	174,240	4
0012348	SINGLE FAMILY	09/02/2008	61,460	21,042	39,500	5
0012704	SINGLE FAMILY	09/02/2008	126,290	93,042	173,244	9
0011961	SINGLE FAMILY	09/02/2008	28,052	20,197	57,093	4
0011948	SINGLE FAMILY	09/02/2008	54,016	11,470	89,474	6
0012753	SINGLE FAMILY	09/02/2008	38,287	20,915	98,291	5
0053635	SINGLE FAMILY	09/02/2008	49,393	14,128	107,818	5
0002688	NON-RESIDENTIAL	09/02/2008	39,015	6,200	479,829	4
0001795	NON-RESIDENTIAL	09/02/2008	49,286	23,378	128,496	7
0062241	SINGLE FAMILY	09/01/2008	89,546	15,189	173,175	4
0012773	SINGLE FAMILY	09/01/2008	55,985	22,986	131,877	5
0006307	SINGLE FAMILY	09/01/2008	70,257	1,145	111,975	4
0006441	SINGLE FAMILY	09/01/2008	60,091	32,209	109,228	5
0012222	SINGLE FAMILY	07/01/2004	52,179	10,797	113,157	5
0052902	NON-RESIDENTIAL	04/29/1991	23,638	106,527	374,000	8
0006296	NON-RESIDENTIAL	04/29/1991	34,873	17,059	38,220	4
0006216	NON-RESIDENTIAL	04/29/1991	18,706	19,281	52,640	4
0006294	NON-RESIDENTIAL	04/28/1991	22,731	18,461	51,030	5
0006215	SINGLE FAMILY	04/28/1991	30,927	19,027	81,000	4
0012068	SINGLE FAMILY	04/29/1991	104,167	51,138	92,672	4
0022453	NON-RESIDENTIAL	05/05/1989	63,831	6,200	301,950	5
TOTAL			$2,110,233	$863,612	$4,760,813	166

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Appendix C

STORMWATER CONTROL SYSTEM MAP

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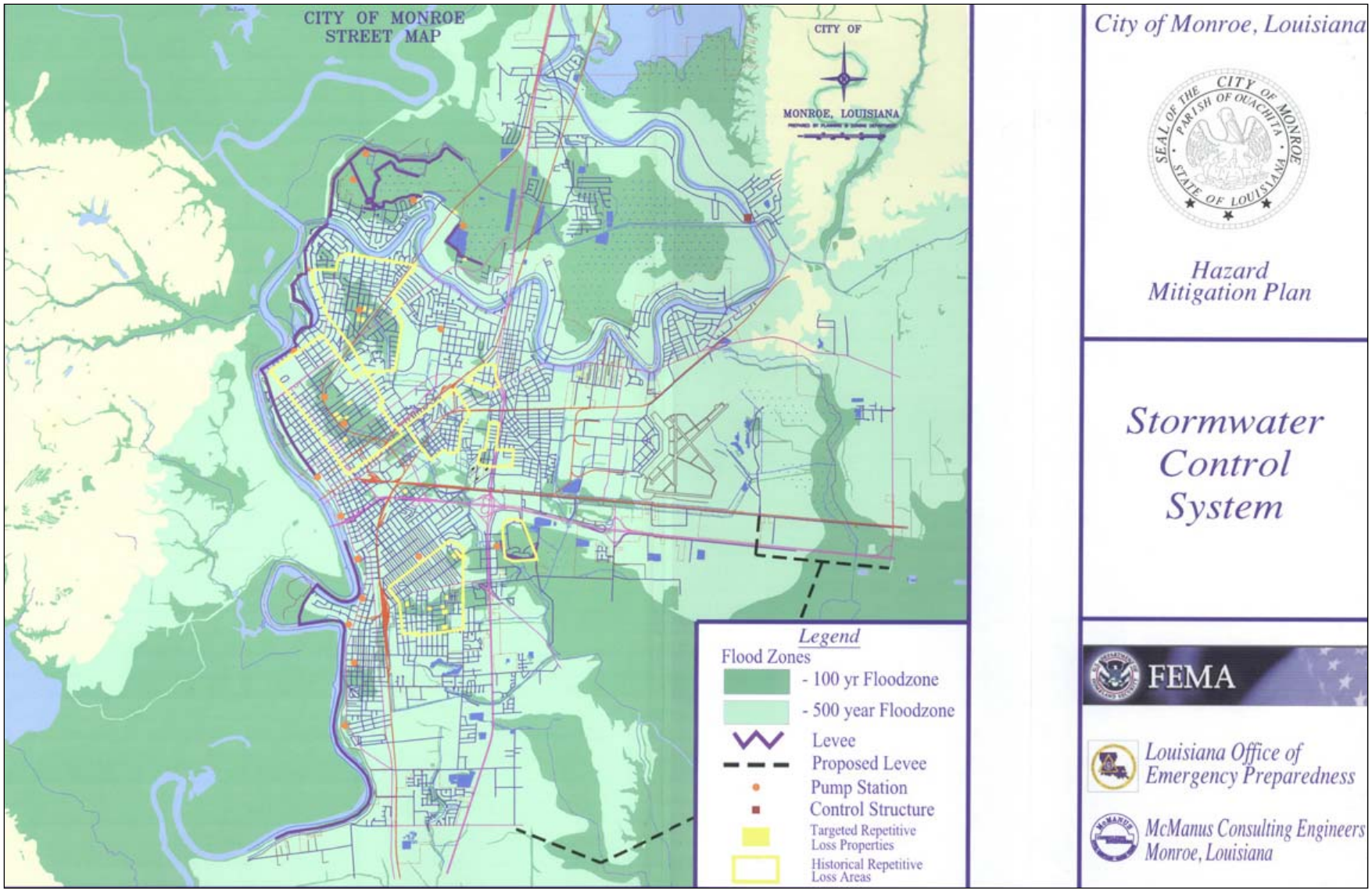

FIGURE C-1: STORMWATER CONTROL SYSTEM MAP

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Appendix D

CRITICAL BUILDINGS AND FACILITIES

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<u>Essential Facilities:</u> Those that are essential to the health and welfare of the whole population and are especially important following hazardous events. The potential consequences of losing them are so great that they should be carefully inventoried. Consider the structure, contents, and effect of loss of services in the selection.

Table D-1. Critical Buildings and Facilities

City of Monroe Structures	Square Footage	Building/ System Replacement Cost* ($)	Contents Replacement Cost* ($)
Monroe Civic Center and Conference Room (Primary Emergency shelter)	266,000	21,280,000	10,000,000
Monroe Police Station, Jails and Courts	46,545	3,821,455	780,296
Monroe City Hall Building	317,361	1,479,000	520,074
Monroe Public Safety Center	51,000	5,700,000	
Fire Dept. Station No. 1 (Central)	17,250	554,242	16,000
Fire Dept. Station No. 2	3,060	129,900	129,900
Fire Dept. Station No. 3		1,000,000	250,000
Fire Dept. Station No. 4	5,246	129,900	129,900
Fire Dept. Station No. 5	4,148	129,900	129,900
Fire Dept. Station No. 6	2,922	129,900	129,900
Fire Dept. Station No. 7	7,005	129,900	129,900
Fire Dept. Station No. 8	2,016	119,028	119,028
Fire Dept. Station No. 9	2,016	119,028	119,028
Fire Dept. Station No. 10	N/A	225,500	225,500
Public Works Sanitation Building	27,000	560,695	560,695
Central Warehouse and Maintenance Building	80,320	7,068,160	1,000,000
Street Department Shop/Offices	5,400	80,730	80,730
Metro Transit System	15,613	1,284,089	1,284,089
Water Distribution/Sewer Divisions Building	3,000	240,000	240,000
Sanitary Sewer Treatment Buildings**	13,150	12,611,368	12,611,368
Water Treatment System Buildings	1,816	155,000	35,000
Water System Plants and Pumping Stations	N/A	10,520,454	3,871,200
Estimated value of critical city-owned facilities		**$61,166,891**	**$32,511,150**

(*Continued*)

Evacuation Shelters (Publicly owned buildings excluding those included above in City facilities)	**Square Footage**	**Building Replacement Cost ($)**	**Contents Replacement Cost ($)**
Barkdull Faulk Elementary School	33,531	3,410,264	711,566
Carroll High School	109,879	14,610,771	543,196
Clark Elementary School	48,206	4,242,128	835,169
Lee Jr. High School	70,290	6,262,838	1,217,775
Lincoln Elementary School	61,771	5,366,860	787,646
Neville High School	105,544	9,403,970	2,468,542
Wossman High School	156,138	16,059,120	3,390,090
Carver Elementary School	38,366	2,742,838	494,507
Lexington Elementary School	53,937	3,880,600	593,693
Sallie Humble Elementary School	52,820	4,321,540	641,892
Carroll Jr. High School	68,503	5,134,015	828,128
Clara Hall Elementary School	40,044	3,934,477	578,690
Jefferson High School	52,860	3,488,760	915,799
Minnie Ruffin Elementary School	39,350	3,543,289	398,181
Sherrouse Alternative School	29,925	1,975,050	518,457
Madison James Foster Elementary School	54,000	4,112,564	1,028,500
Estimated value of critical publicly-owned buildings	**--**	**$92,489,084**	**$15,951,831**

*Note: Essential facilities were limited to structures owned and operated by the City of Monroe and other publicly-owned within the City and include only those structures deemed necessary to ensure the health and welfare of the citizens of the City of Monroe in the event of a natural or man-made disaster. Other privately-owned structures such as churches, hospitals, commercial businesses, state universities, and residences are numerous and would be available if needed. The privately-owned or state-owned facilities are outside the control of the city government but are considered available should the demand warrant it. The resources available from West Monroe, Louisiana and other surrounding municipalities are considered valuable and accessible in extreme circumstances.

Replacement cost for city-owned facilities and their contents were provided for the most part by the City of Monroe and reflect insurance values. Where values were not available, they were estimated using values for similar facilities within the city or calculated using the Consumer Price Index provided on Page 3-10 of the FEMA State and Local Mitigation Planning How-to-Guide manual. The Monroe City School System provided the values of school facilities and their contents.

Appendix E

CITY OF MONROE SCHOOLS

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Table E-1. City of Monroe School District Facilities

School	Grades	Location	2007 Enrollment (As of October 1, 2007)	Building Capacity	Date Constructed and Latest Renovation
Barkdull Faulk Elementary	PK-6	2110 Jackson Street	282	450	1920, 1999
Berg Jones Elementary	PK-5	3000 Burg Jones Lane	356	650	1967, 1997
Career Development Center	N/A	400 Harrison Street	108	150	2003
Carroll Junior High	7-8	2913 Renwick Street	371	600	1957, 2001
Carroll High	9-12	2939 Renwick Street	627	1000	1957, 1997
Carver Elementary	PK-6	1700 Orange Street	426	600	1952, 2004
Clara Hall Accelerated	PK-2	1000 Plum Street	362	575	1952, 1998
Cypress Point Elementary	PK-6	6701 Mosswood Drive	440	700	1997, 2003
J.S. Clark Elementary	PK-6	1207 Washington Street	487	600	1952, 1997
Lexington Elementary	PK-6	1900 Lexington Avenue	605	675	1951, 1996
Lincoln Elementary	PK-6	4200 Elm Street	507	775	1962, 1995
Madison James Foster Elementary	PK-6	1310 Richwood Road #1	420	700	1998
Martin Luther King, Jr. Middle	6-8	3716 Nutland Road	652	800	1963, 1999
Minnie Ruffin Elementary	PK-5	1801 Parkview Drive	475	550	1962, 1995
Neville High	9-12	600 Forsythe	849	1100	1930, 1995
Robert E. Lee Junior High	7-8	1600 North 19th Street	550	700	1956, 1997
Sallie Humble Elementary	PK-6	3800 Westminster Avenue	455	750	1961, 1995
Sherrouse Academic Center	1-11	300 Sherrouse Avenue	85	150	1952, 2003
Thomas Jefferson Elementary	3-5	1001 Pecan Street	222	750	1956, 2000
Wossman High	9-12	1600 Arizona Street	671	1200	1966, 1996
Source: City of Monroe School District					

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Appendix F

HAZUS METHODOLOGY LIMITATIONS AND OUTPUTS

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F.1 HAZUS METHODOLOGY

The City of Monroe, LA 50, 100, 200, 500, 1,000 Year Hurricane Methodology

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Science. The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used by local, state and regional officials to plan and stimulate efforts to reduce risk from multi-hazards and to prepare for emergency response and recovery. Further explanation of these processes and data sources can be found in the HAZUS technical manual.

The City of Monroe modeled the effects of a 50, 100, 200, 500, 1,000 year hurricane event for The City of Monroe, LA using HAZUS-MH MR4 (Patch 1) software from FEMA. The data utilized is standard with the HAZUS software.

The first step was to define the study area. HAZUS software does not allow for calculations for jurisdictions other than State and County. To fix this issue the defined area for the City of Monroe utilized census tracts. Census tracts were chosen to be as accurate as possible to the City of Monroe boundary. A limitation is that some of the census tracts are geographically spaced inside and outside of the City of Monroe's jurisdiction. The method that was selected was to ensure that all buildings within the city of Monroe were selected, but this increased the inclusion of structures and populations outside of the City of Monroe. The number of structures and population are higher than the actual structure number and population of Monroe.

After the study area was defined, the model ran in a probabilistic scenario. This scenario is extrapolates historic data into future occurrence for a given year. Further explanations are explained in fully detail in the HAZUS technical manual.

The model ran within all census tracts selected for the study area. The final model was able to estimate the damages of a 50, 100, 200, 500, 1,000-year hurricane event for structures and populations.

The City of Monroe, LA 100 and 500 Year Flood Methodology

The City of Monroe modeled the effects of a 100-year and 500-year flood for The City of Monroe, LA using HAZUS-MH MR4 (Patch 1) software from FEMA. The data utilized was the standard package which came with the HAZUS software with the exception of the digital elevation model (DEM) which was downloaded from USGS.

The first step was to define the study area. The study area includes all census blocks within the City of Monroe's jurisdiction. Census blocks were utilized because they are more defined geographic spaces to determine flood risk. Some overlapping jurisdictional census blocks were included when defining the study area.

Next, HAZUS developed the stream network with a defined area of 10 square miles as a drainage area (which is a default). A trial and error effort for several other values were tried and based on the number and complexity of the stream network, along with the additional processing time required for the smaller numbers which produce more streams for this study it was decided that 10 was sufficient. In addition, this is based on the relatively flat topography.

In the future, the accurate drainage area value needs to be described to get more accurate results.

Once the stream network was defined, all reaches completely inside the City of Monroe were included in the analysis. This is the foundation for the hydrology and delineation of the 100-year and 500-year floodplains.

Finally, the model produced and analyzed the estimated damage of 100-year flood and 500-year flood hazards for The City of Monroe. Further explanation of these processes and data sources can be found in the HAZUS technical manual.

F.2 HAZUS OUTPUTS: HIGH WIND

Table F-1. Expected Building Damage by Occupancy for 50–Year Hurricane Event

Occupancy	None	Minor	Moderate	Severe	Destruction
Agriculture	63	0	0	0	0
Commercial	1,868	6	0	0	0
Education	49	0	0	0	0
Government	81	0	0	0	0
Industrial	309	1	0	0	0
Religion	215	1	0	0	0
Residential	25,164	14	0	0	0
Total	**27,749**	**22**	**0**	**0**	**0**

Table F-2. Expected Building Damage by Building Type for 50-Year Hurricane Event

Building Type	None	Minor	Moderate	Severe	Destruction
Concrete	398	2	0	0	0
Masonry	4,189	12	0	0	0
MH	923	0	0	0	0
Steel	759	3	0	0	0
Wood	2,1477	4	0	0	0

Table F-3. Expected Building Damage by Occupancy for 100-Year Hurricane Event

Occupancy	None	Minor	Moderate	Severe	Destruction
Agriculture	63	0	0	0	0
Commercial	1,863	11	0	0	0
Education	49	0	0	0	0
Government	81	0	0	0	0
Industrial	308	2	0	0	0
Religion	215	1	0	0	0
Residential	25,105	72	2	0	0
Total	**27,682**	**87**	**2**	**0**	**0**

Table F-4. Expected Building Damage by Building Type for 100–Year Hurricane Event

Building Type	None	Minor	Moderate	Severe	Destruction
Concrete	397	3	0	0	0
Masonry	4,174	26	1	0	0
MH	923	0	0	0	0
Steel	756	6	0	0	0
Wood	21,435	45	1	0	0

Table F-5. Expected Building Damage by Occupancy for 200–Year Hurricane Event					
Occupancy	**None**	**Minor**	**Moderate**	**Severe**	**Destruction**
Agriculture	62	1	0	0	0
Commercial	1,849	23	1	0	0
Education	48	1	0	0	0
Government	80	1	0	0	0
Industrial	306	4	0	0	0
Religion	214	2	0	0	0
Residential	24,864	302	12	0	0
Total	**27,423**	**334**	**14**	**0**	**0**

Table F-6. Expected Building Damage by Building Type for 200–Year Hurricane Event					
Building Type	**None**	**Minor**	**Moderate**	**Severe**	**Destruction**
Concrete	393	6	0	0	0
Masonry	4,134	61	5	0	0
MH	923	0	0	0	0
Steel	750	11	1	0	0
Wood	21,241	235	5	0	0

Table F-7. Expected Building Damage by Occupancy for 500–Year Hurricane Event					
Occupancy	**None**	**Minor**	**Moderate**	**Severe**	**Destruction**
Agriculture	60	3	1	0	0
Commercial	1,789	74	11	0	0
Education	47	2	0	0	0
Government	77	3	0	0	0
Industrial	298	11	1	0	0
Religion	207	8	1	0	0
Residential	23,708	1,371	98	0	0
Total	**26,186**	**1,472**	**111**	**0**	**0**

Table F-8. Expected Building Damage by Building Type for 500–Year Hurricane Event					
Building Type	**None**	**Minor**	**Moderate**	**Severe**	**Destruction**
Concrete	379	19	2	0	0
Masonry	3,967	199	34	0	0
MH	919	3	1	0	0
Steel	724	31	6	0	0
Wood	20,267	1,160	52	0	0

Table F-9. Expected Building Damage by Occupancy for 1,000–Year Hurricane Event					
Occupancy	**None**	**Minor**	**Moderate**	**Severe**	**Destruction**
Agriculture	56	5	2	1	0
Commercial	1,706	138	29	1	0
Education	45	3	1	0	0
Government	74	6	1	0	0
Industrial	286	21	3	0	0
Religion	198	15	2	0	0
Residential	22,270	2,638	260	4	5
Total	**24,636**	**2,826**	**297**	**7**	**5**

Table F-10. Expected Building Damage by Building Type for 1,000–Year Hurricane Event					
Building Type	**None**	**Minor**	**Moderate**	**Severe**	**Destruction**
Concrete	360	33	7	0	0
Masonry	3,753	362	84	2	0
MH	911	9	2	0	1
Steel	690	54	17	1	0
Wood	19,044	2,272	156	4	4

F.2 HAZUS OUTPUTS: FLOOD

Table F-11. Damage by Occupancy for 100-Year Flood (in square feet)								
Occupancy	**Total Square Feet**	**None**	**1-10%**	**11-20%**	**21-30%**	**31-40%**	**41-50%**	**Substantial**
Agriculture	10	5	3	2	0	0	0	0
Commercial	1,511	709	367	348	62	22	3	0
Education	27	19	8	0	0	0	0	0
Government	47	29	16	2	0	0	0	0
Industrial	127	55	10	34	17	10	1	0
Religion	158	105	41	12	0	0	0	0
Residential	3,116	2,220	73	286	467	26	39	5
Total	**49,96**	**3,142**	**518**	**684**	**546**	**58**	**43**	**5**

Table F-12. Damage by Occupancy for 500-Year Flood (in square feet)								
Occupancy	**Total Square Feet**	**None**	**1-10%**	**11-20%**	**21-30%**	**31-40%**	**41-50%**	**Substantial**
Agriculture	9	5	3	1	0	0	0	0
Commercial	1,641	777	339	435	50	33	3	1
Education	29	19	10	0	0	0	0	0
Government	35	19	15	1	0	0	0	0
Industrial	156	54	9	43	43	6	1	0
Religion	162	102	48	12	0	0	0	0
Residential	3,314	2,312	79	324	509	45	40	5
Total	**5,343**	**3,288**	**503**	**816**	**602**	**84**	**44**	**6**

Table F-13. Damage by Building Type for 100-Year Flood (in square feet)							
Building Type	**None**	**1-10%**	**11-20%**	**21-30%**	**31-40%**	**41-50%**	**Substantial**
Steel	243	115	107	18	7	0	0
Masonry	563	150	147	56	8	3	0
Concrete	121	70	66	6	4	0	0
MH	2,053	115	274	403	26	24	0
Wood	54	0	0	0	0	5	1
Total	**3034**	**450**	**594**	**483**	**45**	**32**	**1**

Table F-14. Damage by Building Type for 500-Year Flood (in square feet)							
Building Type	**None**	**1-10%**	**11-20%**	**21-30%**	**31-40%**	**41-50%**	**Substantial**
Steel	264	110	134	22	9	0	0
Masonry	586	148	187	59	15	3	0
Concrete	120	66	85	13	4	0	0
MH	55	0	0	0	0	6	0
Wood	2,164	110	325	446	44	22	0
Total	**3,189**	**434**	**731**	**540**	**72**	**31**	**0**

Appendix G

HAZUS MAPS

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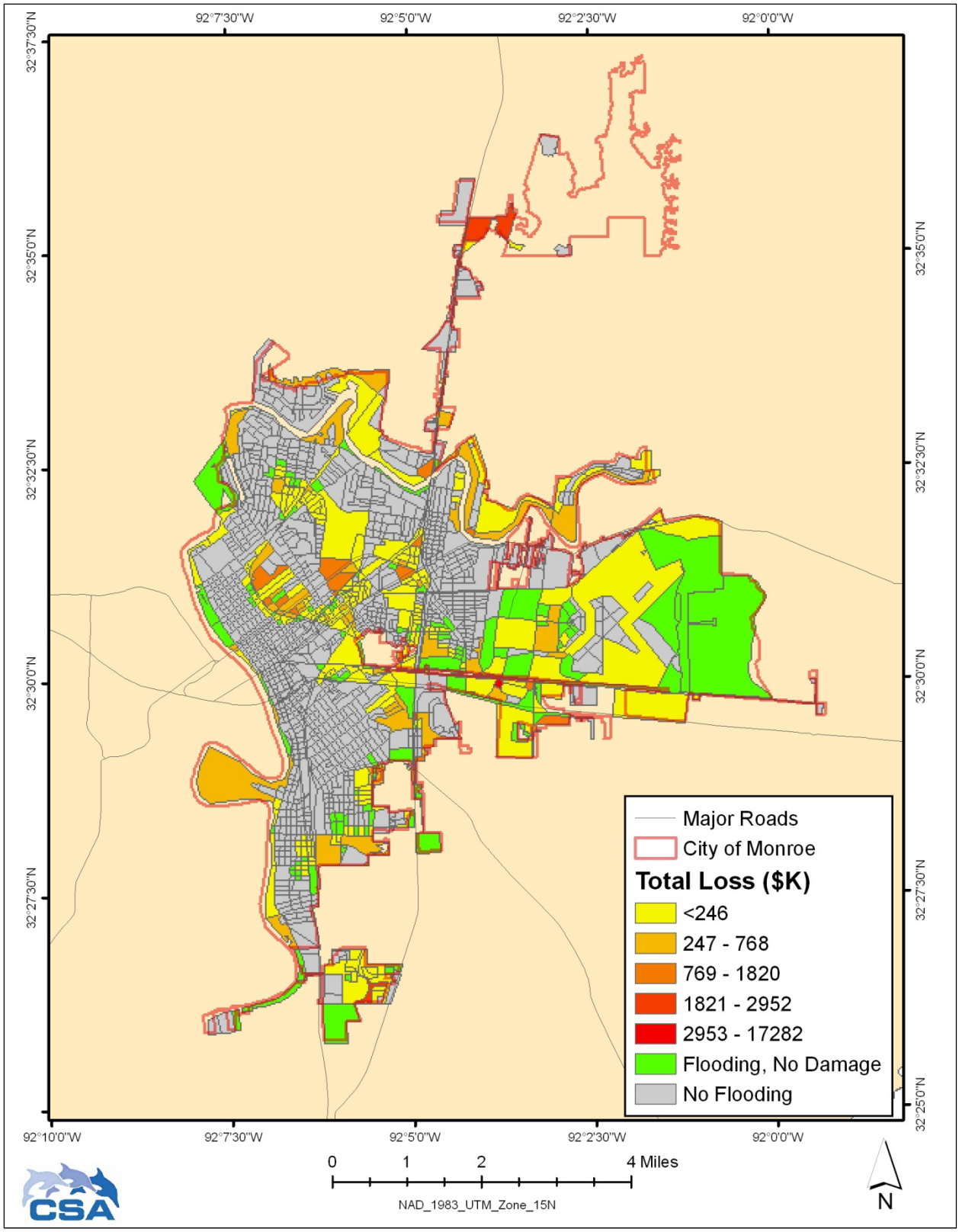

Figure G-1. Geographic Location of Building Losses

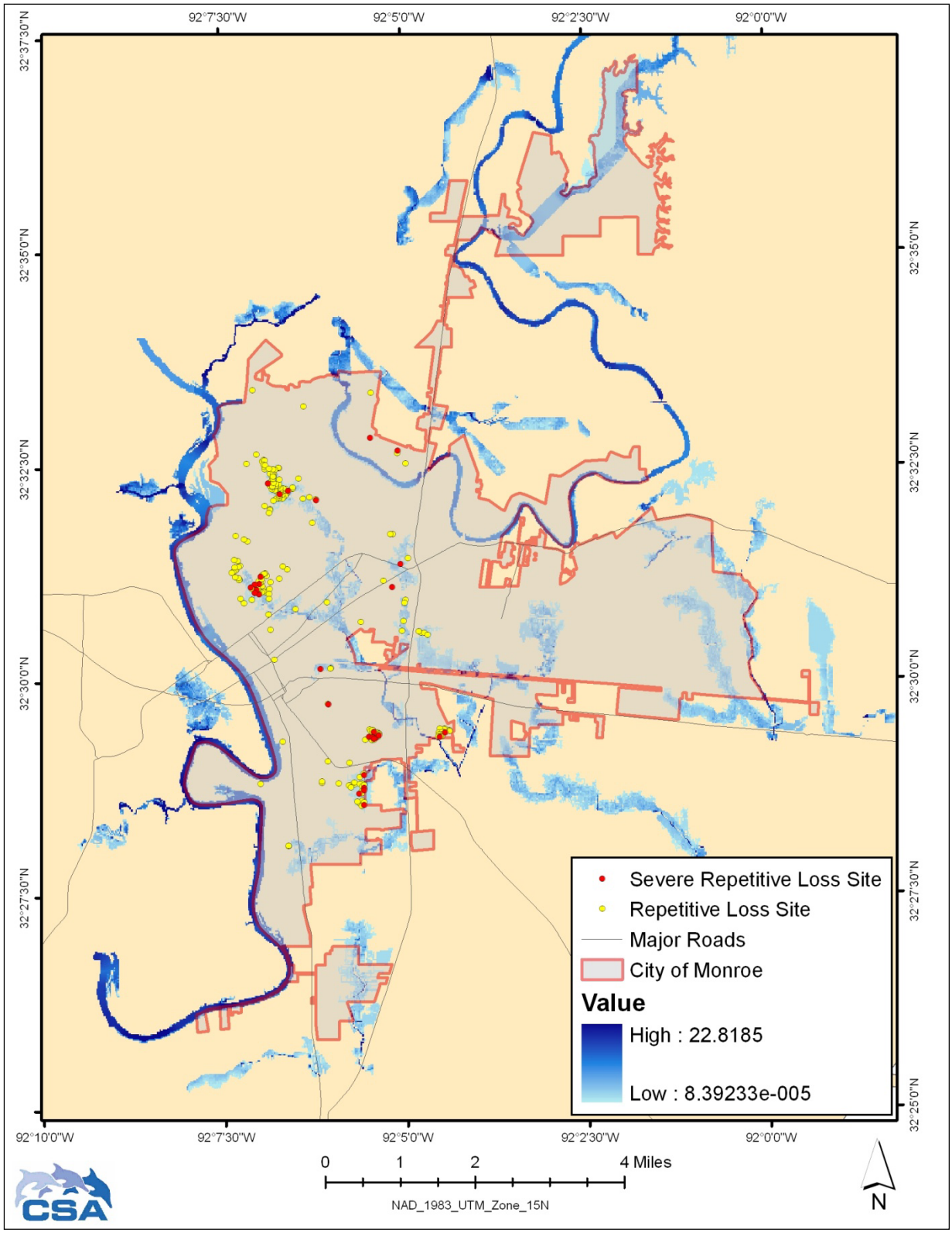

Figure G-2. Flood Prone Areas

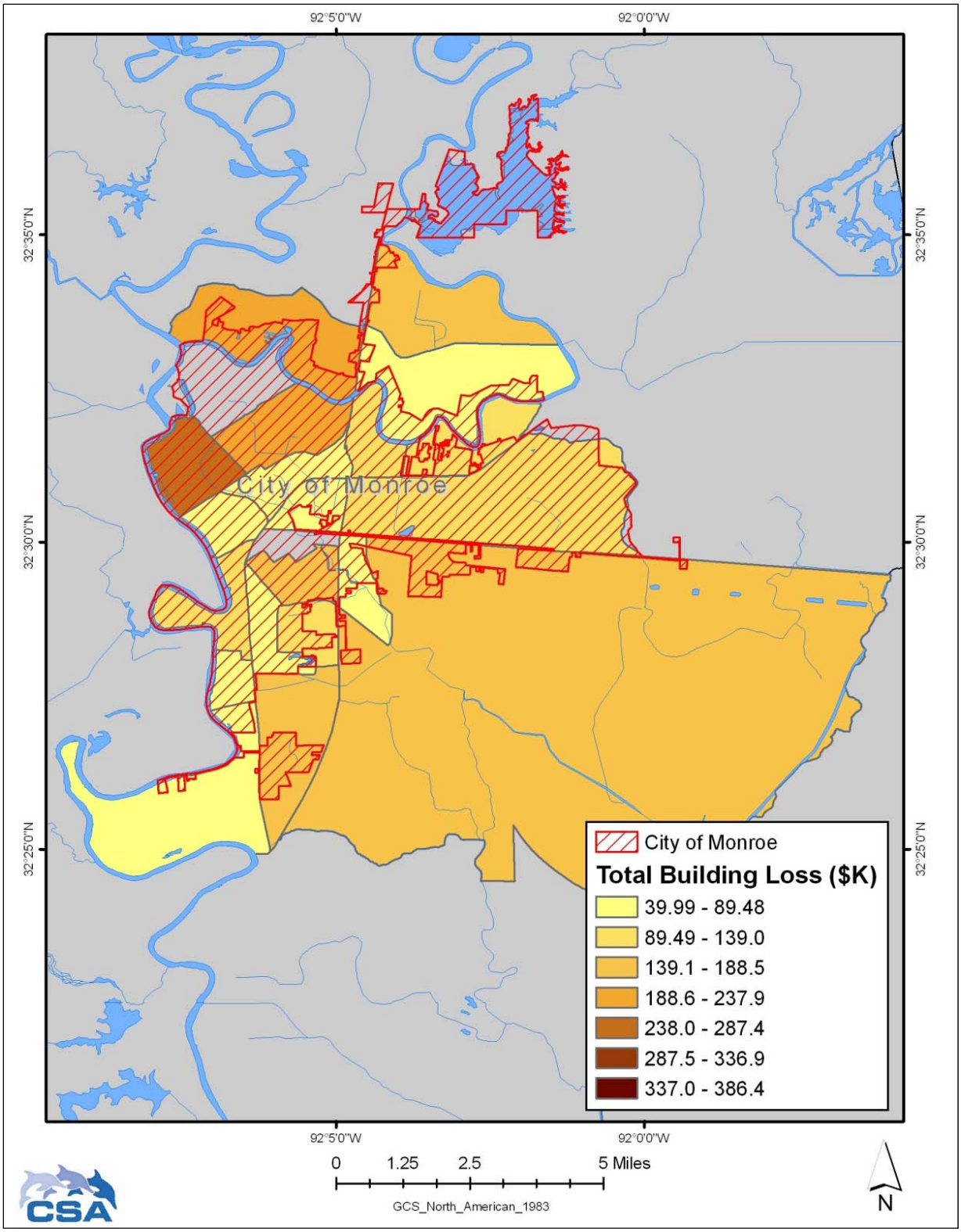

Figure G-3. Building Economic Loss for the Census Tracts in and Around the City of Monroe, Louisiana, for a 100-Year Return Period for High Wind (Estimated by HAZUS)

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Appendix H

TORNADO SCENARIOS

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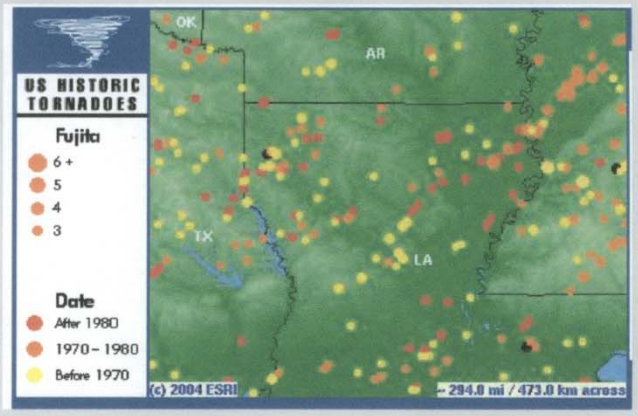
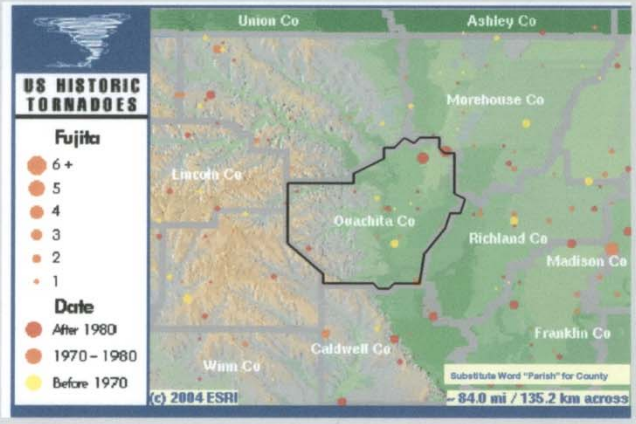
TORNADO HISTORY

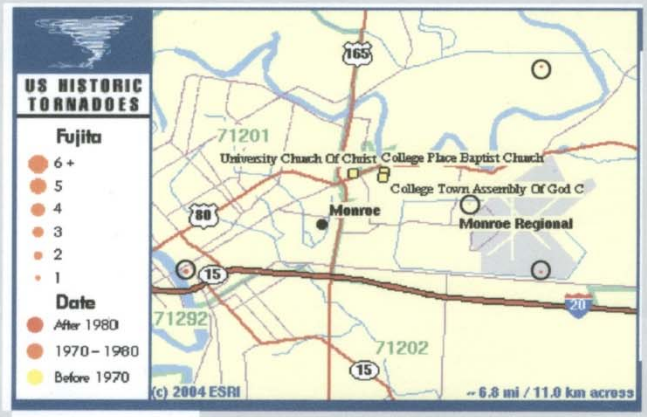
Regional Historical Events:



Parish Historical Events:



Monroe, La Historical Events:



Note: Monroe Events Circled

Data collected by the National Weather Service and graphically presented by the Environmental Systems Research Institute

Figure H-1. Tornado History

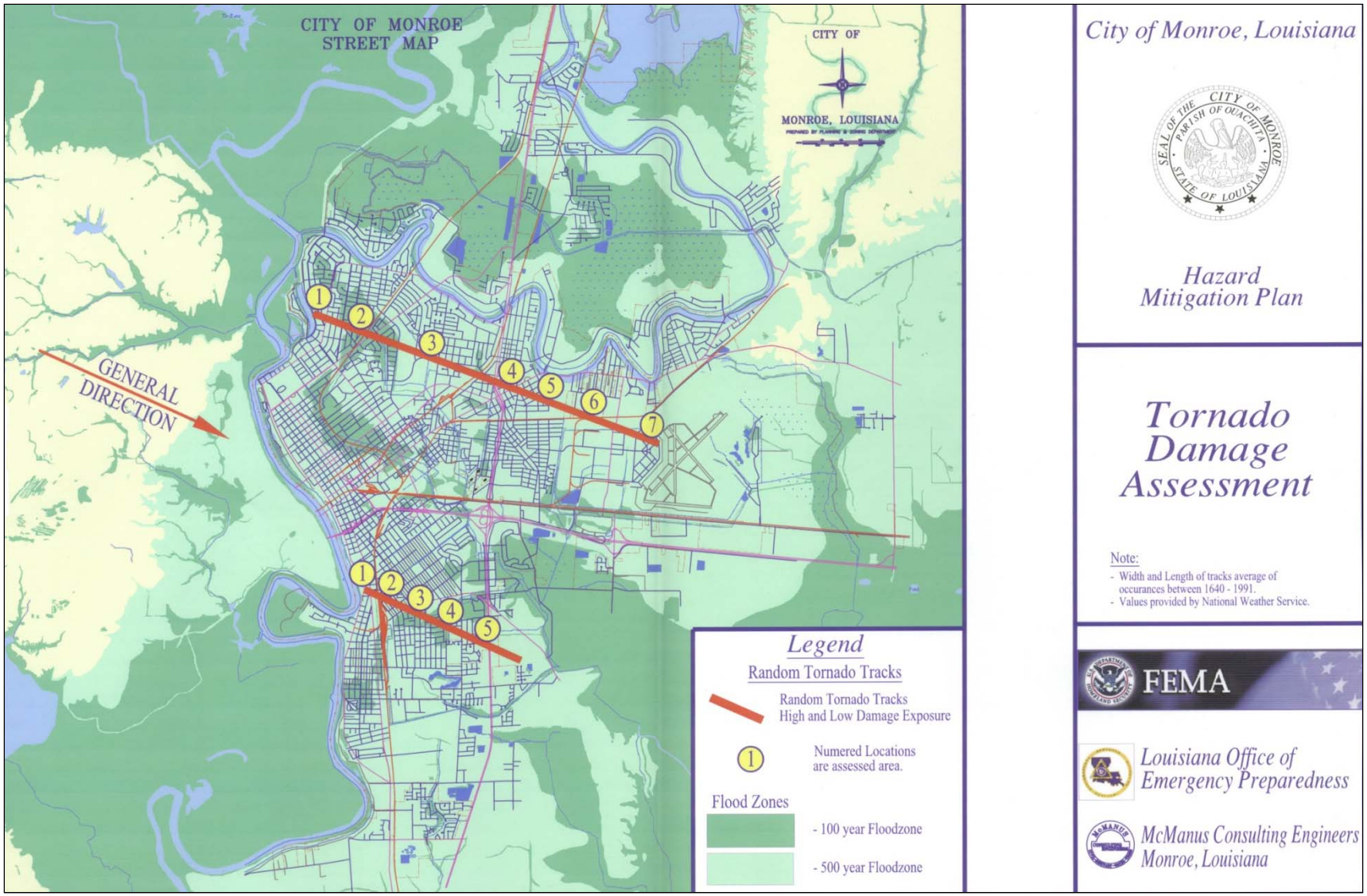


FIGURE H-2. TORNADO TRACKS

Appendix I

MONROE HAZARD MITIGATION
STEERING COMMITTEE
PROJECT PRIORITIZATION FORM

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STEERING COMMITTEE PROJECT PRIORITIZATION FORM

(*See form instructions below*)

Action #	Projects/Initiatives	Project/ Initiative Description	Voting Box	SELECTION CRITERIA						
				Protect Health and Safety of Citizens	Mandate by State or Federal	Leads to Community Resilience	Has Strong Local Support Within Community	Enhances Environment	Provides Long-Term Benefits	Funding Available
1	**Backup/Redundant Emergency Generators for Utilities**	Secure emergency generators.								
2	**City Sewer System Rehabilitation**	Continued sewer line rehabilitation program.								
3	**New Water Plant Chemical Building**	Construct new chemical storage building that meets 100 mph wind load.								
4	**Maintenance of Bayous and Drainage Canals**	Develop and implement within the Public Works Department a sustainable bayou and canal maintenance program.								
5	**Debris Reduction Public Outreach Program - Bayous and Drainage Canals**	Develop a public outreach program focused on debris reduction in the City's drainage canals.								
6	**Hydraulic Studies**	Conduct hydraulic studies in areas located within the 100-year flood zone.								
7	**School-based Multi-Hazard Education Program**	Incorporate a multi-hazard education program into all City of Monroe school curriculums. To discuss and create masters for disasters at a particular grade level.								
8	**Recertification of Floodwall Levee**	Council will provide the TBLB a formal letter strongly supporting the recertification of floodwall along the Ouachita River.								
9	**Commodity Flows Study**	Conduct a transportation chemical commodity flow study.								

Date: _____ *Steering Committee Member* _____

Action #	Projects/Initiatives	Project/ Initiative Description	Voting Box	SELECTION CRITERIA						
				Protect Health and Safety of Citizens	Mandate by State or Federal	Leads to Community Resilience	Has Strong Local Support Within Community	Enhances Environment	Provides Long-Term Benefits	Funding Available
10	**Community Rating System (CRS) Strategy**	Develop strategy that identifies actions the city can take to enhance its CRS rating.								
11	**Historical Structure Hazard Mitigation Plan**	Conduct study that provides a highly detailed inventory of historic structures.								
12	**Roads and Evacuation**	Prepare Transportation Evacuation Study.								
13	**Private and Public Coordination**	Integrate hazard considerations through increased involvement with private and public community partners.								
14	**Community Planning – Comprehensive Plan Revision**	Review and upgrade the existing Comprehensive Plan so that it incorporates hazard considerations.								
15	**Community Planning – Zoning Revision**	Review and upgrade the existing Zoning Ordinance.								
16	**Calypso Street Storm Water Station Improvement**	Elevate floor of pump station, modify piping, and replace all three pumps and controls.								
17	**Phillips Lake Drainage Project**	Modify the existing Marquette Street pump station.								
18	**Storm Drainage Pumping Stations Upgrades**	Modify and upgrade nine pump stations, and purchase portable diesel generators.								
19	**Generator for Sewer Lift Stations**	Purchase one 125 kw trailer-mounted generator.								
20	**Fire Station Assessment**	Conduct Fire Station structural assessment study.								

***INSTRUCTIONS**: Each member is assigned **10** votes. Your scoring is done in the column titled, VOTING BOX. Each vote is graphically depicted by dot (**•**). You may NOT vote more than twice for any particular Project/Initiative. In addition to voting for each Project/Initiative, please indicate with a check mark the criteria that supported your selection.*

Date: _____ Steering Committee Member _____