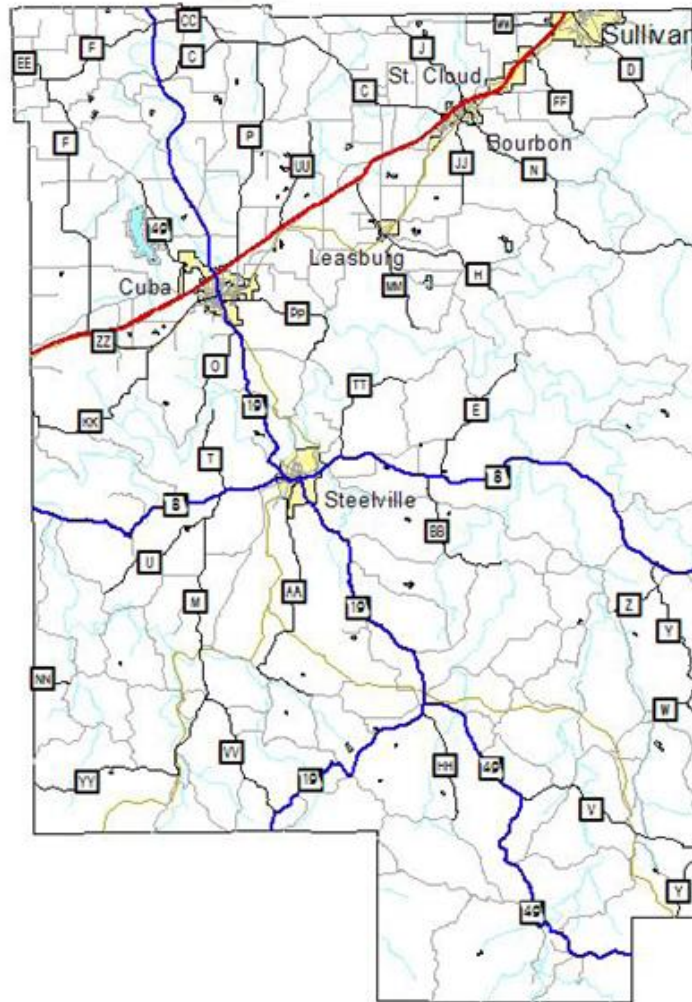


Crawford County Multi-Jurisdiction Natural Hazard Mitigation Plan

February 2013



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TABLE OF CONTENTS

Executive Summary i

Prerequisites xiii

Chapters

1 Introduction and Planning Process

1.1 Purpose 1.1

1.2 Background and Scope 1.1

1.3 Plan Organization 1.3

1.4 Planning Process 1.4

 1.4.1 Multi-Jurisdictional Participation..... 1.5

 1.4.2 The Planning Process 1.8

 1.4.3 Public Participation in the Planning Process 1.12

 1.4.4 Coordination with Other Departments/Agencies/Jurisdictions 1.13

2 Planning Area Profile and Capabilities

2.1 Crawford County Planning Area Profile 2.1

 2.1.1 History and Development 2.1

 2.1.2 Geography and Topography 2.3

 2.1.3 Soil Types 2.8

 2.1.4 Climate 2.9

 2.1.5 Population/Demographics 2.10

 2.1.6 Schools: Vocational/Technical Schools/Colleges/Universities..... 2.15

 2.1.7 Business/Industry 2.17

 2.1.8 Agriculture..... 2.18

 2.1.9 Environmentally Sensitive Areas 2.19

 2.1.10 Endangered Species and Species of Concern 2.23

2.2 Jurisdictional Descriptions and Capabilities 2.24

 2.2.1 Unincorporated Crawford County 2.24

 2.2.2 Cities 2.25

 2.2.3 School Districts..... 2.33

 2.2.4 Colleges/Universities 2.36

3 Risk Assessment

3.1 Identification of Hazards Affecting Crawford County	3.2
3.1.1 Methodology.....	3.2
3.1.2 Disaster Declaration History	3.5
3.2 Profiles of Hazards Affecting Crawford County	3.7
3.2.1 Methodology.....	3.7
3.2.2 Dam Failure.....	3.10
3.2.3 Drought.....	3.24
3.2.4 Earthquake.....	3.30
3.2.5 Extreme Heat	3.37
3.2.6 Flood (Riverine and Flash)	3.41
3.2.7 Landslide	3.48
3.2.8 Land Subsidence/Sinkholes.....	3.53
3.2.9 Severe Storms (Hail Storm/Wind Storm)/Tornado	3.60
3.2.10 Severe Winter Weather.....	3.70
3.2.11 Wildfires	3.75
3.2.12 Hazard Profiles Summary.....	3.82
3.3 Vulnerability Assessment	3.83
3.3.1 Methodology.....	3.83
3.3.2 Community Assets	3.84
3.3.3 Vulnerability by Hazard	3.92
3.3.4 Future Land Use and Development.....	3.129
3.3.5 Summary of Key Issues	3.130

4 Mitigation Strategy

4.1 Goals	4.6
4.2 Identification and Analysis of Mitigation Actions	4.7
4.2.1 STAPLEE Scoring	4.8
4.2.2 Mitigation Goals and Objectives	4.13
4.3 Implementation of Mitigation Actions	4.17
4.4 Mitigation Actions in Support of the National Flood Insurance Program ...	4.59

5 Plan Implementation and Maintenance

5.1 Monitoring, Evaluating and Updating the Plan	5.1
5.2 Plan Maintenance	5.2
5.3 Incorporation of Hazard Mitigation Into Existing Planning	5.3
5.4 Continued Public Involvement	5.4
5.5 Summary of Plan Changes	5.5

Appendices

Appendix A: Planning Process Documentation

Appendix B: References

Appendix C: Adoption Resolutions

Appendix D: Federal / State Mitigation Programs, Activities and Initiatives

EXECUTIVE SUMMARY

The purpose of natural hazards mitigation is to reduce or eliminate long-term risk to people and property from natural hazards. Crawford County and participating jurisdictions developed this multi-hazard mitigation plan to reduce future losses to the County and its communities resulting from natural hazards. The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 and to achieve eligibility for the Federal Emergency Management Agency (FEMA) Flood Mitigation Assistance, Pre-Disaster Mitigation and Hazard Mitigation Grant Programs.

The Crawford County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following local governments and organizations that participated in the planning process:

- Crawford County
- City of Bourbon
- City of Cuba
- Village of Leasburg
- Village of St. Cloud
- City of Steelville
- City of Sullivan
- Village of West Sullivan
- Bourbon R-I School District
- Cuba R-II School District
- Steelville R-III School District
- Sullivan C-2 School District

In addition to the local governments and school districts, several other entities participated in this effort providing support and contributing to the mitigation strategy:

- *Steelville Star*
- Crawford County 9-1-1

The County's planning process followed a methodology prescribed by FEMA, which began with the formation of a Hazard Mitigation Planning Committee (HMPC) comprised of key stakeholders from Crawford County, participating jurisdictions and state and federal agencies. The Crawford County HMPC was assisted in this planning effort by the Meramec Regional Planning Commission (MRPC). The MRPC was created January 23, 1969 by then Governor Warren E. Hearnes. The commission serves the eight-county area of Crawford, Dent, Crawford, Maries, Osage, Crawford, Pulaski and Washington counties as well as 33 municipalities.

Under the initiative set forth by the Missouri State Emergency Management Agency (SEMA), the Missouri Association of Councils of Government (MACOG) agreed to meet the challenge of developing plans for cities and counties throughout the state. SEMA's initiative further states that due to time and funding limitations, the plans developed by Missouri's regional planning commissions should cover natural hazards only. Manmade and/or technological hazards are not addressed in this plan, except in the context of cascading damages.

The MRPC assisted the Crawford County HMPC by providing professional staff to coordinate the committee's activities and prepare the planning document. MRPC staff took the input provided by the HMPC and incorporated it into the plan document. Citizens and public organizations have participated in the process. This effort will be sustainable over the long term because it enjoys grassroots support that stems from a sense of local and individual ownership.

The HMPC assessed the risks, identifying and profiling hazards threatening the county. The HMPC then determined the County's vulnerability to the identified hazards and examined the County's capability to mitigate these hazards. The County is vulnerable to a number of potential hazards and those have been identified, profiled and analyzed in this plan. Tornadoes, floods, winter storms and thunderstorms are among the hazards that can have a significant impact on the County.

Based upon the risk assessment, the HMPC identified goals for reducing risk from hazards. The goals of this multi-hazard mitigation plan are to:

Goal 1: Reduce risks and vulnerabilities of people in hazard-prone areas through current technology, better planning and hazard mitigation activities.

Goal 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.

Goal 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards and hazard mitigation alternatives that can reduce their vulnerabilities.

Goal 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business and industry to create a widespread interest in mitigation.

Goal 5: Establish priorities for reducing risks to the people and their property with emphasis on long-term and maximum benefits to the public rather than short-term benefit of special interests.

Goal 6: Secure resources for investment in hazard mitigation.

To meet the identified goals, the plan recommends the mitigation actions summarized in the table on the follow page. The HMPC also developed an implementation plan for each action, which identifies priority level, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources and more. These additional details are provided in Chapter 4.

The multi-hazard mitigation plan has been formally adopted by the Crawford County Commissioners and the governing bodies of each participating jurisdiction and will be updated within a five-year timeframe.

Summary of Mitigation Programs and Action items Developed for Crawford County and All Jurisdictions

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Implement an education program on personal emergency preparedness.	Reducing Vulnerability of the People	1	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Promote the development of emergency plans by businesses.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Encourage cities to obtain early warning systems and improved communications systems to minimize loss of life.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Promote the use of weather radios by local residents and schools to ensure advanced warning about threatening weather.			High	Severe Storms Tornados

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.	Reducing Vulnerability of the People	1	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	6. Encourage and continue tree trimming programs as well as dead tree removal program.			High	Severe Storms Tornados
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	7. Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.			Flood Earthquake	
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan Bourbon R-I Cuba R-II	8. Encourage the construction of tornado safe rooms and/or storm shelters in areas with high population densities such as schools and large employers.			High	Severe Storms Tornados

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Steelville R-III Sullivan C-2					
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.	Property and Infrastructure Protection	2	High	Earthquake Tornado
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Educate residents about the dangers of floodplain development and the benefits the National Flood Insurance Program.			High	Flood
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Encourage minimum standards for building codes in all cities.			Medium	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Encourage local governments to develop and implement regulations for securing hazardous materials tanks and mobile homes.			Medium	Flood Severe Storms Tornado

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Distribute SEMA brochures at public facilities and events.	Outreach and Education	3	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparedness.	Outreach and Education	3	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Encourage local residents to purchase weather radios.			High	Severe Storms Tornados
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Ask SEMA mitigation specialists to present information to city councils, county commission and local planning organizations.			High	All Hazards
Crawford County Bourbon	5. Re-evaluate the hazard mitigation plan and merge with other community planning			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan					
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	6. Distribute press releases by cities/county regarding adopted mitigation measures.	Outreach and Education	3	Medium	All Hazards
Crawford County	7. Encourage county health department and Red Cross to implement education/awareness campaigns on individual preparedness.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	8. Publicize city and/or county drills.			Medium	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan Bourbon R-I Cuba R-II	1. Encourage joint meetings of different organizations/ agencies for mitigation planning	Communication Enhancement	4	Medium	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Steelville R-III Sullivan C-2					
Crawford County Bourbon Cuba Leasburg, St. Cloud Steelville Sullivan West Sullivan Bourbon R-I Cuba R-II Steelville R-III Sullivan C-2	2. Joint training or drills between agencies, public and private entities including schools and businesses.	Communication Enhancement	4	Medium	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Pool different agency resources to achieve widespread mitigation results.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Encourage meetings between EMD, city/county officials and SEMA to familiarize local officials with mitigation planning and implementation and budgeting for mitigation projects.			High	All Hazards
Bourbon Cuba Leasburg St. Cloud Steelville	1. Encourage communities to budget for enhanced warning systems.	Long-Term Planning	5	High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Sullivan West Sullivan		Long-Term Planning	5		
Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Encourage all communities to develop stormwater management plans.			Low	Flood Severe Storms
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.			Medium	All Hazards
Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Encourage cities to require contractor stormwater management plans in all new development.			Low	Flood Severe Storms
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Encourage local governments to purchase properties in the floodplain as funds become available and convert land into public space/recreation area.			Medium	Flood
Crawford County Bourbon	6. Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.			High	Flood

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan					
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Work with SEMA Region I coordinator to learn about new mitigation funding opportunities.	Finding Funding	6	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.	Finding Funding	6	Medium	Flood Earthquake
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Work with state/local/federal agencies to include mitigation in all economic and community development projects.			Medium	All Hazards
Crawford County Bourbon Cuba Leasburg	4. Encourage local governments to budget for mitigation projects.			Medium	All Hazard

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
St. Cloud Steelville Sullivan West Sullivan Bourbon R-I Cuba R-II Steelville R-III Sullivan C-2					
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Encourage cities and county to implement cost-share programs with private landowners for hazard mitigation projects that benefit the community as a whole.	Finding Funding	6	Medium	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	6. Implement public awareness program about the benefits of hazard mitigation projects, both public and private.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	7. Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.			High	All Hazards

PREREQUISITES

44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Note to Reviewers: When this plan has been reviewed and approved pending adoption by FEMA Region VII, the adoption resolutions will be signed by the participating jurisdictions and added to Appendix C. A model resolution is provided.

The following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan. Resolutions of Adoptions are included in Appendix C.

- Crawford County
- City of Bourbon
- City of Cuba
- City of Leasburg
- Village of St. Cloud
- City of Steelville
- City of Sullivan
- Village of West Sullivan
- Crawford County R-I School District
- Crawford County R-II School District
- Steelville R-III School District
- Sullivan C-2 School District

Participation of local governing bodies as stakeholders is critical to successful mitigation implementation. As former SEMA Deputy Director Beauford C. “Buck” Katt writes:

“One thing we have learned over the years is that mitigation programs crumble unless locals, both private and public, have a stake in the process; they simply must feel a sense of ownership for the program to be successful. We strongly believe that this effort will be successful and sustainable over the long term only if it enjoys grassroots support that stems from a sense of local and individual ownership.”

Citizens and public organizations have participated in the process. This effort will be sustainable over the long term because it enjoys grassroots support that stems from a sense of local and individual ownership. Through SEMA’s Scope of Work, Crawford County contracted with the Meramec Regional Planning Commission and participated fully in the preparation of the plan. Once this plan is approved, Crawford County, its cities, school districts and local utilities will be eligible for future mitigation assistance from FEMA and will be able to more effectively carry out mitigation activities to less the adverse impact of future disasters in the county.

Model Resolution

Resolution # _____
Adopting the Crawford County Multi-Hazard Mitigation Plan

Whereas, the _____ recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S Congress passed the Disaster Mitigation Act of 2000 emphasizing the need for pre-disaster mitigation of potential hazards and made available hazard mitigation grants to state and local governments; and

Whereas, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, the _____ fully participated in the FEMA prescribed mitigation planning process to prepare this Multi-Hazard Mitigation Plan; and

Whereas, the Missouri State Emergency Management Agency and Federal Emergency Management Agency officials have reviewed the Crawford County Multi-Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and

Whereas, the _____ desire to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Crawford County Multi-Hazard Mitigation Plan; and

Whereas, adoption by the governing body for the _____ demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Multi-Hazard Mitigation Plan; and

Whereas, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

Now, therefore, be it resolved, that the _____ adopts the Crawford County Multi-Hazard Mitigation Plan as an official plan and will submit this Adoption Resolution to the Missouri State Emergency Management Agency and the Federal Emergency Management Agency officials to enable the plan's final approval.

Passed on this date _____

Certifying Official Signature _____

1 INTRODUCTION AND PLANNING PROCESS

1.1 Purpose

The purpose of the Crawford County Hazard Mitigation Plan is to substantially and permanently reduce the county's vulnerability to natural hazards. This plan demonstrates the communities' commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the community towards the development of a safer, more sustainable community.

In an effort to ensure the purpose of the Crawford County Hazard Mitigation Plan is fulfilled, the participants in the development of this plan defined and established a list of goals which are directly relevant to meeting the purpose of the plan. The following is a list of the goals identified by the participants of this plan:

1. Reduce risks and vulnerabilities of people in hazard-prone areas through current technology, better planning and hazard mitigation activities.
2. Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.
3. Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.
4. Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.
5. Establish priorities for reducing risks to the people and their property with emphasis on long-term and maximum benefits to the public rather than short-term benefit of special interests.
6. Secure resources for investment in hazard mitigation.

This plan was also developed to make Crawford County and participating jurisdictions eligible for certain federal disaster assistance. Those programs include the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program and Flood Mitigation Assistance Program.

1.2 Background and Scope

Each year natural disasters take the lives of hundreds of people and injure thousands more in the United States alone. Nationwide, taxpayers pay billions of dollars annually to help communities,

organizations, businesses and individuals recover from disasters. Taxpayer dollars only partially reflect the total cost of disasters. Insurance companies and non-governmental organizations that respond to disasters and/or assist with recovery also contribute enormous sums of money in the wake of natural disasters. Many of these events are predictable and loss of life and property damage could be reduced or eliminated with proper planning and preparation.

Hazard mitigation is defined by FEMA as “any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event.” The results of a three-year congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of \$4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council, 2005).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set and appropriate strategies to lessen impacts are determined, prioritized and implemented. This plan documents Crawford County’s hazard mitigation planning process and identifies relevant hazards, vulnerabilities and strategies the County and participating jurisdictions will use to decrease vulnerability and increase resiliency and sustainability in Crawford County.

This multi-jurisdictional plan complies with SEMA’s and FEMA’s planning guidance; Fema regulations, rules, guidelines and checklists; the Code of Federal Regulations; and existing federal and state laws; and such other reasonable criterion as the President, Governor, federal and state congresses and SEMA and FEMA may establish in consultation with local governments while the plan is being developed. This plan also meets the minimum planning requirements for all FEMA mitigation programs, such as the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, the Hazard Mitigation Grant Program (HMGP), and where appropriate, other FEMA mitigation related programs such as the National Earthquake Hazards Reduction Program (NEHRP), the National Flood Insurance Program (NFIP) and the Community Rating System (CRS).

The Crawford County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the participating jurisdictions within the County’s borders, including the following:

- Crawford County
- City of Bourbon
- City of Cuba
- Village of Leasburg
- Village of St. Cloud
- City of Steelville
- City of Sullivan
- Village of West Sullivan

New jurisdictions added in the 2009 plan revision process are:

- Village of St. Cloud
- Crawford County R-I School District

- Crawford County R-II School District
- Steelville R-III School District
- Sullivan C-2 School District

In addition to local jurisdictions, the following entities participated in the planning effort:

- *Steelville Star*
- Crawford County 9-1-1
- Crawford County Water Supply District #1

Table 1.1 Continuing, New or Discontinued Jurisdictions Participating in Plan

Jurisdiction Name	Continuing Jurisdiction	New Jurisdiction	Discontinued Jurisdiction
Crawford County	X		
City of Bourbon	X		
City of Cuba	X		
Village of Leasburg	X		
Village of St. Cloud		X	
City of Steelville	X		
City of Sullivan	X		
Village of West Sullivan	X		
Crawford County R-I School District		X	
Crawford County R-II School District		X	
Steelville R-III School District		X	
Sullivan C-2 School District		X	

The information and guidance in this plan document will be used to help guide and coordinate mitigation activities and decisions for local jurisdictions and organizations. Proactive mitigation planning will help reduce the cost of disaster response and recover to local communities and residents by protecting critical infrastructure, reducing liability exposure and minimizing overall community impacts and disruptions. Crawford County has been affected by natural disasters in the past and participating jurisdictions and organizations are committed to reducing the impacts of future incidents and becoming eligible for hazard mitigation-related funding opportunities.

1.3 Plan Organization

The Crawford County Hazard Mitigation Plan has been prepared according to the requirements of the Disaster Mitigation Act of 2000, which emphasized the need for a more coordinated approach to mitigation planning and implementation. Furthermore, the plan has been developed and organized within the rules and regulations established under the 44 CFR 201.6, published in the *Federal Register* on February 26, 2002 and finalized on October 31, 2007. The regulations

established the requirements that local hazard mitigation plans must meet in order to fulfill the eligibility requirements for local jurisdictions to apply for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act.

The plan contains a mitigation action listing, a discussion of the purpose and methodology used to develop the plan, a profile on Crawford County, as well as the hazard identification and vulnerability assessment of natural hazards. In addition, the plan offers a discussion of the community's current capability to implement the goals, objectives and strategies identified here in. The plan is organized as follows:

- Executive Summary
- Prerequisites
- Chapter 1: Introduction and Planning Process
- Chapter 2: Planning Area Profile and Capabilities
- Chapter 3: Risk Assessment
- Chapter 4: Mitigation Strategy
- Chapter 5: Plan Implementation and Maintenance
- Appendices

To assist in the explanation of the above identified contents, there are several appendices included which provide more detail on specific subjects. This plan is intended to improve the ability of Crawford County and the jurisdictions within to handle disasters and will document valuable local knowledge on the most efficient and effective ways to reduce loss.

1.4 Planning Process

44 CFR Requirement 201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process and how the public was involved.

The Crawford County Hazard Mitigation Planning Committee (HMPC) first organized in 2004 when the Missouri State Emergency management Agency (SEMA) provided funding for hazard mitigation planning to counties throughout the state of Missouri. Crawford County's hazard mitigation plan was originally developed by Meramec Regional Planning Commission. MRPC assisted the county in forming a planning committee comprised of representatives from each of Crawford County's cities, city and rural fire departments, police departments, ambulance districts, the county health department, local businesses, utility companies, the American Red Cross, not-for-profits and school districts. This cross section of local representatives was chosen for their experience and expertise in emergency planning and community planning for Crawford County. The (HMPC) was re-activated in 2009 to conduct the review and update of the plan. The County joined with SEMA to contract with the Meramec Regional Planning Commission (MRPC) to assist with the review and update of the plan document that was originally approved in 2004. Two plan update meetings were held. The first meeting was held on May 11, 2009. A second meeting was held on June 1, 2009. All meetings were advertised on MRPC's website and public notices were provided through the Crawford County Courthouse. Sign in sheets and

meeting notes from each of those meetings are included in Appendix A: Planning Process Documentation. Much of the information gathering for the plan was done by written and electronic correspondence.

The Crawford County Multi-Hazard Mitigation Plan was developed as the result of a collaborative effort among Crawford County, the cities of Bourbon, Cuba, Leasburg, St. Cloud, Steelville, Sullivan and West Sullivan and the Bourbon R-I School District, Cuba R-II School District, Steelville R-III School District and Sullivan C-2 School District, and public agencies, non-profit organizations, the private sector as well as regional, state and federal agencies. MRPC contacted and asked for volunteers to serve on the planning committee from the county and local city governments, school districts, local fire departments, ambulance districts, police departments, the county health department, local businesses, utility companies and the American Red Cross. This cross-section of local representatives was chosen for their experience and expertise in emergency planning and community planning in Crawford County.

Crawford County followed the combination model of plan participation. Due to time and duty constraints, not all the jurisdictions that were invited to participate were able to be active on the planning committee. In those cases where providing a planning committee representative was not possible, MRPC, following the guidance document *Multi-Jurisdictional Mitigation Planning – State and Local Mitigation Planning How-To Guide Number Eight, FEMA 386-8 August 2006*, provided the jurisdiction with a resolution authorizing MRPC to prepare the plan on their behalf. Copies of those resolutions are included in Appendix A: Planning Process Documentation. These authorizing jurisdictions were still asked to review the draft plan, provide input and data for the document and formally adopt the plan.

Interviews were conducted with stakeholders from the community and two meetings were conducted during the plan update. Additionally, through public committee meetings, press releases and draft plan posting on MRPC’s website, ample opportunity was provided for public participation. Any comments, questions and discussions resulting from these activities were given strong consideration in the development as well as the review and update of this plan. A mitigation planning committee guided and assisted the Meramec Regional Planning Commission in both the development and updating of the plan.

1.4.1 Multi-Jurisdictional Participation

44 CFR Requirement 201.6 (a) (3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

During the original planning process in 2004, Crawford County invited incorporated cities, school districts, emergency response agencies, utility companies and not-for-profits to participate in the hazard mitigation planning process. The following is the list of people and organizations that were invited to participate during the 2004 planning process:

- Tim Bailey, Cuba Police Department
- Bob Baldwin, Cuba Public Works
- Bryce Bird, Steelville Ambulance District

- Dave Cochran, Sullivan Parks & Recreation
- George Counts, Sullivan Police Department
- Darrell Cunningham, Bourbon Fire Department
- Al Engelbrecht, Jr., Crawford County Sheriff
- Mark Falloon, Sullivan City Administrator
- Michael Guess, Steelville Police Department
- Kevin Halbert, Sullivan Emergency Management Director
- Mary Heywood, Mayor of Bourbon
- Bob Hutson, Bourbon Emergency Management Director
- Dan King, Sullivan Health Officer
- James King, Leasburg Water Supervisor
- Joan King, Crawford County Red Cross
- John Koch, Mayor of Cuba
- Mark Korver, Sullivan Fire Department
- Ed Mitchell, Crawford County Associate Commissioner
- Les Murdock, Cuba Emergency Management Director
- Tommy Murray, Steelville Public Works
- Terry Palmer, Mayor of Steelville
- Mike Plank, Cuba Fire Department
- Richard Ramstein, Sullivan City Engineer
- Jim Schatz, Mayor of Sullivan
- Davis Skinner, Missouri Baptist Hospital-Sullivan
- Shirley Stulce, Crawford County Health Department
- Kerry Summers, Jr., Steelville Fire Department
- Neil Swyers, Crawford County Associate Commissioner
- Monty Todd, Bourbon Public Works
- Jim Turntine, Village of West Sullivan Chairman
- Roger West, Village of Leasburg Chairman
- William R. Williams, Bourbon Police Department
- Charles Witt, Crawford County Emergency Management Director
- Patricia Woodruff, North Crawford Ambulance District
- Ed Worley, Crawford County Presiding Commissioner

During the 2009 Update and Revision, Crawford County invited incorporated cities, school districts, emergency response agencies, utility companies and not-for-profits to participate in the hazard mitigation planning process. The following is the list of people and organizations that were invited to participate:

- James Happel, Cuba Natural Gas Superintendent
- Richard Dildine, Cuba Police Chief
- Bob Bowen, Cuba Electrical Superintendent
- Bob Baldwin, Public Works Superintendent
- Mike Myers, Cuba Sewer Superintendent
- Dennis Chandler, Cuba Street Superintendent

- Dwayne Cartwright, Intercounty Electric Cooperative
- Vonnie Richards, Leasburg Village Clerk
- Kathy Byrd, Leasburg Street Supervisor
- Michael Bouse, Leasburg Water Supervisor
- Leonard Armstrong, Mayor of Bourbon
- Kenny Killeen, Mayor of Cuba
- David Barkley, Village of St. Cloud Trustee
- Terry Palmer, Mayor of Steelville
- J.T. Hardy, Mayor of Sullivan
- Davis Skinner, Missouri Baptist Hospital – Sullivan
- Mark Keeley, North Crawford Ambulance District
- Bill Patt, Steelville Ambulance District
- Sheila Anderson, Steelville City Clerk
- Steve Phoenix, Steelville Fire Department
- Michael Guess, Steelville City Marshall
- Tommy Murray, Steelville City Superintendent
- Robert Cornick, Steelville Head Electrician
- Terry Lunsford, City Water Superintendent
- Mark Falloon, Sullivan City Administrator
- Jan Koch, Sullivan City Clerk
- Robert Schaffer, Sullivan City Engineer
- Kevin Halbert, Sullivan EMD
- Rich White, Sullivan Fire Chief
- Dan King, Sullivan Health Officer
- J.V. Thurmond, Sullivan Light Commissioner
- Dave Cochran, Sullivan Parks & Recreation
- George Counts, Sullivan Police Chief
- Tom Harman, Sullivan Water Commissioner
- Tom Sharp, Superintendent Crawford County R-I
- Waymon Boast, Superintendent Crawford County R-II
- Harvey Richards, Superintendent Steelville R-III
- Mickie Shank, Superintendent Sullivan C-2
- Michelle Hatton, Village of Leasburg Chairman
- Jim Turntine, Village of West Sullivan Chairman
- Board of Aldermen, City of Steelville
- Board of Aldermen, City of Bourbon
- Board of Aldermen, City of Cuba
- Board of Aldermen, City of Sullivan
- Board of Trustees, Village of Leasburg
- Board of Trustees, Village of West Sullivan
- Mike Biggins, Crawford Electric Cooperative
- Norm DeLeo, Cuba
- Doug Lasley, Cuba Chamber of Commerce
- Liz Bennett, Steelville Chamber of Commerce

- Tim Peterson, Sullivan, Chamber of Commerce

The Disaster Mitigation Act requires that each jurisdiction either participate directly in the planning process or authorize another entity to represent them in the planning process. There were a number of criteria for participation including the following:

- Providing a representative to serve on the planning committee;
- Participating in at least one of two or more meetings of the planning committee, either by direct representation or through authorized representation;
- Providing data for plan development;
- Identifying goals and mitigation actions for the plan;
- Prioritizing mitigation actions/projects for the plan;
- Reviewing and commenting on the draft plan document;
- Informing the public, local officials and other interested parties about the planning process and providing opportunities for them to comment on the plan;
- Formally adopting the plan

The jurisdictions that participated in the process, as well as their level of participation in the process are shown in Table 1.2. Documentation of meetings, including sign-in sheets are included in Appendix A: Planning Process Documentation.

1.4.2 The Planning Process

Crawford County and MRPC worked together to develop the plan and based the planning process on FEMA's Local Multi-Hazard Mitigation Planning Guidance (2008), the State and Local Mitigation Planning How-To Guides (2001) and the *Multi-Jurisdictional Mitigation Planning (2006)*. The planning process has included organizing the county's resources, assessing the risks to the county, developing the mitigation plan and implementing the plan and monitoring the progress of plan implementation.

The planning process formally began with the initial meeting being held in conjunction with the Crawford County Commission meeting on May 11, 2009. MRPC mailed out letters of invitation to all of the jurisdictions listed above. MRPC's invitations were mailed out to representatives of each of Crawford County's cities, city and rural fire departments, ambulance districts, police departments, the county health department, colleges and universities, local businesses, utility companies and the American Red Cross. This cross section of local representatives was chosen for their experience and expertise in emergency planning and community planning for Crawford County. The mailing list is included in Appendix A: Planning Process Documentation. In some cases jurisdictions desired to participate in the planning process but were not able to attend planning meetings. In order to insure that these jurisdictions would be considered part of the plan, MRPC followed the planning guidance provided by FEMA and provided Authorizing Resolutions to those jurisdictions for review and adoption. Copies of the Authorizing Resolutions are included in Appendix A. Those jurisdiction still participated by providing information and reviewing the plan document, but did not have adequate staff to attend planning meetings.

All planning committee members were provided drafts of sections of the plan as they became available. Members of the planning committee then reviewed the plan drafts and provided valuable input to MRPC staff. The planning committee performed a needs assessment, developed goals, objectives and recommendations and prioritized mitigation projects. Additionally, MRPC staff contacted several employees of the county and city governments to gain needed information concerning city services, plans and capabilities.

Crawford County assisted in the planning process by issuing public notice of the planning meetings as well as by providing facilities for the meetings. County officials, including commissioners and the County Clerk attended and participated in the meetings.

The planning committee contributed to the planning process by:

- attending and participating in meetings
- collecting data for the plan
- making decisions on plan content
- reviewing drafts of the plan document
- developing a list of needs
- prioritizing needs and potential mitigation projects
- assisting with public participation and plan adoption

Table 1.2 shows the meeting dates as well as agenda items for each of the meetings.

Table 1.2 Crawford County Hazard Mitigation Planning Meetings

Meeting	Topics Covered	Date
Crawford County Hazard Mitigation Planning Committee	Initial meeting: Welcome & introductions, review of plan update requirements, review of current plan, discussion of goals & objectives & progress made in 5 years, discussion of possible changes to goals and objectives in the next five years	May 11, 2009
Crawford County Hazard Mitigation Planning Committee	Welcome & introductions, review of action items, review of current plan, discussion of goals & objectives & progress made in 5 years, discussion of possible changes to goals & objectives in the next five years	June 1, 2009

Agenda items at the first meeting included a review of the plan update requirements; a review of the current Crawford County Hazard Mitigation Plan; a discussion of mitigation goals and objectives and what if any progress had been made on those goals and objectives during the past five years; and discussion of possible updates and changes that might need to be made to the goals and objectives. Staff provided copies of the plan for HMPC members to take home and review and provided information on where to view the document on the MRPC website. Participants were asked to provide input and updates to MRPC staff. Planning committee members were asked to review the background, history, capabilities and hazards sections to make sure that the information was correct and current. Staff explained how the planning and

review process would progress at the local, state and federal levels. The following individuals, by jurisdictions and organizations, were in attendance at the May 11, 2009 meeting of the Crawford County HMPC:

Tom Murray, City Superintendent, City of Steelville
 Kevin Halbert, City of Sullivan EMD
 Lester Murdock, City of Cuba EMD
 Ed Worley, Crawford County Presiding Commissioner
 Richard Martin, Crawford County Associate Commissioner
 Connie Smith, Crawford County Clerk
 Charles Witt, Crawford County EMD/911
 Amy England, *Steelville Star*
 Tamara Snodgrass, MRPC

The second planning meeting was held in conjunction with the Crawford County Commission meeting on June 1, 2009. At the second meeting MRPC staff went over the list of action items; reviewed sections of the plan; and led a discussion on the goals and objectives and possible changes that need to be made. The participants reviewed the goals, objectives and action items and provided input on any action items that had been accomplished; provided descriptions of programs that had been established since the plan was written that addressed plan objectives; and reviewed and discussed action items that might no longer be applicable or relevant. The following individuals, by jurisdictions and organizations, were in attendance at the June 1, 2009 meeting of the Crawford County HMPC:

Kevin Halbert, City of Sullivan EMD
 Lester Murdock, City of Cuba EMD
 Ed Worley, Crawford County Presiding Commissioner
 Richard Martin, Crawford County Associate Commissioner
 John Hewkin, Crawford County Associate Commissioner
 Connie Smith, Crawford County Clerk
 Charles Witt, Crawford County EMD/911
 Maria Kardon, MRPC
 Tonya Price, MRPC

Table 1.3 shows the entities involved in the planning process and how they participated. All of these jurisdictions, as well as jurisdictions located in neighboring counties, were asked to review the draft plan and provide input into the document.

Table 1.3 Participation in Crawford County Hazard Mitigation Planning Meetings

Jurisdiction	Participating Jurisdiction	Participated in Planning Process	HMPC May 11, 2009 Meeting	HMPC June 1, 2009 Meeting	Signed Authorized Representative Resolution	Completed Surveys/ Provided Information
Crawford County	X	X	X	X		X
City of Bourbon	X				X	X

Jurisdiction	Participating Jurisdiction	Participated in Planning Process	HMPC May 11, 2009 Meeting	HMPC June 1, 2009 Meeting	Signed Authorized Representative Resolution	Completed Surveys/ Provided Information
City of Cuba	X	X	X	X		X
Village of Leasburg	X				X	X
Village of St. Cloud	X					X
City of Steelville	X	X	X			X
City of Sullivan	X	X	X	X		X
Village of West Sullivan	X				X	X
Crawford County R-I School District	X				X	X
Crawford County R-II School District	X					X
Steelville R-III School District	X				X	X
Sullivan C-2 School District	X				X	X

In some cases jurisdictions desired to participate in the planning process but were not able to attend planning meetings. In order to insure that these jurisdictions would be considered part of the plan, MRPC followed the planning guidance provided by FEMA and provided Authorizing Resolutions to those jurisdictions for review and adoption. Copies of the Authorizing Resolutions are include in Appendix A. Those jurisdictions still participated by providing information and reviewing the plan document, but did not have adequate staff to attend planning meetings. Even if a jurisdiction submitted an Authorizing Resolution, in order to be considered a participating jurisdiction, they were still expected to provide information for the plan either by completing surveys or responding to direct requests. In addition, all participating jurisdictions were asked to review the final draft plan, including goals and action items and provide input to the HMPC. Two jurisdictions, St. Cloud and Crawford County R-II School District were not able to attend meetings and did not provide Authorizing Resolutions. These two jurisdictions did participate by providing and reviewing information in the plan document. Both were contacted by mail and by phone and indicated an interest in being participants of the plan, however, neither had the resources or staff to participate in planning meetings. The HMPC considers the contributions of these two jurisdictions to be adequate to include them as participating jurisdictions. Those individuals who provided information for the plan, and the jurisdictions they represent, are listed in Table 1.4 below.

Table 1.4 Names of Participants Providing Data for Crawford County Plan

Name	Jurisdiction	Completed Survey	Provided Information
Connie Smith, County Clerk	Crawford County	X	X
Cathy Bremer, City Clerk	City of Bourbon	X	X
Leonard Armstrong, Mayor	City of Bourbon	X	X
Christine Nash, City Clerk	City of Cuba	X	X
Kenny Killeen, Mayor	City of Cuba	X	X
Nicky Phillips, City Clerk	Village of Leasburg	X	X
Sheila Anderson, City Clerk	City of Steelville	X	X
Jan Koch, City Clerk	City of Sullivan	X	X
Mark Falloon, City Administrator	City of Sullivan	X	X
Jim Turntine, Trustee	Village of West Sullivan		X
David Barkley	Village of St. Cloud		X
Dr. Thomas P. Sharp, Superintendent	Crawford County R-I School District		X
Dr. Waymon W. Boast, Superintendent	Crawford County R-II School District		X
Charles Holder, Superintendent	Steelville R-III School District		X
Dr. Mickie Shank, Superintendent	Sullivan C-2 School District		X

1.4.3 Public Participation in the Planning Process

44 CFR Requirement 201.6 (b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

The development of this plan has involved the public throughout. All meetings were publicized in accordance with Missouri’s Sunshine Law (RSMo 610.010, 610.020, 610.023 and 610.024) the public was notified each time the plan, or sections of the plan, was presented for review and discussion. Input from each public official of city, county and school district, as well as surrounding jurisdictions, was solicited by mailing a postcard and directions to the City of Sullivan website at <http://sullivan.mo.us/> and/or the MRPC website (www.meramecregion.org) where a copy of the draft plan could be viewed or downloaded. Hard copies of the final draft were placed at the Crawford County Courthouse and city hall buildings for Bourbon, Cuba, Leasburg, St. Cloud, Steelville, Sullivan and West Sullivan. A hard copy of the draft could be obtained by contacting MRPC and requesting one. MRPC did press releases to make people aware of the planning process and of where to view drafts of the plan document. Drafts were

made available to any interested citizens. Copies of public notices and press releases are included in Appendix A: Planning Process Documentation.

In addition Crawford County is dedicated to the continued involvement of the public during the bi-annual review and the five-year update, as well as, in the interim. Crawford County and its encompassing jurisdictions have established strategies herein which will provide opportunity for continued public involvement. These strategies include a copy of the adopted plan to be placed at the Crawford County Courthouse and the city hall or municipal building of each jurisdiction for public review. In addition, a copy of the plan and any proposed revisions will be displayed on the county-sponsored website with a phone number for the public to direct questions or comments regarding the plan to the emergency management director.

1.4.4 Coordination with Other Departments/Agencies/Jurisdictions

44 CFR Requirement 201.6 (b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports and technical information.

There are several organizations that have a presence in Crawford County whose purpose and goals coincide with hazard mitigation. In order to insure that those agencies were included in the hazard mitigation planning process they were invited to participate in the planning committee. The organizations that chose to participate in the planning process are listed in 1.4.2. The complete mailing list is included in Appendix A: Planning Process Documentation.

Planning meetings and the planning process were announced through press releases and public notices in accordance with Missouri's Sunshine Law (RSMo 610.010, 610.020, 610.023 and 610.024). Press releases were distributed throughout the eight-county Meramec region. The public was notified each time the plan, or sections of the plan were presented for review. Input from each public official (city and county) was solicited by mailing an explanatory letter and copy of the particular draft. All planning committee members were given a draft of each section as it became available. Additionally, MRPC staff contacted many employees of the county, its cities and other organizations to gain needed information concerning services, plans and capabilities. Drafts of the plan were made available to any interested citizen either in hard copy or via download from the City of Sullivan website. Postcards were mailed out to neighboring jurisdictions inviting them to review the plan and provide input and notifying them of where to view copies of the document. A listing of those jurisdictions that received postcards is included in Appendix A.

MRPC staff contacted jurisdictions as well as the planning committee to insure that all applicable plans, studies, reports and technical information were identified and made available for review and comparison with the draft plan. The list of documents can be found in Section 2.2.

2 PLANNING AREA PROFILE AND CAPABILITIES

Chapter 2 provides a general profile and description of Crawford County and each of the jurisdictions participating in the hazard mitigation planning process. A list of capabilities for each jurisdiction is also included.

2.1 Crawford County Profile

Figure 2.1 provides a map of Crawford County including incorporated cities, major highways, and topography.

2.1.1 History and Development

Crawford County was organized on Jan. 23, 1829, and was named after William H. Crawford of Georgia, who was a candidate for the presidency in 1824. Although the early records of the county court have been lost, it is believed that William Montgomery, Barney Lowe and John Duncan were the first justices of the court, commissioned on the same day the act organizing the county was approved.

The first courthouse, a two-story brick and stone structure, was ordered to be built in 1857 and was used until 1873, when it burned.

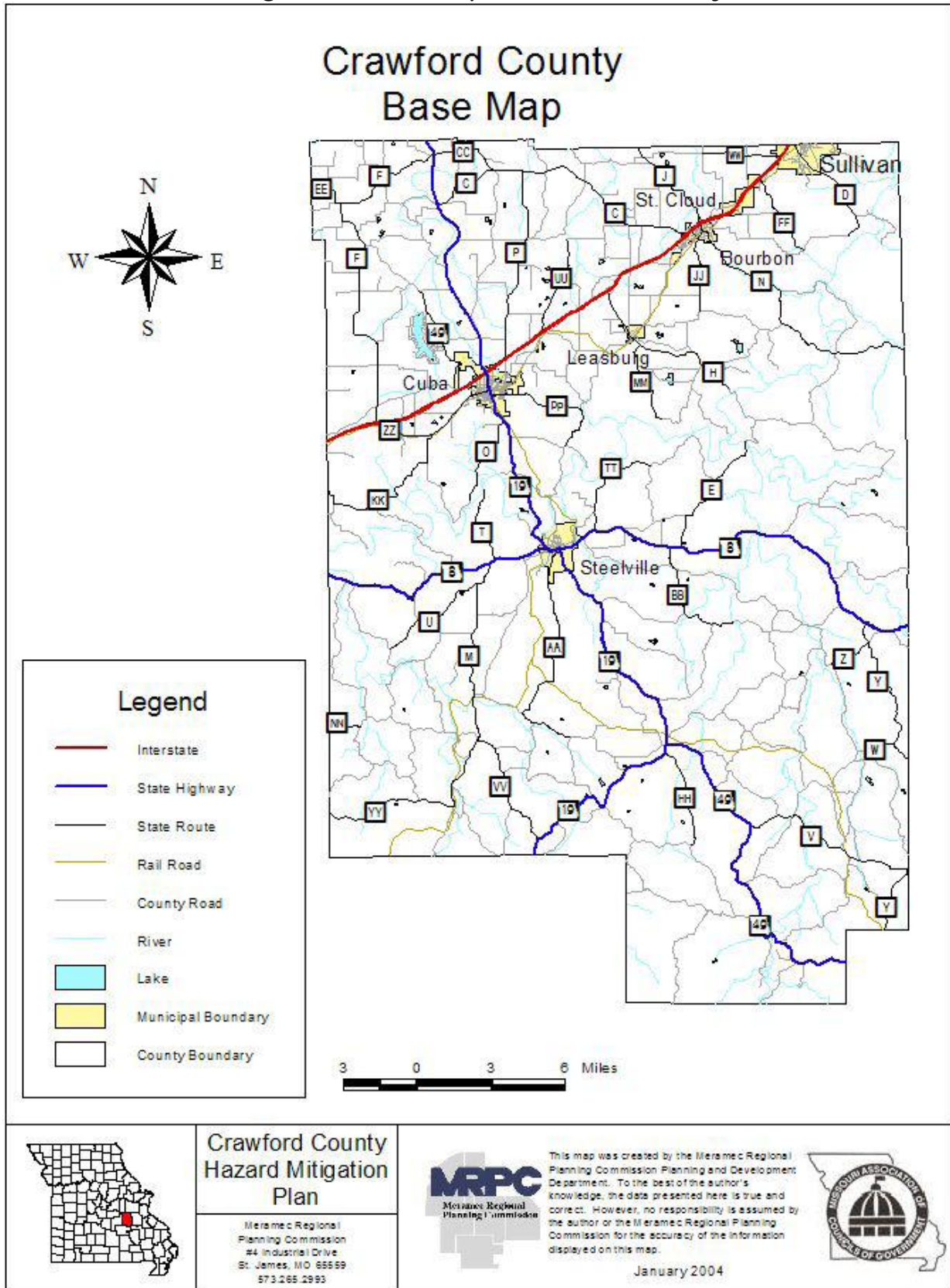
The outbreak of the civil war caused considerable excitement in the county, and lines between those favoring the Union and the Confederacy were sharply drawn. A meeting was held at Cuba by some of those favoring the Confederacy at which resolutions were passed in support of the Confederacy. The only dissenting voice at the meeting was that of E.W. Pinnell who was the only one of the 60 men present, to later enter the regular service of the Confederate States.



**Crawford County Courthouse
built in 1885-86**

The first settler on the town site of Steelville, the county seat, was William Britton, who arrived in 1833. He was responsible for building a small log house and a grist mill. James Steel, for whom the town was later named, was the next settler in the area. Having purchased 40 acres of land from the government, he sold it to the county court for \$50 in 1835. By this time, he had opened a small store, and a small settlement had sprung up in the area. The deed was recorded in December 1835 and the town was platted and lots sold soon afterward.

Figure 2.1 Base Map of Crawford County



Other town sites in the county included Sullivan, Cuba, Leasburg, St. Cloud, Bourbon and West Sullivan. Cuba was laid out and surveyed in December 1857 by M.W. Trask and W.H. Ferguson. At the time the town was surveyed, there were no houses within half a mile of the town site.

Leasburg is situated on the Burlington Northern Railroad approximately 82 miles west of St. Louis. The town was originally named Harrison Station for William Harrison. The name was changed in 1859 in honor of Samuel Lea, who built the first residence on the town site. Lea was also the first merchant to open a general store in the area and became the first postmaster.

Bourbon is also situated on the Burlington Northern Railroad about 75 miles west of St. Louis. The town was named for an old post office, which had existed in the vicinity some years before the town was founded. The post office had been named after bourbon whiskey, which was a new product being introduced in the area at that time.

The City of Sullivan is located on Old Highway 66 and the St. Louis and San Francisco Railroad, 68 miles southwest of St. Louis. It has long been known as the “Gateway to the Ozarks.” Sullivan was founded in the early 1800's by Stephen Sullivan who, with his wife, accompanied Daniel Boone on his return trip from Kentucky to get settlers to populate the territory around the Meramec River. When the railroad reached the small settlement in 1858, a town was laid out that the railroad company named “Sullivan.” Only part of the incorporated area of Sullivan lies within the boundaries of the Meramec Region. The balance is in Franklin County.

The Village of St. Cloud was formed in the 1970's. The community has a board of trustees but no city services or employees. Unincorporated areas of Crawford County include Dillon and Cherryville.

2.1.2 Geography and Topography

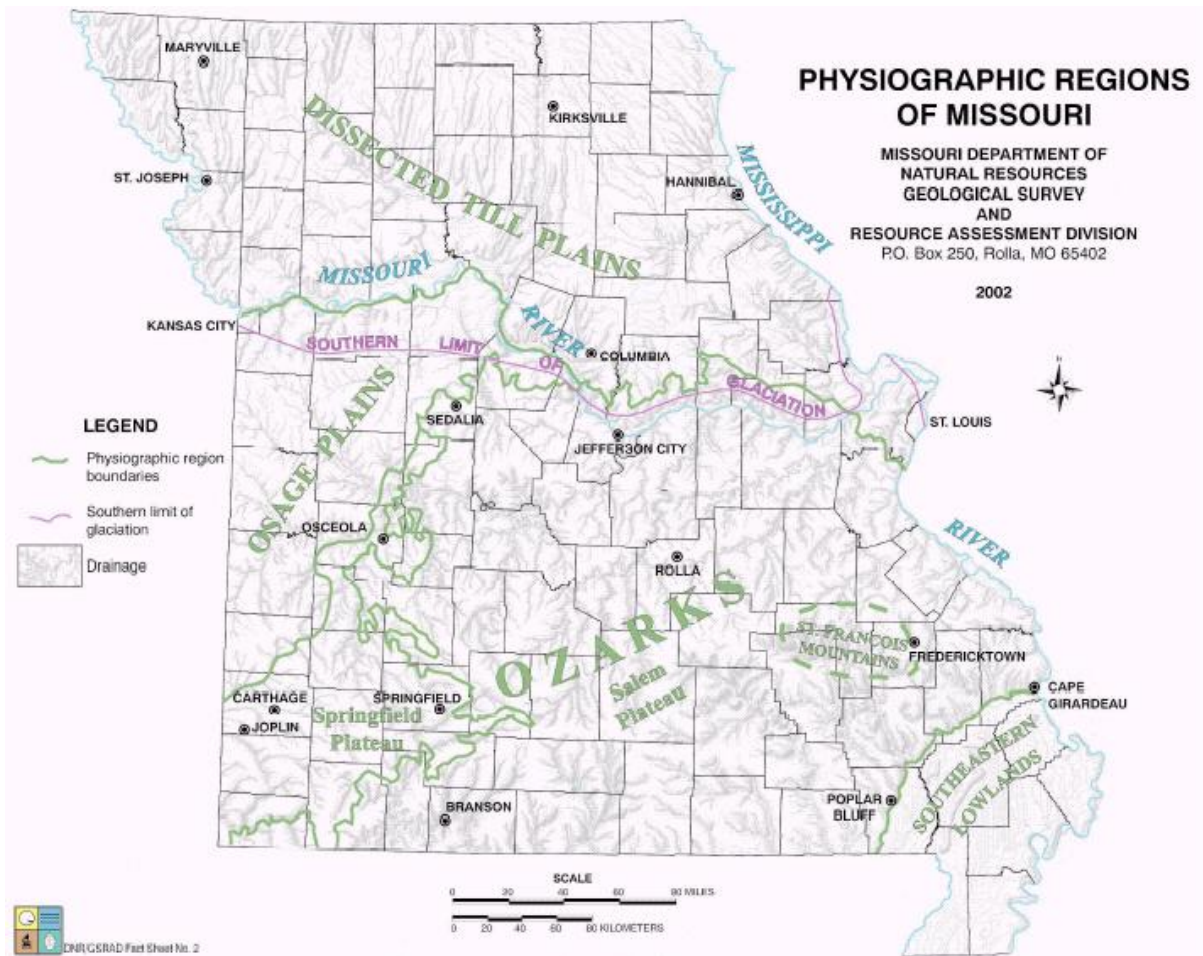
Crawford County is divided by a ridge between the Bourbeuse Watershed to the north and the Meramec Watershed to the south. Interstate Highway 44 runs along this ridge. The Bourbeuse Watershed is characterized by gently rolling hills, with only a few steep slopes in the area. Most of Crawford County lies in the Meramec Basin. This area has rugged terrain with steep sloping hills and narrow valleys. The maximum relief in the county is approximately 600 feet, with the lowest point at the northeast corner of the county, and the highest point in the southeast corner.

Physiographic features, such as river basins and watersheds, play an important role in the development of any given area. Practical planning and engineering methods take advantage of the topography in planning and designing sewer and water facilities. The individual watersheds should form the basis for sewer and water districts, while several contiguous watersheds within the same drainage basin may be combined to form a sewer or water district.

A drainage basin is the total area drained by a river and all of its tributaries. A watershed is the area drained by a single stream. During the last 100 years, stream channels in the Ozarks have become wider and shallower, and deep-water fish habitat has been lost. Historical data indicate that channel disturbances have resulted most directly from clearing of vegetation along stream

channels, which decreases bank strength. Historical and stratigraphic data show that after 1830, Ozarks streams responded to land-use changes by depositing more gravel and less muddy sediment, compared to pre-settlement conditions. Because less muddy sediment is being deposited on flood plains, many streambanks now lack cohesive sediments, and, therefore, no longer support steep banks. Land use statistics indicate that the present trend in the rural Ozarks is toward increased populations of cattle and increased grazing density; this trend has the potential to continue the historical stream-channel disturbance by increasing storm-water runoff and sediment supply.ⁱ

Figure 2-2
Physiographic Regions of Missouri



Crawford County is located in two river basins: Bourbeuse and Meramec. The Meramec River includes the following tributaries: Bourbeuse River, Dry Creek, Huzzah Creek, Courtois Creek, Hazel Creek, Big River and Mineral Fork. Included with this basin are 36 springs—23 in Crawford County.

Seven miles northeast of the town of Salem in Southeastern Missouri, a spring-fed brook called the Watery Fork merges with a larger wet-weather branch and becomes the source of the Meramec River. For many millions of years the Meramec has been carving its twisting, sometimes-tortuous 240-mile course into the solid rock of the Ozark Plateau, scouring its way through a deep, slowly widening valley, bordered by limestone bluffs and steep hills. It is joined along the way by innumerable springs, creeks, and four large tributaries, which transform the Meramec into a 100-yard to 200-yard wide floodplain stream at its confluence with the Mississippi River eighteen miles below St. Louis.

Maramec Spring is the first of the four major contributors. It pours an average volume of 100 million gallons of cold clear water into the Meramec River per day, swelling the river to twice its size. It is interesting to note that the Dry Fork creek, which is about the same size as the Meramec River in that area, loses most of its volume underground to become a major contributor to Maramec Spring, and in a round-about way—a major contributor to the Upper Meramec. Over the next 30 miles, the inflows from many smaller branches turn the river into a prime stream. Then, from the right, the translucent waters of the second and largest of the headwater contributors, the Courtois-Huzzah creek, mingles with the Meramec, giving it the impression of a truly big river. Swirling on past Onondaga Cave (Leasburg), Meramec State Park (Sullivan), and the Meramec Caverns (Stanton)—all on the left—the Meramec receives the cloudy waters of the Bourbeuse River—its only major contributor from the west. As the darker waters flow on, the valley widens, and the river becomes a series of long, slow, wide pools, connected by short, fast, riffles. Around 25 miles below the Bourbeuse River confluence, the last major contributor, the Big River, flows into the Meramec from the right. Now, even wider and more sluggish, it enters the Mississippi floodplain, and wends its way another thirty miles before draining into the Mississippi. The name Meramec is of Algonquin Indian origin (probably the Fox tribe), and is widely thought to mean 'the good fish' or 'catfish', which were abundant in its waters. But, there is evidence that the river may get its name after a tribe of Indians called the Maroa, who once lived in Illinois across from the Meramec's mouth. Since the Algonquin syllable 'mec' or 'meg' stands for small river or stream, the names Meramec or Merameg (the river has been called Merameg in the past) could be derived from the Algonquin Maroamec, which means 'Little River of the Maroas'. The name of the Mississippi is also of Algonquin origin, derived from their term mesisi-piya, meaning Big River. Also, the title of this state Missouri is of Indian origin, meaning People of the Big Canoe or He of the Big Canoe.

Even in geological time, the Meramec is a very old river. It does not drain its northeastern section of the Ozark Plateau with the reckless abandon of a mountain stream. Instead, it meanders through the landscape in a countless succession of bends, riffles, and placid slow stretches, each of which is another small step in the Meramec's 800-foot decent from the Ozark Plateau to the Mississippi River.ⁱⁱ

The Bourbeuse River watershed is located within the northeastern quarter of the Ozark Highlands. The main stem of the Bourbeuse River winds northeasterly through Phelps, Gasconade, and Franklin counties to join the Meramec River, and its watershed additionally encompasses portions of Maries, Osage, and Crawford counties. The Bourbeuse River is 147 miles from mouth to headwaters, and the lower 132 miles have permanent flow. The Bourbeuse River watershed drains 843 square miles and is composed of a number of smaller watersheds

including Spring Creek, Boone Creek, Brush Creek, Red Oak Creek, Dry Fork, Little Bourbeuse River, and the Lower Bourbeuse River. The gradient of the main stem is low compared to other streams of the Ozark Highlands, and gradients of the tributaries are slightly higher in the lower watershed compared to the upper watershed. The Bourbeuse River has fewer springs with smaller discharges than the Meramec River.

Cropland and pasture are the land uses for 45% of the Bourbeuse River watershed. According to 1992 NRCS estimates, approximately 16,600 acres were cultivated, another 59,100 acres of farmland were uncultivated, and 140,900 acres were pasture. These areas are found primarily within stream floodplains. Fifty-one percent of the total land area within the watershed is deciduous forest. Other forest types are evergreen and mixed forestland. Successional areas, such as shrub and brush rangeland, are small in total acreage, reflecting the high grazing rates and hay production in the watershed. Most of the urban-type land use is found in the lower watershed near Union.

Although some exceptions are present and improvements are needed, water quality in the Bourbeuse River watershed is generally good. Sewage treatment plants for St. James, St. Clair, and Cuba have not always met water quality standards for their treated discharge. In general, non-point pollution in the form of sediment from erosion and organic wastes from livestock impair water quality. In particular, organic wastes from livestock contribute to excessive algal production in watershed streams. Contaminant sampling for pesticide bioaccumulation in fish indicates that Bourbeuse fish are safe for human consumption.

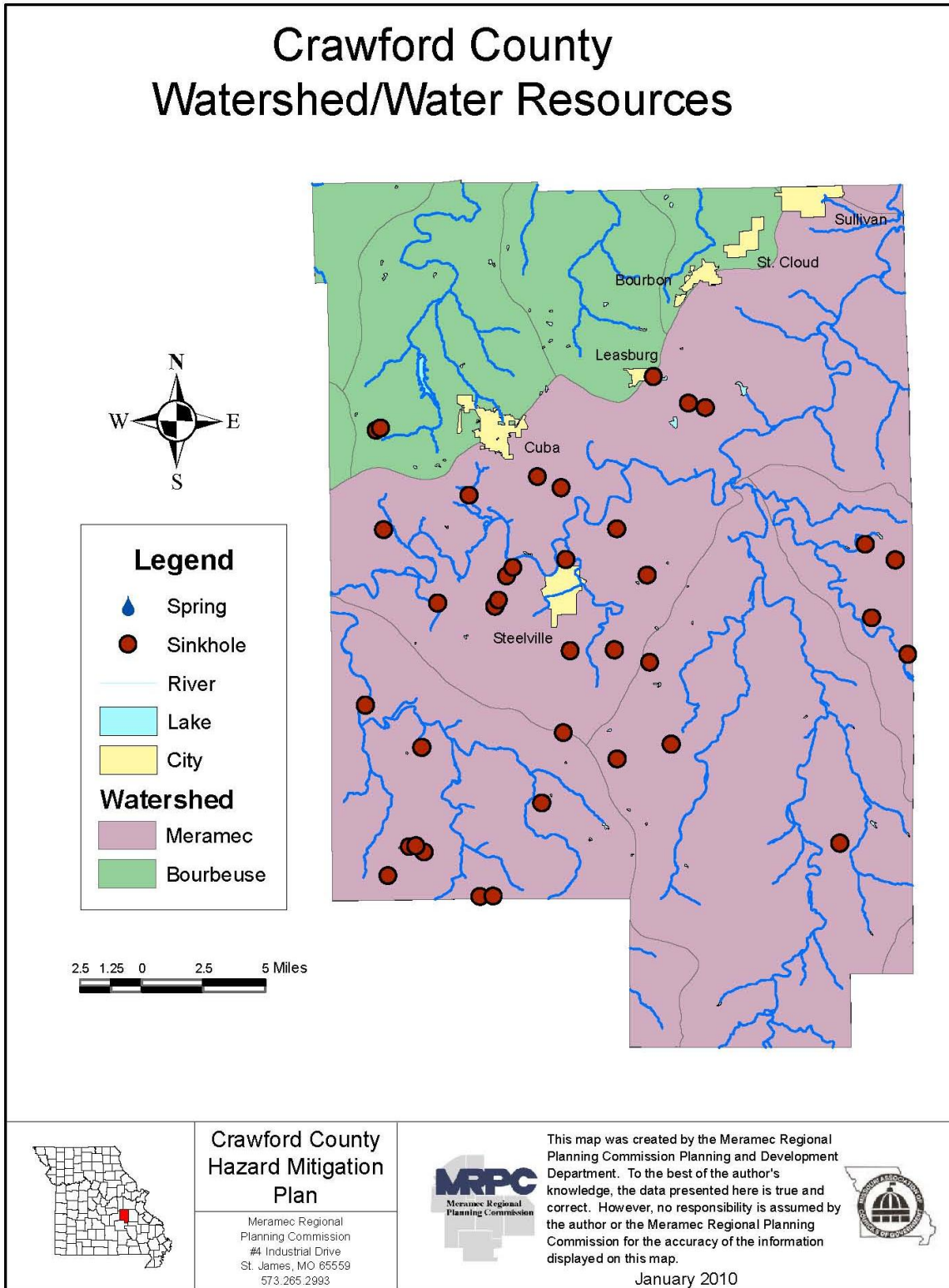
Stream habitat conditions within the Bourbeuse River and its tributaries are variable. The main stem has no channelized segments, and old mill dams located near Beaufort and Union provide channel grade controls. A number of tributaries are impounded, with the largest impoundment being Indian Lake (326 acres) in the Brush Creek sub-watershed. In many streams, the lack of adequate riparian corridors, excessive nutrient loading, streambank erosion, excessive runoff and erosion, and the effects of extensive in-stream gravel mining are among the problems observed. Grazing practices along many streams contribute to streambank instability, nutrient loading, and poor riparian corridor conditions.ⁱⁱⁱ

Crawford County has been a participant in the National Flood Insurance Program since May 1987. The City of Bourbon has been a participant in the NFIP program since August 1984, Leasburg since August 1984, Steelville since February 1976 and Sullivan since June 1981.^{iv}

As part of its floodplain management plan, the county requires that houses be built one foot above base flood elevation. A permit must be granted by the floodplain administrator for any new construction inside the floodplain. County road crews or employees are expected to notify the flood plain administrator when they witness any new construction in the floodplain that has not been granted a construction permit. Crawford County's Emergency Management Director serves as floodplain administrator.

Figure 2-3

Crawford County Watershed/Water Resources



Crawford County Hazard Mitigation Plan

Meramec Regional
Planning Commission
#4 Industrial Drive
St. James, MO 65559
573.265.2993



This map was created by the Meramec Regional Planning Commission Planning and Development Department. To the best of the author's knowledge, the data presented here is true and correct. However, no responsibility is assumed by the author or the Meramec Regional Planning Commission for the accuracy of the information displayed on this map.

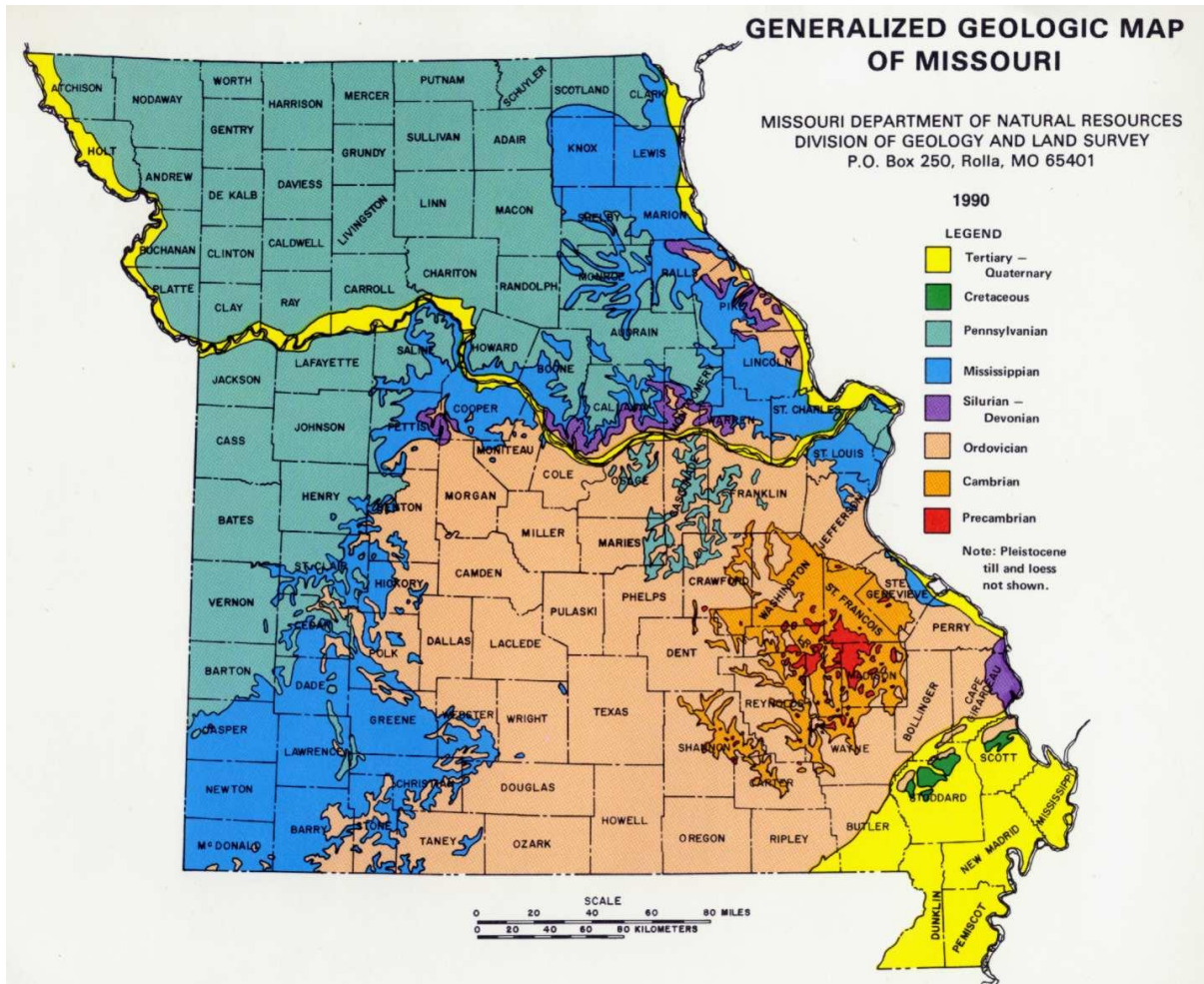


January 2010

2.1.3 Soil Types

Crawford County is divided by a ridge between the Bourbeuse Watershed to the north and the Meramec Watershed to the south. Most of Crawford County lies in the Meramec Basin. This area has rugged terrain with steep sloping hills and narrow valleys. The maximum relief in the county is approximately 600 feet, with the lowest point at the northeast corner of the county, and the highest point in the southeast corner.

Figure 2-4



Two basic soil types are found in Crawford County – The Ozark Border soils and Ozarks soils. The Ozark Border soils are located in an area of dissected plateau characterized by narrow ridge tops and narrow valleys. A thin mantle of loess caps the ridge tops. The steep side slopes contain deep cherty, clayey, reddish-colored soils developed over dolomite or limestone. Sandy, loamy and gravelly alluvial soils are in the bottom lands. These soils are found throughout most of northeastern Crawford County. The Ozark Border soils include the Union-Goss-Gasconade Peridge and Hobson-Clarksville-Gasconade soil associations.

The Ozarks soils are located in an area of narrow, cherty limestone ridges that break sharply to steep side slopes of narrow valleys. Loess occurs in a thin mantle or is absent. Soils formed in the residuum from cherty limestone or dolomite range from deep to shallow and contain a high percentage of chert in most places. Some of the soils formed in a thin mantle of loess are on the ridges. Soils formed in loamy, sandy and cherty alluvium are in narrow bottom-land areas. These soils are found in most of Crawford County. The Ozarks soils include the Lebanon-Goss-Bardley-Peridge, Needle-ey-Viration-Wilderness, Gerald-Union-Goss, Lebanon-Hobson-Clarksville, Hobson-Coulstone-Clarksville, Captina-Clarksville-Hartville-Ashton-Cedargap-Nolin soil associations. The Hartville-Ashton-Cedargap-Nolin soils association is located along the Meramec River.^v

2.1.4 Climate

Snow occurs between November and April, both inclusive, but most of the snow falls in December, January and February. An average of about 13 inches of snow occurs annually in the Meramec Region. It is unusual for snow to stay on the ground for more than a week or two before it melts. Winter precipitation usually is in the form of rain, snow or both. Conditions sometimes are borderline between rain and snow, and in these situations freezing drizzle or freezing rain occurs. Spring, summer and early fall precipitation comes largely in the form of showers or thunderstorms. Thunderstorms are most frequent from April to July. Measurable precipitation occurs on the average of less than 100 days per year. About half of these will be days with thunderstorms.

Most of the precipitation is absorbed by the soil and plants; however, a portion of the precipitation forms runoff and is returned to streams and other bodies of water.

Table 2.1 Average Rainfall for Crawford County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Inches	1.81	2.12	3.58	3.50	3.97	3.72	3.85	2.85	3.12	2.68	3.28	3.03	37.51

Average of rainfall from 1971-2000. Source: www.met.utah.edu/jhorel/html/wx/climate/normrain.html

Because of its inland location, Missouri and Crawford County are subject to frequent changes in temperature. The average annual temperature is in the mid 60s with an average in January of about 30 degrees and an average in July of about 77 degrees.

Table 2.2 Average Minimum and Maximum Temperatures for Crawford County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Minimum	18.8	23.3	31.8	40.6	49.6	58.9	63.3	61.2	53.5	42.3	33.0	23.3	41.6
Average	30.8	36.4	45.8	55.4	63.7	72.0	76.6	75.1	67.6	56.9	45.3	34.9	55.0
Maximum	42.7	49.5	59.7	70.1	77.7	85.0	89.9	88.9	81.7	71.5	57.5	46.5	68.4

Min and Max represent the coldest and warmest average months on record.^{vi}

Source: <http://www.average-temperature.com>

While winters are cold and summers are hot, prolonged periods of very hot weather are unusual. Occasional periods of mild, above freezing temperatures are noted almost every winter. Conversely, during the peak of the summer season occasional periods of dry, cool weather break up stretches of hot, humid weather. About half of the days in July and August will have temperatures of 90 degrees or above, but it is not unusual for the temperature to drop into the 50s by the evening. In winter, there is an average of about 100 days with temperatures below 32 degrees. Temperatures below zero are infrequent with only about three days per year reaching this low temperature. The first frost occurs in mid-October, and the last frost occurs about mid-April.

2.1.5 Population/Demographics

Crawford County’s current 22,804 residents are spread across the county’s 743 square miles and almost evenly divided by sex with 49.3 percent male and 50.7 percent female. The median age of county residents is 37.9 years. Seventy-four percent of the population is 17 years of age or older and 18.9 percent is 62 years of age or older. Ninety-eight percent of Crawford County residents are Caucasian, 0.1 percent black or African American, 0.4 percent American Indian and 0.1 percent Asian.^{vii}

According to Census 2000 data, the population of Bourbon is 1,348, Cuba is 3,230, Leasburg is 323, Steelville is 1,429, Sullivan is 6,351 and West Sullivan is 75. There are 8,858 households in Crawford County and 10,850 housing units.^{viii} The median value for homes in rural and urban Crawford County is estimated at \$66,100. Fifty percent are valued between \$50,000 and \$99,999 and thirty percent are valued less than \$50,000.

According to the State of Missouri’s Office of Administration, Crawford County is predicted to grow eight percent by 2005, 16 percent by 2010, and 23 percent by 2015 from its current population of 22,804.^{ix}

Table 2.3 Crawford County vs. Statewide Projected Population Growth 2000-2015^x

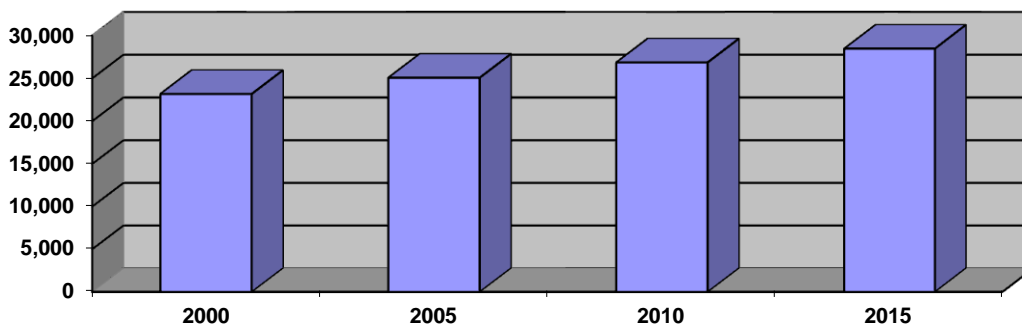


Table 2.4 shows population trends for communities in Crawford County from 1900 to 2000.

**Table 2.4 Historic Population Trends of Crawford County Communities
1900-2000**

Community	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Bourbon	***	382	377	379	360	543	779	955	1,259	1,188	1,348
Cuba	552	619	704	814	1,033	1,301	1,672	2,070	2,120	2,537	3,320
Leasburg	***	***	***	130	173	178	176	218	304	289	323
St. Cloud	***	***	***	***	***	***	***	***	***	59	56
Steelville	686	773	767	854	1,013	1,157	1,127	1,392	1,470	1,465	1,429
Sullivan*	714	934	909	2,013	2,517	3,019	4,098	5,100	5,461	5,661	6,351
West Sullivan	***	***	***	***	***	***	***	***	***	***	82

Source: Missouri Census Data Center

*Entire population of Sullivan provided - includes both Crawford and Franklin counties.

Table 2.5 shows both populations trends and racial group breakdowns for Crawford County.

Table 2.5 Crawford County Population Trends and Breakdown of Racial Groups

Year	1970	1980	1990	2000
Total Population	14,828	18,300	19,173	22,804
White Alone	14,796	18,207	19,092	22,408
Black/African American Alone	7	0	81	33
Amer. Indian/ AK Native Alone	**	60	3	99
Asian Alone	**	33	36	30
Hawaiian/ Pacific Islander Alone	**	Included with Asian	30	14
Some Other Race Alone	25	0	12	32
Two or More Races	**	**	**	188
% White	99.78	99.49	99.6	98.26
% Non-White	.22	.51	.42	1.74

Source: 1970, 1980, 1990, 2000 U.S. Census of Population, Bureau of the Census, US Department of Commerce

Table 2.6 shows the age and sex composition of the county for the years 1990 and 2000.

Table 2.6
AGE-SEX COMPOSITION OF THE POPULATION
FOR
CRAWFORD COUNTY, 1990-2000

Age Group	2000				1990			
	Number of Males	% of Total Males	Number of Females	% of Total Females	Number of Males	% of Total Males	Number of Females	% of Total Females
0-4	755	6.7	730	6.3	672	7.2	624	6.3
5-9	812	7.2	823	7.1	787	8.4	745	7.6
10-14	935	8.3	824	7.1	766	8.2	735	7.5
15-19	873	5.5	821	7.1	681	7.3	645	6.6
20-24	613	5.5	607	5.3	485	5.2	509	5.2
25-29	587	5.2	617	5.3	659	7.1	677	6.9
30-34	690	6.1	697	6.0	724	7.8	733	7.5
35-39	867	7.7	881	7.6	613	6.6	653	6.6
40-44	913	8.1	891	7.7	576	6.2	596	6.1
45-49	732	6.5	758	6.6	497	5.3	499	5.1
50-54	691	6.1	704	6.1	496	5.3	531	5.4
55-59	599	5.3	595	5.1	494	5.3	497	5.1
60-64	593	5.3	594	5.1	475	5.1	505	5.1
65-69	492	4.4	553	4.8	433	4.6	537	5.5
70-74	460	4.1	462	4.0	388	4.2	443	4.5
75-79	285	2.5	410	3.5	308	3.3	387	3.9
80-84	216	1.9	289	2.5	159	1.7	291	3.0
85+	132	1.2	303	2.6	125	1.3	228	2.3
County Totals	11,245	49.3%	11,559	50.7%	9,338	48.7%	9,835	51.3%

SOURCE: 1990 & 2000 Census, U.S. Department of Commerce

Table 2.7 shows the median age of the population of Crawford County for 1970 through 2000.

Table 2.7 Median Age In Years for Crawford County: 1970-2000

1970			1980			1990			2000		
Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
31.9	33.2	32.6	32.0	34.4	33.2	34.2	36.8	35.5	37.5	38.6	37.8

Source: 1970, 1980, 1990, 2000 Census, U.S. Department of Commerce

Table 2.8 compares the family income of Crawford County residents with the rest of the Meramec Region, State of Missouri and United States. This table shows that Crawford County has a slightly higher percentage of families living on \$19,999 or less than the rest of the region –

33.4 percent compared to 30.4 percent for the region; and a slightly lower percentage of families living on \$35,000 or more – 43.8 percent compared to the regional average of 45 percent. Compared to the state and nation, Crawford County also fared worse than average for families living on \$19,999 or less and \$35,000 or more on the state level.

Table 2.8 Crawford County Family Income

	Under \$10,000	\$10,000 - \$14,999	\$15,000- \$19,999	\$20,000 - \$24,999	\$25,000 - \$29,999	\$30,000- \$34,999	\$35,000 and over
Crawford County	1,183 13.3%	900 10.1%	887 10.0%	650 7.3%	688 7.8%	679 7.7%	3,883 43.8%
Meramec Region	8,676 12.9%	5,792 8.6%	5,942 8.9%	5,773 8.6%	5,810 8.7%	4,911 7.3%	30,172 45.0%
State of Missouri	221,242 10.1%	156,370 7.0%	156,062 7.1%	163,924 7.5%	159,663 7.3%	154,948 7.1%	1,187,005 54.0%
United States	10,067,027 9.5%	6,657,228 6.3%	6,601,020 6.3%	6,935,945 6.6%	6,801,010 6.4%	6,718,232 5.9%	61,758,660 58.5%

Source: 2000 U.S. Census Bureau, U.S. Department of Commerce

Table 2.9 compares Crawford County’s median income with the rest of the Meramec Region, State of Missouri and nation. Crawford County’s median income is slightly higher than the region’s average and, as with most rural counties in south central Missouri, significantly lower than the State and National averages. These figures are based on the 2000 Census.

Table 2.9 Crawford County Median Income Comparison

Location	Median Family Income	Percent of U.S. Median	Persons in Poverty	Percent in Poverty
Crawford County	\$36,558	73.1	3,668	16.3
Meramec Region	\$38,118	76.2	24,260	14.0
State of Missouri	\$46,044	92.0	637,891	11.7
United States	\$50,046	100.0	33,899,812	12.4

Source: 2000 U.S. Census Bureau, U.S. Department of Commerce

Table 2.10 shows the educational attainment of Crawford County residents – both the number and percentage of the population. As demonstrated by the table, 17.5 percent of the population has some education beyond high school, with 4.3 percent holding an associate degree, 5.4 percent holding a bachelors degree and three percent with graduate or professional degrees.

Table 2.10 Crawford County General Education Attainment (2000)

Education Attainment	High School no diploma	High School Diploma	Some College No Degree	Associate Degree	Bachelors Degree	Graduate or Professional Degree
Number of Population	2,648	5,897	2,641	644	815	454
Percent of Population	17.6	39.2	17.5	4.3	5.4	3.0

Source: 2000 U.S. Census Bureau, U.S. Department of Commerce

The civilian labor force in the Meramec Region increased 36.9 percent between 1980 and 2000, while the civilian labor force in Missouri grew 22.3 percent for the same time period. The bulk of that growth occurred as more and more women entered the workforce. From 1980 – 2000 the male civilian labor force in Missouri increased by 12.5 percent compared to 25.1 percent in the Meramec Region, while the female civilian labor force increased by 35.3 percent statewide but 53.7 percent for the region.

As shown in Table 2.11, Crawford County’s civilian labor force increased by 30.5 percent and the unemployed person percentage went from 8.2 percent in 1980 to 6.0 percent unemployment in 2000. The female civilian labor force percentage of unemployed dropped from 6 percent in 1980 to 5.2 percent in 2000. The male civilian labor force unemployment remained in stasis, holding at 7.5 percent in 1980 and 2000. According to the Missouri Department of Economic Development, unemployment for the United States has dropped from 7.1 percent in 1980 to 5.5 percent in 2006. The Missouri rates closely mirror those percentages and usually are a few tenths of a point less than the national figure. According to statistics from 2006, Crawford County had unemployment rates slightly higher than the national level of 4.8 percent, with an average unemployment rate of 5.95 percent.

When comparing 2000 weekly wage rates, Crawford County wage rates are about 77.5 percent of Missouri’s average weekly wage rates. The highest paying employment sector in Crawford County in 2000, according to the Quarterly Census of Employment and Wage Industry Information is Manufacturing with an average weekly salary of \$459. This is followed by Government with an average weekly salary of \$425. Service jobs come in third with \$267 average weekly salaries.

The 2000 average of \$410 per week was 22.5 percent lower than the state of Missouri average of \$529 and 48 percent lower than the national average of \$779.

Table 2.11 Crawford County Labor Force

LABOR FORCE FOR CRAWFORD COUNTY			
1980			
	Total	Male	Female
Persons 16 years and older	13,633	6,552	7,081
Civilian Labor Force	7,902	4,773	3,129
Persons Employed	7,256	4,332	2,924
Persons Unemployed	646	441	205
% Unemployed CLF	8.2	8.9	7.1
Persons Not in Labor Force	5,731	1,779	3,952
1990			
	Total	Male	Female
Persons 16 years and older	14,549	6,972	7,577
Civilian Labor Force	8,173	4,681	3,492
Persons Employed	7,583	4,325	3,258
Persons Unemployed	590	356	234
% Unemployed CLF	7.2	7.6	6.7
Persons Not in Labor Force	6,387	2,355	4,032
2000			
	Total	Male	Female
Persons 16 years and older	17,604	8,615	8,989
Civilian Labor Force	10,316	5,656	4,660
Persons Employed	9,698	5,292	4,406
Persons Unemployed	618	364	254
% Unemployed CLF	6.0	6.4	5.5
Persons Not in Labor Force	7,288	2,959	4,329

SOURCE: 1980, 1990 & 2000 Census of Population

2.1.6 Schools/Vocational/Technological Schools/Colleges/Universities

Crawford County has four public school districts. Of those four, all have elementary through high school. Those school districts and the size of the student population are identified in Table 2.12.

Table 2.12 Crawford County School Districts and Student Enrollment 2009

School District	Crawford County R-I	Crawford County R-II	Steelville R-III	Sullivan
Student Enrollment	1038	1394	954	2244

Source: Missouri Department of Elementary and Secondary Education website www.dese.mo.gov

Rolla Technical Institute (RTI) located at 1304 East 10th Street, Rolla, MO 65401 and Rolla Technical Center (RTC) located at 500 Forum Drive, Rolla, MO 65401 provide adult education opportunities for people in not only Phelps County, but in surrounding counties, including Crawford. RTI and RTC are operated by the Rolla Public School District 31. Most of the programs are built around a training period that can be completed as a half-time student in two years or one year as a full-time student. These programs are designed for secondary students and adults. The career and technical education courses offer highly specialized training using state-of-the-art technology and equipment to enable students to acquire the skills, knowledge and work attitudes needed to secure entry-level employment and advance with additional training and education.

RTI/RTC serves approximately 600 secondary students annually. These students are from 11 sending schools located in four different counties. These sending schools are located in the counties of Phelps, Crawford, Maries, and Gasconade and in the towns of Belle, Bourbon, Cuba, Licking, Newburg, Owensville, Rolla, Salem, St. James, Steelville, and Vienna.

RTI/RTC serves about 300 adult students annually. Adult students commute from approximately a 50-mile radius.

The school has a community and continuing education program that serves approximately 1,000 adult students annually, with both daytime and evening classes. This program is also responsible for developing customized training to meet the needs of local businesses. The school also serves as a satellite for East Central College and William Woods University.

Additionally, RTI/RTC houses the administrative offices of a full-time Adult Education and Literacy (AEL) program.

There is one other higher education campus located in Crawford County, the University of Cosmetology located at 100 West Main, Sullivan, MO. This school provides training and licensing in Cosmetology.

In addition, Crawford County is serviced by several parochial and private schools. They include:

- St. Anthony's – located at 201 W. Springfield Rd, Sullivan;
- Holy Cross Catholic School – located at 415 West School Street, Cuba;
- Meramec Valley Christian School – located at 11061 North Service Rd, Bourbon;
- Community Christian Academy – located at 300 Frisco Street, Steelville; and
- Sullivan Montessori – located at 10 Bud Street, Sullivan.

2.1.7 Business/Industry

The major employers located in Crawford County are Industrial Wire Products in Sullivan with 150 employees and Paramount Cap in Bourbon with 400 employees. Other large manufacturers include Mar-Bal, Inc. with 95 employees; Meramec Electrical Products with 90 employees and McGinness Wood Products with 85 employees. Large public employers in the county include Crawford County Schools with 485 employees, and Crawford County with 104 employees.

Table 2.13 Employees By Industry for the Employed Civilian Population 16 Years Old & Over

Category	Number
Total Employed:	9,698
Agriculture, forestry, fishing and hunting, mining:	387
Agriculture, forestry, fishing and hunting	277
Mining	110
Construction	976
Manufacturing	2,509
Wholesale trade	180
Retail trade	1,393
Utilities:	397
Transportation and warehousing	325
Utilities	72
Information	150
Finance, insurance, real estate and rental and leasing:	323
Finance and insurance	198
Real estate and rental and leasing	125
Professional, scientific, management, administrative and waste management services:	489
Professional, scientific and technical services	193
Management of companies and enterprises	0
Administrative and support and waste management services	296
Educational, health and social services:	1,513
Educational services	537
Health care and social assistance	976
Arts, entertainment, recreation, accommodation and food services:	586
Arts, entertainment and recreation	81
Accommodation and food services	505
Administration	427
Public administration	368

Source: U.S. Census Bureau, 2000 U.S. Census

There are 59 employers in the county that are considered private manufacturing firms, with the largest being Paramount Cap., with 400 employees. According to the 2002 Census of Retail Trade, conducted by the U.S. Department of Commerce, there are 81 retail trade establishments in Crawford County, with annual combined sales of \$157,824,000.^{xi}

2.1.8 Agriculture

Due to the rural nature of the area, agriculture and timber are significant factors in the local economy. According to the 1997 Census of Agriculture, Crawford County had 789 farms encompassing 221,709 acres, with an average farm size of 281 acres. Five years later in the 2002 Census of Agriculture, the number of farms had fallen to 751 encompassing 217,790 total acres and the average farm size had increased to 290 acres. In 2002 the county had 37 farms with 1,000 or more acres, 4.9 percent of the total number of farms in the county.^{xii} Due to the rugged nature of the region, row crop farming is for the most part limited to the river valleys. According to the 2002 Census of Agriculture, Crawford County’s market value of agricultural products sold was \$9,375,000.

The Ozarks region of Missouri is the focal point of several converging ranges of plant associations. Eastern hardwoods, southern pines and western prairies and the wildlife each supports, all reach the outward limits of their range in this area. As a result, various types of forest lands and animal habitats co-exist within a limited area. Several sawmills operate in the area and the large amount of National Forest Lands in the region also contribute to the importance of timber production and logging to the local economy.

Table 2.14 shows the amount of timber resources available in Crawford County.

Table 2.14 Timber Resources of Crawford County

Category	Total	Softwoods	Hardwoods
All Live Trees on Timberland (in cubic feet)	355,449,142	9,732,341	345,716,801
Net Volume of Growing-Stock on Timberland (in cubic feet)	319,764,929	9,408,497	310,376,432
Average Annual Mortality of Growing-Stock on Timberland(in cubic feet)	4,036,182	0	4,036,182
Average Number of Growing Trees on Timberland (in cubic feet)	5,545,141	450,678	5,094,463

Source: U.S. Department of Agriculture: Forest Service, EVALIDator version 4.1, <http://fiatools.fs.fed.us/Evalidator401/tmprc.jsp>

2.1.9 Environmentally Sensitive Areas

The location and characteristics of natural areas need to be included when considering hazard mitigation projects. Environmentally sensitive areas exist in Crawford County because of the area's geological characteristics, primarily karst terrain and seismic zones. Karst can best be described as a land area lying on soluble rock through which a tangible amount of water moves through naturally occurring cracks and crevices. The most significant natural process occurring in karst areas is the solutional weathering of the soluble rock. This process takes place when rainwater combines with carbon dioxide in the soil or atmosphere and forms a carbonic acid (a weak acidic solution that breaks down limestone). The dissolved limestone washes away leaving cracks and crevices in the rock. These fissures in the stone formation act as conduits from surface water to groundwater.

Because of the porous nature of the underlying rock, a large amount of the rainfall in karst areas moves quickly and directly into the groundwater system. Water moves rapidly through karst and does not undergo the purification it would receive if seeping through soil and less permeable rock formations. Karst area groundwater is very susceptible to contamination, thus making it extremely difficult, if not impossible, to site landfills in karst areas under Subtitle D regulations. The state, when compared to the nation as a whole, is at a distinct disadvantage.

The Ozark Plateaus National Water Quality Assessment Program (NAWQA) study, initiated by USGS in 1991, determined that the factors that affect water quality are climate, physiography, soils, water use, land use, population, and geology. Poultry, cattle and swine production, in addition to septic tanks and sewage-treatment plants, have affected water quality by increasing concentrations of nutrients and bacteria in water. Surface- and ground-water quality has been significantly degraded by drainage from abandoned lead and zinc mines in the Tri-State District of Kansas, Missouri, and Oklahoma and the Old Lead Belt in southeastern Missouri.^{xiii}

National Forest

Mark Twain National Forest owns 50,053 acres of land in Crawford County. The Mark Twain National Forest includes 13 ranger districts and encompasses 1.5 million acres of Missouri land. The Potosi/Fredericktown Ranger District serves Crawford County. The responsibilities of the National Forest include the following:

1. Coordinate timber management activities with the use of other resources.
2. Achieve a better balance of size classes throughout the forest, based on a rotation period of 80 years for pine and 90 years for hardwood.
3. Market the programmed annual cut and promote the marketing of the allowable cut.
4. Assist industries, communities, and area development agencies to expand wood using industries.
5. Assure adequate stocking of all regeneration areas.

Table 2.15 Summary of Public Use Areas and Conservation Areas

County	Area
Crawford	John N. & Melba S. Anderson Memorial Conservation Area Blue Springs Creek Conservation Area Campbell Bridge Access Crawford County (Bird’s Nest Access) Crooked Creek Conservation Area Huzzah Conservation Area Keysville Towersite Maramec Spring Fish Hatchery Maramec Spring Park Mint Spring Access Onyx Cave Conservation Area Riverview Access Sappington Bridge Access Scotts Ford Access Sizemore (Pearl G. & John J.) Memorial Conservation Area Woods (Woodson K.) Memorial Conservation Area

Source: Missouri Department of Conservation Atlas, 2003.

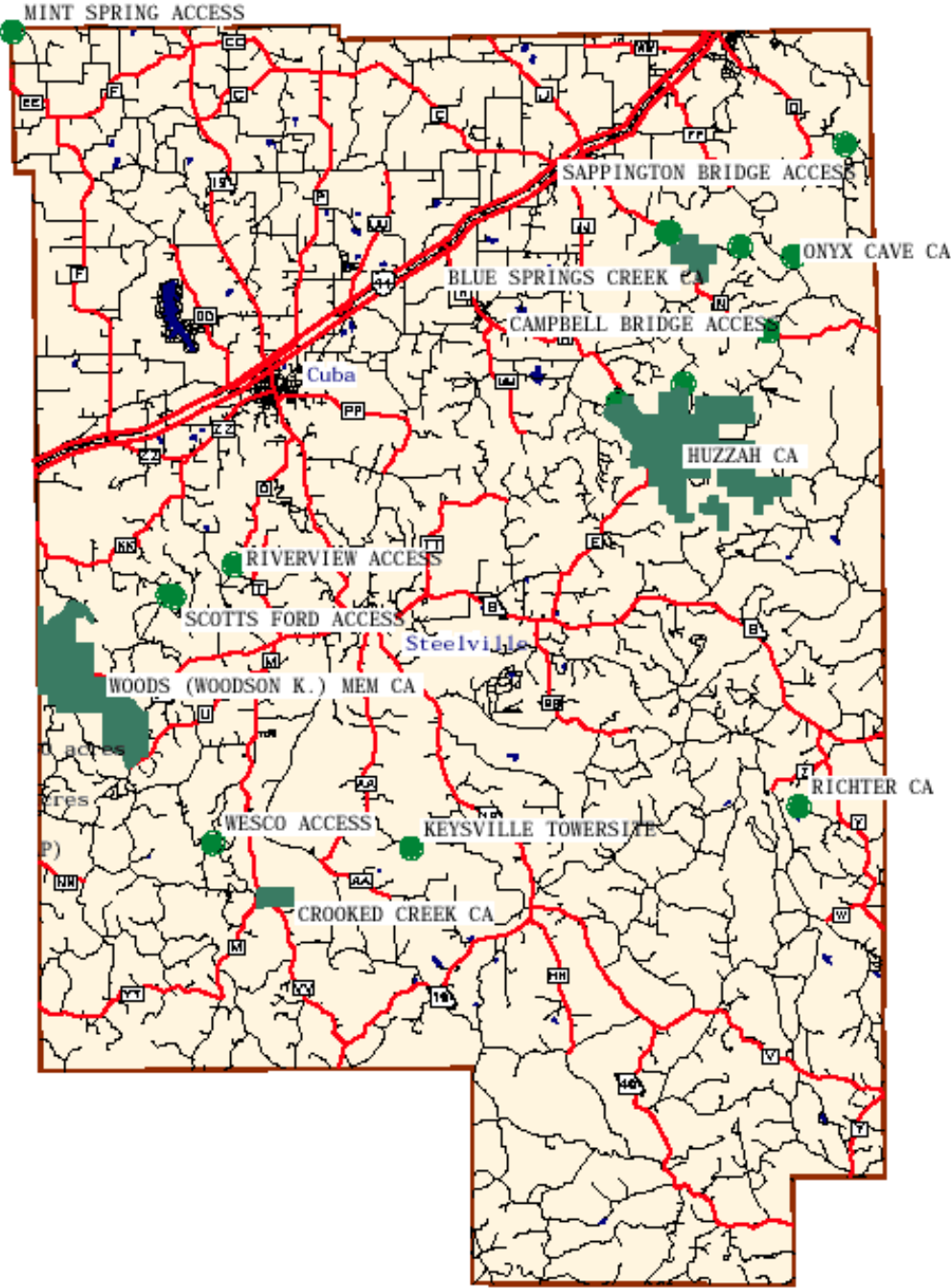
The Mark Twain National Forest contains several recreational opportunities in Crawford County. Trails and wilderness provide adequate opportunity for hiking, biking, horseback riding or ATV/motorcycle. MTNF maintains Red Bluff Recreation Area and Holiday Lake in Crawford County.

The Missouri Department of Natural Resources operates two sites in Crawford County: Onondaga State Park is located outside of Leasburg. Onondaga Cave is one of Missouri’s more than 5,500 caves and the state park offers camping, hiking, canoeing and picnic facilities. Dillard Mill State Historic Site is located on Highway 19, south of Steelville. Completed in 1908, Dillard Mill sits along Huzzah Creek and was the second mill built at that site. Today, most of the original machinery is still intact and operational. Picnic sites are available.

The Courtois, Huzzah and Meramec rivers are popular tourist destinations, especially during summer weekends.

Other areas that are considered environmentally sensitive would include the water resources located in the county, including the Meramec River basin, and the Bourbeuse River basin.

Figure 2.5 Missouri Department of Conservation Lands in Crawford County



Source: Missouri Department of Conservation, 2003.

Crawford County is home to a large number of natural springs. Meramec Spring, located in the Meramec River, with an average flow of 93 million gallons per day, is included among the 15 largest springs in Missouri. Twenty-three springs located in Crawford County are significant

enough to have had flow studies done by the Missouri Department of Natural Resources. In the Meramec River basin these include:

- Beaver Spring, 129,000 gpd
- Blue Spring, 3,170,000 gpd
- Blunt Spring, 26,000 gpd
- Collins Spring, 1,030,000 gpd
- Elm Spring, 484,000 gpd
- Ebb and Flow Spring, 13,000 gpd
- Evans Spring, 3,420,000 gpd
- Gibbs Spring, 924,000 gpd
- Indian Spring, 155,000 gpd
- James Spring-1,400,000 gpd
- McDade Spring, 517,000 gpd
- McIntosh Spring, 879,000 gpd
- Onondaga Spring, 1,230,000 gpd
- Richart Spring, 808,000 gpd
- Roaring Spring, 2,650,000 gpd
- Saranac Spring, 833,000 gpd
- Springling Spring, 465,000 gpd
- Steelville Spring, 323,000 gpd
- Unnamed Spring, 1,890,000 gpd
- Unnamed Spring, 2,470,000 gpd
- Camper Spring, 258,000 gpd
- Westover Spring, 8,200,000 gpd
- Woodlock Spring, 1,260,000 gpd

Most of these springs are used for watering stock, but at least one is used for a commercial trout hatchery. Many are unused and most are located on private property. Several springs in the county were once used to power grist mills or to generate electricity for farms or small communities.

The Forest Service lands located in Crawford County are part of the Salem/Potosi Ranger District. The responsibilities of the National Forest include the following:

1. Coordinate timber management activities with the use of other resources.
2. Achieve a better balance of size classes throughout the forest, based on a rotation period of 80 years for pine and 90 years for hardwood.
3. Market the programmed annual cut and promote the marketing of the allowable cut.
4. Assist industries, communities, and area development agencies to expand wood using industries.
5. Assure adequate stocking of all regeneration areas.

2.1.10 Endangered Species and Species of Concern



According to the Missouri Department of Conservation, several of Missouri's endangered animal and plant species, as well as species of concern, are found in Crawford County. The tiny, white, eyeless Central Missouri cave amphipod lives under rocks or sticks in seven caves and springs in three Missouri counties and nowhere else in the world. This species and other karst species are highly susceptible to poor water quality. Landowners and others work to protect recharge areas that supply water to cave streams and

springs.^{xiv} Also of concern are the Pink Mucket, a thick-shelled freshwater mussel that lives in large rivers in sand and gravel; the Hellbender, a large salamander that lives in streams and rivers; the Cerulean Warbler, a bird that nests in mature hardwood forests in river valleys; the Gray Bat, the Indiana Bat, and the Plains Spotted Skunk.



2.2 Jurisdictional Descriptions and Capabilities

The mitigation capabilities for each of the jurisdictions participating in the hazard mitigation plan are profiled in this section. These profiles include an overview of the jurisdiction and its organizational structure; a description of staff, fiscal and technical resources; and information regarding existing hazard mitigation capabilities such as adopted plans, policies and regulations, if any. The descriptions and capabilities assessments are based on available and applicable data, including information provided by the jurisdictions during the planning process.

2.2.1 Unincorporated Crawford County

Crawford County

Overview



Current Crawford County Courthouse

The jurisdiction of Crawford County includes all unincorporated areas within the county boundaries. Crawford County is governed by a three-member County Commission. The Commission is composed of a presiding commissioner, representing all of the county's population who is elected for a four-year term. Two associate commissioners representing roughly half the county's population each, are elected for four-year terms.

Crawford County operates as a third-class county. The county government has the authority to administer county structures, infrastructures, and finances as well as floodplain regulations. Third class counties do not have building regulations. The three-member county commission meets every Monday and generally is the final authority on county issues. Other county officials include the county clerk, assessor, circuit clerk and recorder, collector, treasurer, prosecuting attorney, sheriff, associate circuit judge, coroner, public administrator, surveyor and emergency management director.

Crawford County has staff resources in floodplain management, emergency management and GIS. The Crawford County Clerk's office, serves as the floodplain manager for the county. The county has a part-time emergency management director. The Assessor's office has GIS capabilities. The county has a 9-1-1 central dispatch center that includes enhanced 9-1-1. The 9-1-1 Central Dispatch is located at 61 E. Hwy 8, Suite 204 in Steelville, MO. Table 2.16 outlines Crawford County's personnel resources in 2009.

Table 2.16 Crawford County Administrative and Technical Resources

Personnel Resources	Department/Position	Comments
Personnel Skilled in GIS	County Assessor’s Office	
Floodplain Manager	County Clerk’s Office	
Emergency Management Director	Office of Emergency Management	Part-time

There are five fire departments located in the county. All are volunteer departments with the exception of Sullivan which has a full-time staff of 10 in addition to volunteers. Those departments include Bourbon Fire Protection District, Cuba Fire Department, Leasburg Volunteer Fire Department and Steelville Fire District.

The county is served by two ambulance districts – North Crawford County Ambulance District located in Cuba and Steelville Ambulance District located in Steelville. Missouri Baptist Hospital is located in Sullivan.

Existing Plans and Policies

Crawford County participates in the National Flood Insurance Program. The county does have a flood plain ordinance. The County Clerk’s office serves as the floodplain manager for the county. Construction occurring in the floodplain in unincorporated areas of the county is not required to obtain a permit from the County. The unincorporated areas of the County do not have building codes. The county has a local emergency operations plan (LEOP) that is administered and maintained by the Emergency Management Director.

Other Mitigation Activities

The Office of Emergency Management, local fire departments, Sheriff’s Department and the Crawford County Health Department have conducted public education campaigns to raise awareness and increase preparedness among the county’s population. Those programs have included Ready-In-3 emergency preparedness, fire safety, storm preparedness, heat wave preparedness and DARE (Drug Abuse Resistance Education).

2.2.2 Cities

Seven incorporated cities participated in the planning development process. The mitigation capability of these communities varies, but each supports the mitigation goals of the county overall. Descriptions of each participating city are provided below and Table 2.17 at the end of the section summarizes mitigation capabilities for each of the cities.

City of Bourbon

Overview

Bourbon is located just west of Sullivan on U.S. Interstate I-44. Bourbon, Missouri had its beginnings in the early 1800's. Bourbon is believed to be the only town in the United States

named for Bourbon whiskey. The beginnings of the city coincide with the construction of the railroad (first called the Pacific and later the Frisco).

When a post office was established in September 1853, the name was given as "Bourbon in the village of St. Cloud ". The town was never located at the proposed village, but was built further west where the steam engines could stop and start where there was no grade. The town of Bourbon sprang up along the railroad tracks and the Old Springfield Road, where it is located today.

According to the 2000 U.S. Census, the community has a population of 1,348. As a fourth class city, Bourbon's government consists of an elected mayor, four alderman and a city collector. The mayor, with the aldermen's approval, appoints a city clerk, a commissioner of public safety, a public works department supervisor, a parks department superintendent, five full time police officers, two full time city employees, and any other needed employees.^{xxiii}

Technical and Fiscal Resources

Bourbon is a participating community in the National Flood Insurance Program and has a Flood Insurance Study. The Public Works Director is the Flood Plain manager. Law enforcement in the community is provided by a police department which is located on Pine Street in Bourbon. The city has five full-time and two part-time police officers. The police department provides the DARE program at the public school. The city has one warning siren, but is in the process of purchasing another. The warning siren is controlled by the Central Communications Center, Police and Fire Departments.

The Central Communications Center is currently being created and is located in the basement of the city hall. The back-up location will be the police station located at 355 East Pine. The Central Communications Center has 9-1-1 capabilities. The North Crawford County Ambulance Service provides ambulance service for the city and surrounding area. There is a Rural Fire Protection District located in Bourbon, which serves the city and the surrounding area as well as the Bourbon R-I School District. There is a full time fire chief and approximately 30 volunteer firemen.

Bourbon's Public Works Director administers and enforces all codes and ordinances. The public works director is a certified inspector. All residential and non-residential construction – both new and renovations – require a building permit and inspections by the city.

Fiscal tools or resources that the City could potentially use to help fund mitigation activities include Community Development Block Grants, capital improvements project funding, taxes for specific purposes, fees for water, sewer, gas or electric services, impact fees for new development, debt through general obligation bonds, debt through special tax bonds, debt through private activities and withholding spending in hazard prone areas.

Existing Plans and Policies

Bourbon is a member of the National Flood Insurance Program and has had a flood insurance study. Bourbon's Fire Department has an ISO rating of 7 inside the city limits and 9 outside city limits. The city has a Capital Improvement Plan, City Comprehensive Plan, city planning and

zoning ordinances and stormwater management ordinances. The city is included in the county LEOP.

Other Mitigation Activities

The local fire department provides education/awareness programs and materials on a variety of subjects including Fire Safety Week and emergency preparedness. The police department provides the DARE program at the Bourbon R-I School District.

City of Cuba

Overview

Cuba was founded in 1857 in anticipation of the construction of the southern branch of the Pacific Railroad. With the arrival of the southern branch of the Pacific Railroad in 1859-1860, the train brought a new way to get goods and send products to market. Cuba became a shipping center for agriculture and industry. From 1865-1912, Cuba was known as “The Land of the Big Red Apple.” By 1900, Cuba was the largest producer and distributor of apples in Missouri.

With the advent of the Model T, road improvements became necessary. Paving for Route 66, the “Mother Road,” through Cuba was completed in 1931. With more automobile traffic, new business opportunities were created. Restaurants, gasoline stations and motels opened their doors all along Route 66 to answer the needs of traveling motorists.

Cuba is located on U.S. Interstate 44, just over eighty miles west of downtown St. Louis, in the north central portion of Crawford County. The city is bisected by Highway 19, which runs north / south. According to the 2000 U.S. Census, the community has a population of 3,230. Cuba is incorporated as a fourth class city with six aldermen and the mayor who make decisions regarding city issues. Other city personnel include a city clerk, city attorney, city collector, police chief, fire chief, public works director, municipal judge and court clerk.

Technical and Fiscal Resources

Cuba currently participates in the National Flood Insurance Program. Law enforcement in the community is provided by a police department that is located on Franklin Street in Cuba. The department has eleven full-time police officers. The city’s volunteer fire department and rural fire protection district provides fire protection for the area. The Central Communications Center located in the EOC building. The back-up location is in the Public Works building. The North Crawford County Ambulance Service accommodates the county, including the city of Cuba. The city government has high speed broadband internet capabilities at all city facilities.

Cuba’s Public Works Director administers and enforces all building codes and ordinances. The public works director is a certified inspector. All residential and non-residential construction – both new and renovations – require a building permit and inspections by the city. The city also has Site Plan Review requirements.

Fiscal tools or resources that the City could potentially use to help fund mitigation activities include Community Development Block Grants, capital improvements project funding, taxes for

specific purposes, fees for water, sewer, gas or electric services, impact fees for new development, debt through general obligation bonds, debt through special tax bonds, debt through private activities and withholding spending in hazard prone areas.

Existing Plans and Policies

The city has Planning and Zoning ordinances that were adopted in 2004 as well as building codes that are enforced by the Public Works Director. Cuba has an Emergency Operations Plan, City Comprehensive Plan and an Economic Growth Strategy. The rural fire district's ISO rating is 9, while the city ISO rating is 6. The city is also part of the county LEOP.

Other Mitigation Activities

The local fire department provides education/awareness programs and materials on a variety of subjects including Fire Safety Week and emergency preparedness. The police department provides the DARE program at the Crawford County R-II School District.

Village of Leasburg

Overview

Leasburg is located in the north central portion of Crawford County. Leasburg is situated on the Burlington Northern Railroad approximately 82 miles west of St. Louis. The town was originally named Harrison Station for William Harrison. The name was changed in 1859 in honor of Samuel Lea, who built the first residence on the town site. Lea was also the first merchant to open a general store in the area and became the first postmaster. According to the 2000 U.S. Census, the community has a population of 323. Leasburg is incorporated as a village and has a four member board of aldermen and a chairman. The city employs a city clerk, attorney and water and street superintendents.

Technical and Fiscal Resources

Leasburg participates in the National Flood Insurance Program but is not in a flood plain therefore the village does not have a Flood Insurance Study nor maintains certificates of elevation. The village is in the process of determining the need of a Flood Plain Management ordinance and will adopt one if it is needed.

Law enforcement in the community is provided by a police department. The village does not have a Central Communications Center. 9-1-1 dispatch is provided by the county. The North Crawford County Ambulance District provides ambulance service for the northern portion of the county, including the Village of Leasburg. The Leasburg Volunteer Fire Department provides fire protection. The village has one warning siren which is controlled by the fire department.

Fiscal tools or resources that the City could potentially use to help fund mitigation activities include Community Development Block Grants, capital improvements project funding and taxes for specific purposes.

Existing Plans and Policies

Leasburg is a member of the National Flood Insurance Program. The fire department's ISO rating is nine. The city is also part of the county LEOP.

Other Mitigation Activities

The local fire department provides in-house training and CPR classes.

Village of St. Cloud

Overview

St. Cloud is located in northern Crawford County and lies along Interstate 44 between the cities of Bourbon and Sullivan approximately 75 miles west of St. Louis. The community was formed in the 1970s in response to concerns from the residents that their property might one day be annexed by the City of Bourbon. A village was formed and a board of trustees established for governance.

Technical and Fiscal Resources

The community has no paid employees and collects no taxes or fees from residents. Law enforcement services are provided by Crawford County. Fire services are provided by the Bourbon or Sullivan fire departments. Ambulance services are provided by either the ambulance service in Sullivan or the North Crawford County Ambulance District.

Fiscal tools or resources that the village could potentially use to help fund mitigation activities include Community Development Block Grants or other grants.

Existing Plans and Policies

The city has no plans of its own, but is part of the Crawford County LEOP.

Other Mitigation Activities

None.

City of Steelville

Overview

The City of Steelville is located in the center of Crawford County approximately eight miles south of Interstate 44. The first settlers in Steelville were William Britton, who built a small grist mill along the Yadkin Creek, and James Steel, who operated a trading post and was appointed by the government as Commissioner to lay out the city in 1835—the year in which Steelville was founded. Britton remained in the area. Steel, according to census, moved northward to continue his interest in mining.

James Steel purchased 40 acres of land from the government which he later sold to the "County Court" on December 16, 1835 for \$50. By this time a little settlement had sprung up. Crawford

County Court named the town Steelville as the County Seat. The deed was recorded on December 18, 1835, the town was platted, and the first deeds to lots were sold for \$12 each.

The town was incorporated as a city of the fourth class in 1885. At this time, there were 500 inhabitants. According to the 2000 census, the current population is 1,429. There is a four member city council and a mayor. The city employs a city clerk, prosecutor, chief of police, city superintendent and superintendent of water, sewer and streets, building inspector and a number of other employees within these departments.

The city has building codes that were adopted in 1975 as well as zoning ordinances and site plan review requirements. Building permits, codes and ordinances are enforced by the city's building inspector.

Technical and Fiscal Resources

Steelville participates in the National Flood Insurance Program. The city building inspector serves as the floodplain administrator for the City of Steelville. Steelville has a Flood Insurance Plan and maintains certificates of elevation.

Steelville's building inspector administers and enforces all building codes. All residential and non-residential construction – both new and renovations – require a building permit and inspections by the city. The city has site plan review requirements.

In addition to being served by Crawford County 9-1-1, the city has dispatch capability through the city police dispatch and fire department. The city government has high speed broadband internet capabilities at all city facilities.

Fiscal tools or resources that the City could potentially use to help fund mitigation activities include Community Development Block Grants, capital improvements project funding, taxes for specific purposes, debt through general obligation bonds, debt through special tax bonds, debt through private activities and withholding spending in hazard prone areas.

Existing Plans and Policies

Steelville is a member of the National Flood Insurance Program. The city has a Comprehensive Economic Development Plan. The fire department's rural ISO rating is nine, while the city ISO rating is seven. The city is also part of the county LEOP.

Other Mitigation Activities

The local fire department provides education/awareness programs and materials on a variety of subjects including Fire Safety Week and emergency preparedness. The police department provides DARE at the local school.

City of Sullivan

Overview

Sullivan is located on the Interstate 44 corridor. The City of Sullivan, long known as the "Gateway to the Ozarks," is located on Old Highway 66 and the St. Louis & San Francisco Railroad, 68 miles southwest of St. Louis, at the southern border of Franklin County. The area was founded in the early 1800's, by Stephen Sullivan who with his wife Dorcas accompanied Daniel Boone on his return trip from Kentucky to secure settlers to populate the wild and unbroken territory around the Meramec River. When the railroad finally reached the small settlement in 1858, a town was laid out that the railroad company appropriately named "Sullivan." The population was 6,351 at the 2000 census.

There is a six member city council and a mayor. The city employs a city clerk, prosecutor, chief of police, city administrator, street commissioner, light commissioner, water and sewer commissioner, judge, court clerk, park and recreation director, EMD, collector, engineer, building inspector and any other needed employees.

Technical and Fiscal Resources

Sullivan participates in the National Flood Insurance Program. The city code administrator serves as the floodplain administrator for the City of Sullivan. The city's Flood Plain Ordinance was adopted in April 2004 Ordinance #2923. The city's Stormwater Management Ordinance was adopted March 2005 Ordinance #2994. The city has a Flood Insurance Plan and maintains certificates of elevation.

Sullivan's code administrator administers and enforces all building codes. All residential and non-residential construction – both new and renovations – require a building permit and inspections by the city. The city has site plan review requirements.

The Central Communications Center, located in and operated by the Sullivan Police Department, is contracted by Crawford County to provide 9-1-1 dispatching. The office is staffed 24 hours a day. The North Crawford County Ambulance Service and MO Baptist Hospital accommodate the City of Sullivan. Sullivan receives fire protection services from both the City of Sullivan Fire & Rescue and Sullivan Rural Fire Protection District.

The city has four severe weather sirens that are activated by the central dispatch center with coordination from the city fire chief. In addition to being served by Crawford County 9-1-1, the city has dispatch capability through the city police dispatch. Additional warning is provided through the local radio stations, KTUI, KNSX, and KXMO Radio and the local Channel 6 cable television station.

The City EOC is located at 106 Progress Drive at the local police department. The community and city government has high speed broadband internet capabilities at all city facilities.

Existing Plans and Policies

Sullivan has a city comprehensive plan, stormwater management ordinances, floodplain management ordinances and an Emergency Operations Plan. The rural fire district's ISO rating is 9, while the city ISO rating is 4. The city is also part of the county LEOP.

Other Mitigation Activities

The fire department provides a number of education/outreach programs in the community and school district, including Fire Safety Week, and home smoke detectors. The Sheriff's Department provides DARE at the local schools.

Village of West Sullivan

Overview

The village of West Sullivan is located just west of the City of Sullivan on Interstate 44 in the northeastern edge of Crawford County. West Sullivan is a village on former U.S. Route 66. The village limits are adjacent to Sullivan on the east and St. Cloud on the west. The community was incorporated in 2000. The community has a population of 82. West Sullivan is incorporated as a village and has a four member board of trustees. The city contracts for a part-time city clerk.

Technical and Fiscal Resources

Law enforcement in the community is provided by the Crawford County Sheriff's Office and the Missouri Highway Patrol. The Sullivan Fire Protection District provides fire protection for the community. Ambulance service is provided by the Missouri Baptist Hospital located in Sullivan and the North Crawford Ambulance District.

Fiscal tools or resources that the City could potentially use to help fund mitigation activities include Community Development Block Grants and capital improvements project funding.

Existing Plans and Policies

None.

Other Mitigation Activities

None.

Table 2-17 Crawford County & Participating Cities: Summary of Mitigation Capabilities

Capability	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan
Emergency Operations Plan	Y	Y	Y	Part of County plan	Part of County plan	Y	Y	Part of County Plan
Building Code/Year	N	N	Y	For Mobile homes only	N	Y	Y/1975	N
Fire Department ISO Rating	9	7/9	6/9	9/9	n/a	7/9	4/9	9
Floodplain Management Ordinance	Y	N	N	In progress	N	Y/1977	Y/2004	N
Zoning Ordinance	N	Y/1970's	Y/2004	In progress	N	Y	Y/2005	N
Site Plan Review Requirements	N	Y	Y	N	N	Y	Y	N
National Flood Insurance Program	Y	Y	Y	Y	N	Y	Y	N
Economic Development Plan/Policy	N	N	Y	Info not available	N	N	Y	N
Stormwater Management Ordinance	N	Y/1990's	N	In progress	N	N	Y/2005	N
Flood Insurance Study	Y	N	N	N	N	Y	Y	N
Elevations Certificates Maintained	N	N	N	N	N	Y	Y	N

2.2.3 School Districts

The following school districts are participating jurisdictions in this plan: Crawford County R-I (Bourbon), Crawford County R-II (Cuba), Steelville R-III and Sullivan C-2. As public institutions responsible for the care and education of the county's children, these school districts share an interest with Crawford County in public safety and hazard mitigation planning. Figure 2-6 provides the boundaries of the school districts participating in this planning process.

Technical and Fiscal Resources

The school districts in Crawford County all have the authority to levy taxes for special purposes related to education and student safety and/or incur debt through general obligation or special tax bonds.

All schools in the district participating in this plan have NOAA all hazard radios on site to provide early warning of hazard events. Cuba, Bourbon and Sullivan have communication radios that can be used during hazard events. In addition, each school has fire alarms and a public address system capable of providing specific instructions in the event of an emergency. All of the Crawford County school districts all have automated phone message systems used to contact

parents for normal school announcements. These automated phone message systems could also be utilized to provide emergency information regarding the schools.

None of the school districts have dedicated grant writers on staff. Existing staff work on grants when necessary. At most schools the Superintendent of schools, principals, curriculum directors, or director of student services perform grant writing duties as well as emergency management planning.

Existing Plans and Policies

All schools in the district have crisis management plans in place. All schools in the district participate in the Emergency Response Information Portal (ERIP) program sponsored by the Missouri Department of Homeland Security or are in the process of training and registering for ERIP. This internet based project assists schools with the development of all-hazards emergency plans and through a restricted website provides access to those plans to local emergency response agencies.

Other Mitigation Activities

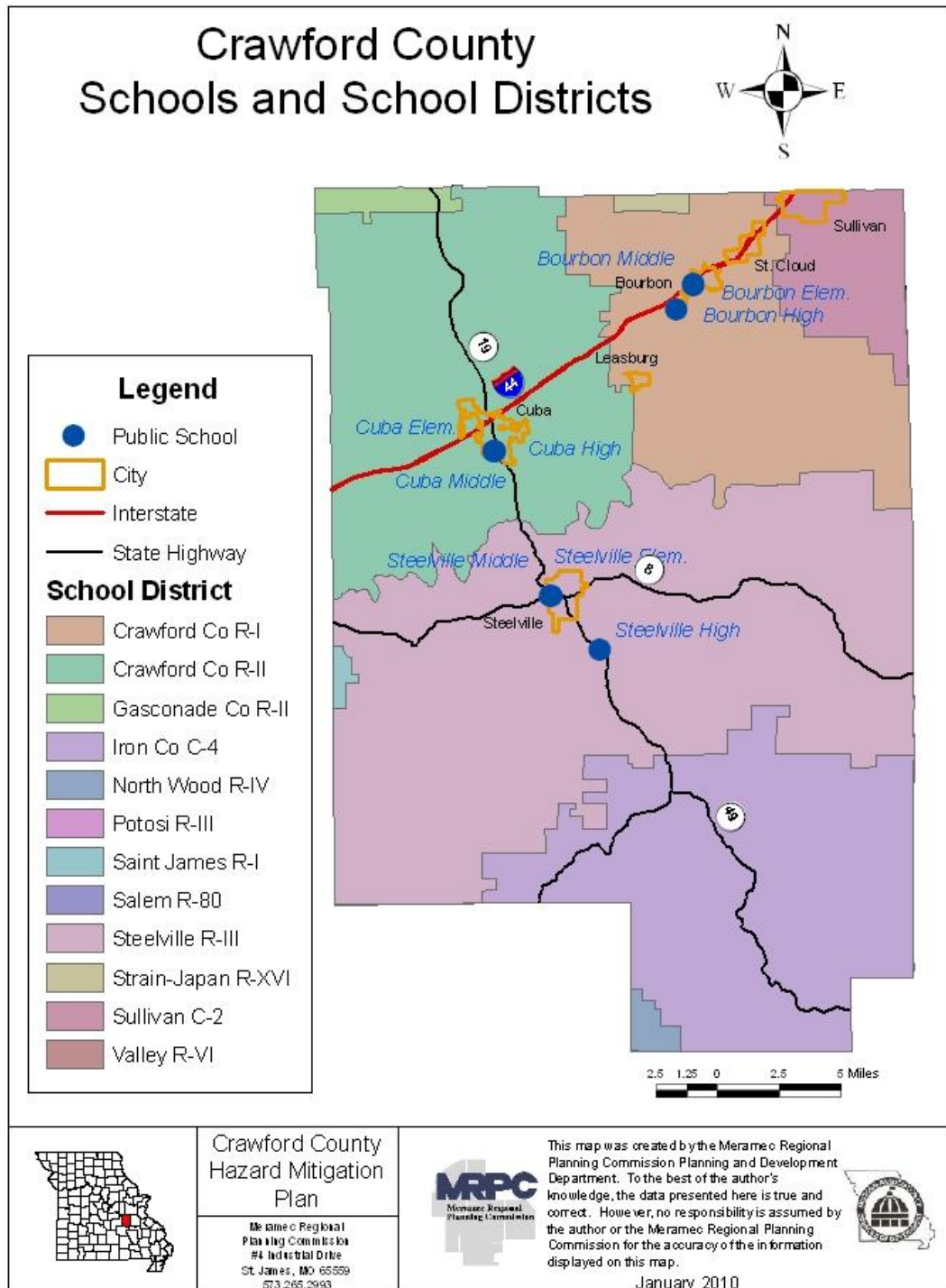
All schools participating in the plan conduct regular fire, earthquake and tornado drills and tornado drills on a quarterly basis or semi-annual basis. Although all the schools have designated safe areas for tornados – none of these areas would be considered certified safe rooms.

Table 2.18 Schools in Participating Districts with Reported 2009-10 Enrollment

Crawford Co. R-I School District (Bourbon)	2009-10 Enrollment – Total: 1,038
Bourbon Elementary School (PK-4)	429
Bourbon Middle School (5-8)	302
Bourbon High School (9-12)	307
Crawford Co. R-II School District (Cuba)	2009-10 Enrollment – Total: 1,394
Cuba Elementary School (K-4)	584
Cuba Middle School (5-8)	411
Cuba High School (9-12)	399
Steelville R-I School District	2009-10 Enrollment – Total: 954
Steelville Elementary School (PK-4)	350
Steelville Middle School (5-8)	315
Steelville High School (9-12)	289
Sullivan School District	2009-10 Enrollment – Total: 2,244
Sullivan Primary School (PK-1)	408
Sullivan Elementary School (2-5)	564
Sullivan Middle School (6-8)	481
Sullivan High School (9-12)	791

Source: Missouri Department of Elementary and Secondary Education website: <http://www.dese.mo.gov>

Figure 2-6



2.2.4 Colleges/Universities

The Southwest Area campus of East Central College is located in Sullivan, Crawford County, Missouri. There are several institutions of higher learning located in adjacent counties such as the Missouri University of Science and Technology in Phelps County, and the main campus of East Central Community College in Franklin County.

Table 2.19 College/University Satellite Campuses Located in Crawford County

College/University	Location	Description
East Central College	11 North Clark Sullivan, MO 63080	Main campus in Union, MO Associate degrees

ⁱ U.S. Geological Survey Fact Sheet FS-027-96

ⁱⁱ Kammer, William Ray. "The Meramec River: Then and Now" 3rd edition.

ⁱⁱⁱ Ibid.

^{iv} NFIP Community Status Report

^v Ozark Rivers Solid Waste Management District Plan, revised 2004.

^{vi} <http://www.average-temperature.com/temps/MO/Rolla>

^{vii} U.S. Census Bureau, Census 2000.

^{viii} U.S. Census Bureau, Census 2000.

^{ix} Missouri State Government, Division of Budget & Planning website
<http://www.oa.state.mo.us/bp/projections/scenario.html>

^x Ibid.

^{xi} 2002 Census of Retail Trade – U.S. Department of Commerce- census.gov/prod/ec02/ec0244amott

^{xii} 1997 & 2002 Census of Agriculture, USDA, National Agriculture Statistics Service

^{xiii} U.S. Geological Survey Fact Sheet FS-027-96

^{xiv} Missouri Department of Conservation, "Missouri Animals of Conservation Concern"

<http://www.bourbonmo.com/>

<http://www.cubamo.com>

<http://www.sullivanmo.com/index.php>

<http://sullivan.mo.us/>

<http://www.crawfordcountymo.net/>

<http://www.eastcentral.edu/ecc/extcamp/SAC/>

3 RISK ASSESSMENT

44 CFR Requirement 201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to those identified hazards. The goal of the risk assessment process is in the event of a hazard event, to approximate the potential losses in Crawford County, including loss of life, personal injury, property damage and economic losses. The risk assessment process provides an opportunity for the county and the communities within the county to better understand their potential risks from natural hazards and to better prepare for those potential events through preparedness and mitigation planning.

The risk assessment for Crawford County and its jurisdictions followed the methodology described in the FEMA publication 386-2, *Understanding your Risks: Identifying Hazards and Estimating Losses* (2002). This methodology includes the following steps:

- Identifying the hazards
- Profiling hazard events
- Inventorying assets
- Estimating losses

Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional hazard mitigation plan, the risk assessment looks at each jurisdiction's risks whenever they deviate from the risks facing the entire planning area. Crawford County is uniform in terms of climate and topography as well as construction characteristics and development trends. Therefore, overall hazards and vulnerability do not vary greatly across the planning area for most hazards. Weather-related hazards will impact the entire the county in much the same fashion, as do topographical/geological related hazards such as earthquake. Sinkholes are widespread in the county, but more localized in their effects.

The hazards that do vary across the planning area include dam failure and flood. Table 3.2 shows the hazards identified for each participating jurisdiction and in Section 3.2, under each hazard description, the section Likely Location discusses how some hazards vary among jurisdictions in the planning area. The section titled Hazard History provides a narrative, based on the best available data, on where past hazard events have occurred and the approximated losses to specific jurisdictions during those events. In Section 3.3 Vulnerability Assessment, includes information on structures and estimates of potential losses by jurisdiction (where data is available) for hazards of moderate and high priority.

3.1 Identification of Hazards Affecting Crawford County

44 CFR Requirement 201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.

3.1.1 Methodology

FEMA provided the following list of potential hazards for consideration in the hazard mitigation planning process:

- Avalanche
- Coastal Erosion
- Coastal Storm
- Dam/Levee Failure
- Debris Flow
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flood
- Hailstorm
- Hurricane
- Land Subsidence
- Landslide
- Severe Winter Storm
- Tornado
- Volcano
- Wildfire
- Windstorm

Based on past history and future probability, the Hazard Mitigation Planning Committee (HMPC) determined that the following potential hazards would be included in the Crawford County Hazard Mitigation Plan:

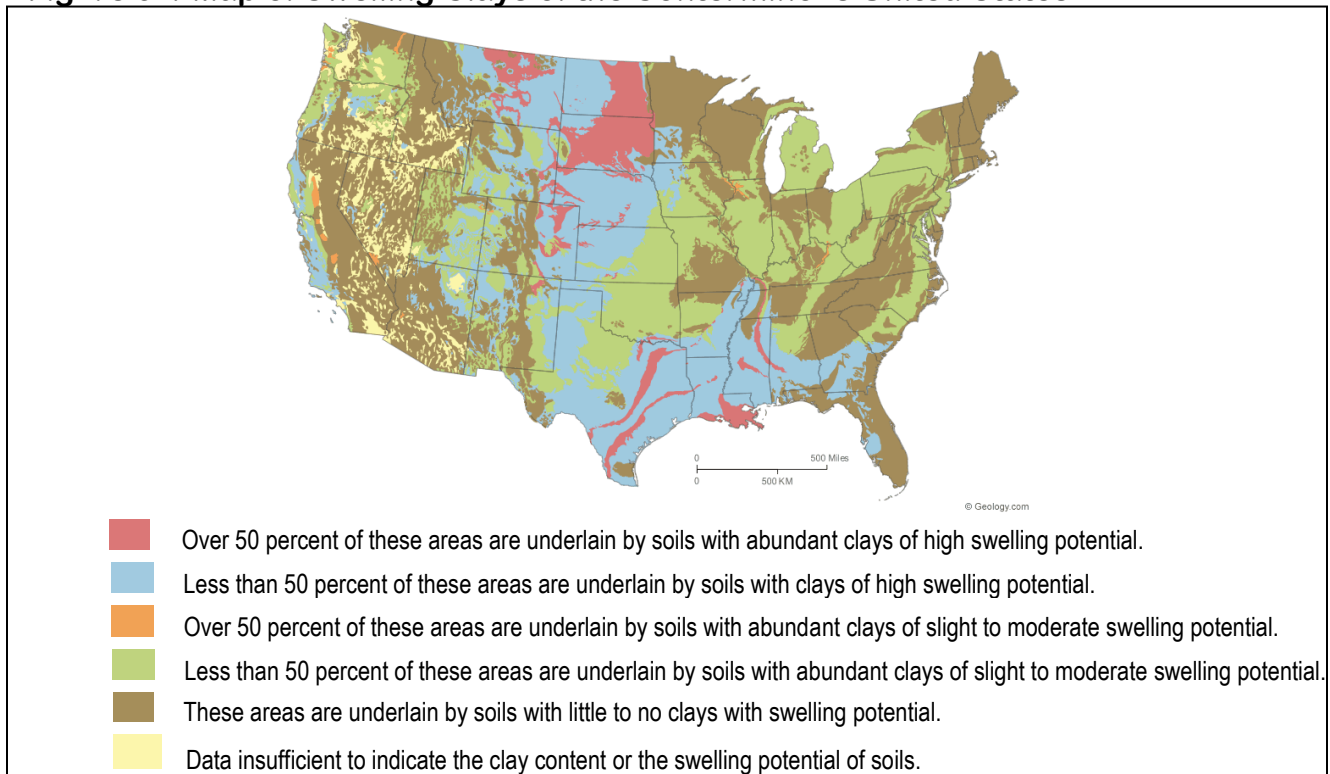
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Landslide
- Land Subsidence/Sinkholes
- Severe Storm (Hailstorm/Windstorm)/Tornado
- Severe Winter Weather
- Wildfire

Several hazards were not included. Some were eliminated because they do not exist in the planning area and the risk of some hazards was considered insignificant. Table 3.1 outlines the hazards eliminated from the plan and the reasons for doing so.

Table 3.1 Hazards Not Profiled in the Plan

Hazard	Reason for Omission
Avalanche	No mountains in the planning area.
Coastal Erosion	Planning area is located in the Midwest, not on any coast.
Coastal Storm	Planning area is located in the Midwest, not on any coast.
Debris Flow	There are no mountainous areas in the planning area where this type of event occurs.
Expansive Soils	There are no areas of expansive soils in the planning area. The map in Figure 3-1 demonstrates the lack of swelling clay soil types in the southern half of Missouri.
Hurricane	Planning area is located in the Midwest, not on any coast.
Levee Failure	Planning research revealed no Corps of Engineer regulated levees in the planning area. If there are any privately owned levees in Crawford Co., they could not be identified. No records indicate that the breaching or overtopping of any levee ever has or would impact property or structures other than the owner of the levee. Damage to residential structures is unlikely.
Volcano	There are no volcanic areas in the county.

Figure 3-1 Map of Swelling Clays of the Conterminous United States



Source: <http://geology.com/articles/soil/>, "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider & R. Schuster

Some hazards have been combined in the Crawford County Plan to match how the hazards are listed in the Missouri State Hazard Mitigation Plan. That state-wide plan combines Severe Thunderstorms with Tornados.

Data on hazards was gathered from a variety of sources but primarily from the following:

- Missouri State Hazard Mitigation Plan
- Spatial Hazard Event and Loss Database (SHELDUS), provided through the University of South Carolina hazards Research Lab
- National oceanic and Atmospheric Administration’s (NOAA) National Climatic Data Center
- Federal Disaster Declarations from the Federal Emergency Management Agency (FEMA)
- Various articles, data sets and publications available via the internet (sources are indicated at the end of each section of the plan document)

The Crawford County HMPC identified eleven hazards that had the potential to affect the planning area. Those hazards are listed in Table 3.2 and further described in the following section of the plan. It was determined by SEMA that only natural hazards would be addressed in the plan.

Table 3.2 Hazards Identified for Crawford County Plan and Affected Jurisdictions

Hazard	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan	Crawford Co. R-I School	Crawford Co. R-II School	Steelville R-III School	Sullivan C-2 School District
Dam Failure	X		X				X					
Drought	X	X	X	X	X	X	X	X	X	X	X	X
Earthquake	X	X	X	X	X	X	X	X	X	X	X	X
Extreme Heat	X	X	X	X	X	X	X	X	X	X	X	X
Riverine/Flash Flood	X	X	X	X	X	X	X	X	X	X	X	X
Landslide	X	X	X	X	X	X	X	X	X	X	X	X
Severe Storms-Hail/Wind Storm	X	X	X	X	X	X	X	X	X	X	X	X
Tornado	X	X	X	X	X	X	X	X	X	X	X	X
Severe Winter Weather	X	X	X	X	X	X	X	X	X	X	X	X
Land Subsidence/Sinkholes	X			X		X						
Wildfire	X	X	X	X	X	X	X	X	X	X	X	X

3.1.2 Disaster Declaration History

In order to assess risk, it was logical to review the disaster declaration history for the State of Missouri and specifically for Crawford County. Federal and state disaster declarations are granted when the severity and magnitude of a hazard event surpasses the ability of local government to respond and recover. Disaster assistance is initiated when the local government's response and recovery capabilities have been exhausted. In this type of situation, the state may declare a disaster and provide resources from the state level. If the disaster is so great that state resources are also overwhelmed, a federal disaster may be declared in order to allow for federal assistance.

There are three agencies through which a federal disaster declaration can be issued – FEMA, the U.S. Department of Agriculture (USDA) and/or the Small Business Administration. A federally declared disaster generally includes long-term federal recovery programs. The type of declaration is determined by the type of damage sustained during a disaster and what types of institutions or industries are affected.

A declaration issued by USDA indicates that the affected area has suffered at least a 30 percent loss in one or more crops or livestock industries. This type of declaration provides those farmers affected with access to low-interest loans and other programs to assist with disaster recovery and mitigation.

Missouri has been especially hard hit by natural disasters in the recent past. The state has had 49 federally declared disasters since 1957. Of those, 21 have occurred between 2000 and 2009. All of these disasters have been weather related – severe wind and rain storms, tornados, flooding, hail, ice storms and winter storms. Table 3.3 lists the federal disaster declarations for Missouri that included Crawford County from 2000 through 2009.

Table 3.3 Disaster Declaration History of Crawford County 2000-2009

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
1847	6/26/2009	Severe Storms, Tornados and Flooding	Public Assistance	Adair, Barton, Bollinger, Camden, Cape Girardeau, Cedar, Crawford , Dade, Dallas, Dent, Douglas, Greene, Hickory, Howell, Iron, Jasper, Knox, Laclede, Lewis, Madison, Maries, Marion, Miller, Newton, Oregon, Ozark, Perry, Crawford, Polk, Pulaski, Ray, Reynolds, Ripley, St. Francois, Ste. Genevieve, Saline, Shannon, Shelby, Stone, Sullivan, Texas, Vernon, Washington, Wayne, Webster, and Wright
1809	11/13/2008	Severe Storms, Flooding and Tornados	Public Assistance	Adair, Audrain, Barry, Bollinger, Butler, Callaway, Cape Girardeau, Carter, Christian, Clark, Crawford , Dent, Douglas, Dunklin, Howard, Howell, Knox, Lewis, Lincoln, Linn, Madison,

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
				Maries, Marion, Miller, Mississippi, New Madrid, Oregon, Ozark, Perry, Ralls, Randolph, Ray, Reynolds, Ripley Schuyler, Scotland, Scott, Shannon, Shelby, St. Genevieve, Stoddard, Stone, Sullivan, Taney, Texas, Wayne, Webster and Wright counties.
1749	3/19/2008	Severe Storms and Flooding	Individual and Public Assistance	Audrain, Barry, Barton, Boone, Bollinger, Butler, Callaway, Camden, Cape Girardeau, Carter, Cedar, Christian, Cole, Cooper, Crawford , Dade, Dallas, Dent, Douglas, Dunklin, Franklin, Gasconade, Greene, Hickory, Howard, Howell, Iron, Jasper, Jefferson, Laclede, Lawrence, Lincoln, Madison, Maries, McDonald, Miller, Mississippi, Montgomery, Moniteau, Morgan, New Madrid, Newton, Oregon, Osage, Ozark, Pemiscot, Perry, Crawford, Pike, Polk, Pulaski, Reynolds, Ripley, St. Charles, St. Clair, St. Francois, St. Louis, Ste. Genevieve, Shannon, Scott, Stoddard, Stone, Taney, Texas, Vernon, Warren, Washington, Wayne, Webster, and Wright Counties and the Independent City of St. Louis
1676	1/15/2007	Winter Storms and Flooding	Public Assistance	Barry, Barton, Callaway, Camden , Christian, Cole, Crawford , Dade, Dallas, Dent, Franklin , Gasconade, Greene, Hickory , Jasper, Laclede, Lawrence , Lincoln , Maries, McDonald, Miller, Montgomery , Newton , Osage, Crawford, Polk, Pulaski, St. Charles , St. Clair, St. Louis , Stone, Warren , Webster, Wright, and the independent City of St. Louis
1631	3/16/2006	Severe Storms, Tornadoes, and Flooding	Individual and Public Assistance	Benton, Boone, Carroll, Cass, Cedar, Christian, Cooper, Greene, Henry, Hickory, Iron, Johnson, Lawrence, Lincoln, Mississippi, Monroe, Morgan, New Madrid, Newton, Perry, Pettis, Crawford , Putnam, Randolph, Scott, St. Clair, Ste. Genevieve, Saline Counties, Taney, Vernon, Webster, and Wright Counties, Bates, Christian, Howard, Jefferson, Monroe, Montgomery, and Washington Counties

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
1463	5/6/2003	Severe Storms, Tornadoes and Flooding	Individual and Public Assistance	Barry, Barton, Bates, Benton, Bollinger, Buchanan, Camden, Cass, Cedar, Christian, Clay, Clinton, Cooper, Crawford , Dade, Dallas, Dent, Douglas, Franklin, Knox, Gasconade, Cape Girardeau, Greene, Henry, Hickory, Iron, Jackson, Jasper, Jefferson, Johnson, Laclede, Lafayette, Lawrence, Marion, McDonald, Miller, Monroe, Morgan, Newton, Osage, Perry, Pettis, Crawford , Platte, Polk, Pulaski, Ray, Saint Francois, Saint Louis, Sainte Genevieve, Saline, Scott, St. Clair, Stoddard, Stone, Taney, Vernon, Washington and Webster
1412	5/6/2002	Severe Storms, Tornadoes	Individual and Public Assistance	Adair, Barry, Bollinger, Butler, Cape Girardeau, Carter, Crawford , Dade, Dallas, Dent, Douglas, Dunklin, Howell, Iron, Jefferson, Johnson, Knox Lafayette, Lawrence, Madison, Pemiscott, St. Genevieve and Taney
1328	5/12/2000	Severe Thunderstorms and Flash Flooding	Individual Assistance	Crawford , Franklin, Gasconade, Jefferson, St. Charles, Ste. Genevieve, St. Francois, St. Louis, Warren and Washington
3236	9/10/2005	Hurricane Katrina	Evacuation Support	All

Source: Federal Emergency Management Agency, www.fema.gov

3.2 Profile of Hazards Affecting Crawford County

44 CFR Requirement 201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

3.2.1 Methodology

Each hazard that has been determined to be a potential risk to Crawford County is profiled individually in this section of the plan document. The information provided varies dependent upon the amount of data available to use in the profile and risk assessment process. As the plan is updated, and additional data becomes available, this information will be added to provide a more detailed picture of the hazards affecting Crawford County. This process will increase the county's ability to assess and prioritize hazards and mitigation strategies.

Each hazard profile includes:

- Description of the hazard
- Characteristics of the hazard
- History of how the hazard has affected the county—the frequency of damage in the past
- Information on the geographic location of hazards (if applicable)
- Seasonal pattern (if applicable)
- Speed of onset and existing warning systems (if applicable)
- Severity of past incidents, i.e. damages relative to that of other hazards
- Discussion of Probable Risk/Likelihood of Future Occurrence
- Discussion of likely adverse impact on the planning area—the estimated magnitude/severity of the hazard
- Recommendations

In order to maintain consistency and incorporate multiple factors into the ranking process, the hazards were prioritized based on a calculated priority risk index (CPRI) that takes into account four elements of risk: probability, magnitude/severity, warning time and duration. This process and the formula for weighting each element of risk were described in MitigationPlan.com™.

The probability of each profiled hazard is classified and quantified in the following manner:

- Highly likely: An event is probable within one year—a near 100 percent probability of occurring. (4)
- Likely: An event is probable within the next three years—a 33 percent probability of occurring. (3)
- Occasional: An event is probable within the next five years—a 20 percent probability of occurring. (2)
- Unlikely: An event is possible within the next 10 years—a 10 percent probability of occurring. (1)

The magnitude of each profiled hazard is classified and quantified in the following manner:

- Catastrophic – More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths. (4)
- Critical – 25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses resulting in permanent disability. (3)
- Limited – 10-24 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses do not result in permanent disability. (2)
- Negligible – Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid. (1)

The potential speed of onset was classified and quantified in the following manner:

- Less than six hours (4)
- Six to less than 12 hours (3)
- 12-24 hours (2)
- More than 24 hours (1)

The duration of the hazard was classified and quantified in the following manner:

- More than one week (4)
- Less than one week (3)
- Less than one day (2)
- Less than six hours (1)

After assigning a score to each of the risk elements listed above, a formula is used to determine the score for each hazard. The formula was developed by MitigationPlan.com™:

$$(\text{Probability} \times .45) + (\text{Magnitude/Severity} \times .30) + (\text{Warning Time} \times .15) + (\text{Duration} \times .10) = \text{CPRI}$$

Based on the CPRI scores, the hazards were then separated into three categories, as used in the Missouri Hazard Mitigation Plan. Based on the data available and the ranking process provided in the State of Missouri Hazard Mitigation Plan, the hazards adverse impact on the community are ranked based on High, Medium or Low: High (2.5-4.0) Moderate (2.0-2.5) and Low (1.1-1.9).

Data used to determine ranking included the hazard profile, HAZUS data and information gleaned from the State Hazard Mitigation Plan (2007) and Missouri Hazard Analysis (2008). Table 3.4 summarizes the results of the hazard profiles using this methodology.

Table 3.4 Crawford County Hazard Profile Summary

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Dam Failure – Bourbon, Leasburg, St. Cloud, Steelville, West Sullivan, all school districts	1	1	4	3	1.65	Low
Crawford County, Cuba and Sullivan	1	2	4	3	1.95	Low
Drought	1	1	1	4	1.3	Low
Earthquake	2	1	4	4	2.05	Moderate
Extreme Heat	4	1	1	3	2.55	High
Flood – Bourbon, Cuba, Leasburg, St. Cloud, Sullivan, West Sullivan, Bourbon R-I, Cuba R-II, Sullivan C-2	4	1	4	2	2.9	High
Steelville, Steelville R-III	4	1	4	3	3.0	High
Landslide	1	1	4	1	1.45	Low
Land Subsidence/ Sinkholes – Leasburg and						

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Steelville	1	2	4	3	1.95	Low
County, Bourbon, Cuba, Sullivan and West Sullivan	1	1	4	3	1.45	Low
Severe Storm (Hail storm/Wind storm)	4	1	4	1	3	High
Tornado	2	2	4	1	2.2	Moderate
Severe Winter Storm	4	1	1	3	2.55	High
Wildfire – County	4	1	4	2	2.9	High
Cities	3	1	4	2	2.45	Moderate
Schools	1	1	4	2	1.55	Low

Sources: Crawford County hazard mitigation planning committee, Missouri Hazard Mitigation Plan (2007), Missouri Hazard Analysis (2008)

Developing rankings for each hazard helps the county plan for and prioritize risks. Those hazards ranked as High risk should receive the most attention from preparedness and hazard mitigation planners. Hazard mitigation projects developed by the county should focus first on hazards ranked as High risk. These include extreme heat, flood, severe storm (hail/wind storm), severe winter storm and for the unincorporated areas of the county, wildfire.

3.2.2 Dam Failure

Description

Over the years dam failures have injured or killed thousands of people, and caused billions of dollars of property damage in the United States. Among the most catastrophic were the failures of the Teton Dam in Idaho in 1976, which killed 14 people and caused more than \$1 billion in damage, and the Kelly-Barnes Dam in Georgia which left 39 dead and \$30 million in property damage. In the past few years, there were over 200 documented dam failures nationwide, that caused four deaths and millions in property damage and repair costs.

The problem of unsafe dams in Missouri was underscored by dam failures at Lawrenceton in 1968, Washington County in 1975, Fredricktown in 1977, and a near failure in Franklin County in 1979. A severe rainstorm and flash flooding in October 1998 compromised about a dozen small, unregulated dams in the Kansas City area. But perhaps the most spectacular and widely publicized dam failure in recent years was the failure of the Taum Sauk Hydroelectric Power Plant Reservoir atop Proffitt Mountain in Reynolds County, Mo.

In the early morning hours of December 14, 2005, a combination of human and mechanical error in the pump station resulted in the reservoir being overfilled. The manmade dam around the reservoir failed and dumped over a billion gallons of water down the side of Proffitt Mountain, into and through Johnson's Shut-Ins State Park and into the East Fork of the Black River. The massive wall of water scoured a channel down the side of the mountain that was over 600 feet wide and 7,000 feet long that carried a mix of trees, rebar, concrete, boulders and sand downhill and into the park.ⁱ The deluge destroyed Johnson's Shut-Ins State Park facilities—including the

campground—and deposited sediment, boulders and debris into the park. The flood of debris diverted the East Fork of the Black River into an older channel and turned the river chocolate brown. Fortunately the breach occurred in mid-winter. Five people were injured when the park superintendent's home was swept away by the flood, but all were rescued and eventually recovered. Had it been summer, and the campground filled with park visitors, the death toll could have been very high.ⁱⁱ This catastrophe has focused the public's attention on the dangers of dam failures and the need to adequately monitor dams to protect the vulnerable.

Despite the significance of the immediate damage done by the Taum Sauk Reservoir dam failure, the incident also highlights the long-term environmental and economic impacts of an event of this magnitude. Four years later, the toll of the flooding and sediment on aquatic life in the park and Black River is still being investigated. Even after the removal of thousands of dump truck loads of debris and mud, the river is still being affected by several feet of sediment left in the park. The local economy, heavily reliant upon the tourism from the park and Black River, has also been hit hard.ⁱⁱⁱ

Overall, many of Missouri's smaller dams are becoming a greater hazard as they continue to age and deteriorate. While hundreds of them need to be rehabilitated, lack of available funding and often questions of ownership loom as obstacles difficult to overcome.^{iv}

Hazard Characteristics

A dam is defined by the National Dam Safety Act as an artificial barrier which impounds or diverts water and: (1) is more than six feet high and stores 50 acre feet or more, or (2) is 25 feet or more high and stores more than 15 acre feet. Based on this definition, there are over 80,000 dams in the United States. Over 95 percent are non-federal, with most being owned by state governments, municipalities, watershed districts, industries, lake associations, land developers, and private citizens. Dam owners have primary responsibility for the safe design, operation and maintenance of their dams. They also have responsibility for providing early warning of problems at the dam, for developing an effective emergency action plan, and for coordinating that plan with local officials. The State has ultimate responsibility for public safety, and many states regulate construction, modification, maintenance, and operation of dams, and also ensure a dam safety program. Dams can fail for many reasons. The most common are:

1. **Piping:** internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
2. **Erosion:** inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
3. **Structural Failure:** caused by an earthquake, slope instability or faulty construction.^v

Dam construction varies widely throughout the state. A majority of dams are of earthen construction. Missouri's mining industry has produced numerous tailing dams for the surface disposal of mine waste. These dams are made from mining material deposited in slurry form in an impoundment. Other types of earthen dams are reinforced with a core of concrete and/or asphalt. The largest dams in the state are built of reinforced concrete and are used for hydroelectric power.^{vi}

According to the Missouri State Hazard Mitigation Plan, as of July 2003, Missouri had 4,100 recorded dams. This is the largest number of manmade dams of any state, due mainly to the topography of the state that allows lakes to be built easily and inexpensively. Of these 4,100, only about 620 fall under state regulations, while another 85 dams are under federal control.

According to Stanford University's National Performance of Dams Program, there were 72 dam incidents in Missouri between 1975 and 2001. Of these 72 incidents, 16 were classified as dam failures.^{vii}

Missouri's Department of Natural Resources (MDNR) Water Resources Center maintains a Dam and Reservoir Safety Program. The objective is to ensure that dams are safely constructed, operated and maintained pursuant to Chapter 236 Revised Statutes of Missouri. Under that law, a dam must be 35 feet or higher to be state regulated. These dams are surveyed by state inspectors at least every five years. However, most Missouri dams are less than 35 feet high and so are not regulated. The state encourages dam owners to inspect unregulated dams, but the condition of these dams may be substandard.^{viii}

The hazard potential for dam failure is classified by the Interagency Committee on Dam Safety by the following three definitions:

- **Low Hazard Potential:** Failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
- **Significant Hazard Potential:** Failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities or other impacts. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- **High Hazard Potential:** Failure or mis-operation will probably cause loss of human life.

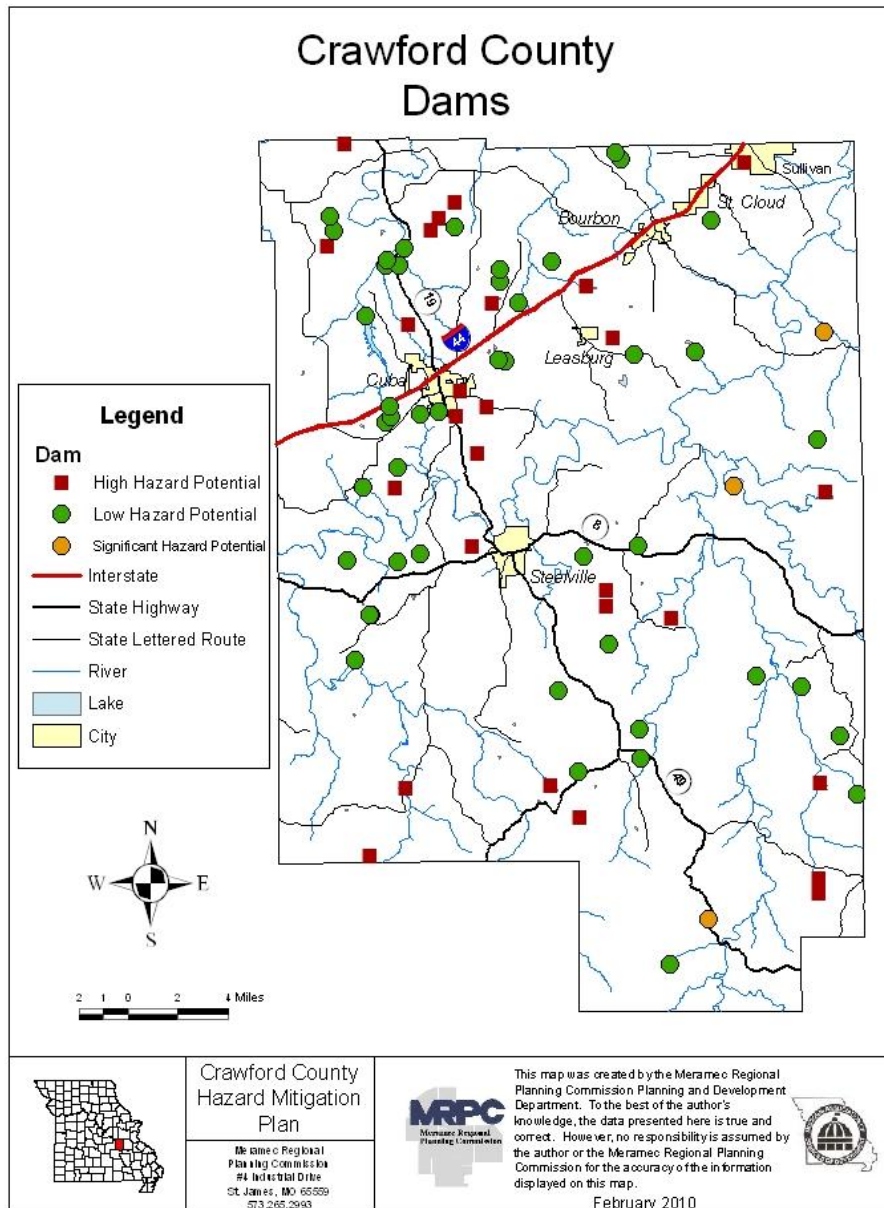
Likely Locations

According to the Missouri Spatial Data Information Services (MSDIS), based on information provide to MSDIS by the Missouri Department of Natural Resources, Water Resources Center (MDNR-WRC), there are 75 dams located in Crawford County. The majority are privately owned. Eleven of the 75 dams are greater than 34 feet in height and are regulated by the state. Of those eleven dams, six are rated as high risk dams – Keeven Dam, Geisz Lake Dam, Green Dam, Brummet Lake Dam, Haladale Dam and City Park Dam. There are a total of 26 high risk dams in Crawford County. Four of the dams are rated as significant hazards. The remaining are considered low risk. All of the dams registered by MDNR-WRC on the MSDIS website and their hazard rating are listed in Table 3.5. The non-regulated dams vary in height from 14 to 34 feet. Figure 3-2 is map of the dams in Crawford County that also categorizes the dams by hazard risk.

Table 3.5 shows a listing of dams in Crawford County, dam height, lake area and their hazard risk. There are four dams categorized as having significant risk – this means that a failure of the dam could result in significant property damage. There are twenty-six dams in the county that are categorized as high risk. This means that a failure of the dam could result in not only property losses but injuries and deaths. The remaining forty-five dams in the county are categorized as

low risk. This means that a failure of the dam would likely not result in significant property damage and no injuries or deaths. The majority of the lakes in Crawford County are small farm lakes and not a serious threat. Based on the locations of the dams in Crawford County, and in particular the high hazard dams, the jurisdictions most vulnerable to dam failure are the cities of

Figure 3-2



Sullivan and Cuba and Crawford County. The only affect any dam failures might cause any other jurisdictions, including school districts, would be possible damage to some roads and/or bridges that might result in adjustments made to travel or bus routes. In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county the county would benefit from collecting data on these issues to improve future planning efforts.

Table 3.5 Crawford County Dams Hazard Risk

Name of Dam	Dam Height (feet)	Lake Area (acres)	Hazard Risk
Alexander Lake Dam	25	3	Low
Asher Lake Dam	25	1	Low
Ballard Lake Sect. 14 Dam	30	28	High
Ballard Lake Sect. 13 Dam	25	6	Low
Barnett Lake Dam	35	7	Low
Big Lake Dam	34	7	High
Brummet Lake Dam	37	15	High
Budget Buster Dam	25	4	Low
Cardon Lake Dam	34	19	Low
Castanis Lake Dam	30	4	Low
Cattinari Lake Dam	31	14	Significant
City Park Lake Dam	53	6	High
Cobine's Folly Dam	25	3	High
Cuba Fish Farm Dam	30	12	Low
Dam Vera	25	3	Low
Durbin Lake Dam	25	4	High
Eickhoff Lake Dam	25	3	High
Elders Lake Dam	29	14	High
Field Lake Dam	25	5	High
Ford Lake Dam	25	8	Low
Forester Lake Dam	30	5	High
Fox Spring Lake Dam	28	4	Low
Frerichs Sect.-22 Lake Dam	30	15	Low
Frerichs Sect.-4 Lake Dam	20	8	High
Frumar Lake Dam	37	4	Low
Geisz Lake Dam	37	4	High
Gould Lake Dam	18	7	Low
Green Dam	51	13	High
Haas, R & Heck A. Dam	16	5	High
Haladale Dam	38	28	High
Hedrick Lake Dam	30	3	Low
Helmering Farms Dam	20	8	Low

Name of Dam	Dam Height (feet)	Lake Area (acres)	Hazard Risk
Holiday Lake Dam	24	11	High
Holifield Lake Dam	25	3	Low
Holmstrom N. Lake Dam	23	5	Low
Holmstrom S. Lake Dam	28	15	Low
Hubbman Lake Dam	25	6	Low
Indian Hills Lake Dam	50	355	Low
J. Bristow Lake Dam	30	5	High
Jellystone Park Dam	27	6	High
Keeney Lake Dam	15	12	Low
Keeven Dam	37.3	23	High
Kemp Lake Dam	22	18	High
Klontz Lake Dam	32	15	Low
Kozlowski Lake Dam	25	15	Significant
Krekeler Lake Dam	26	4	Low
Lerwick Lake Dam	32	5	Low
Matthews Lake Dam	25	6	Low
Mononame 133	15	7	Low
Mononame 352	26	9	Low
Mononame 410	14	10	Low
Mononame 717	25	32	Low
Mononame 718	19	4	Low
Mononame 845	20	15	Low
Mononame 846	25	18	Low
Mononame 852	20	12	Low
Mononame 860	20	10	Low
Neill Lake Dam	25	4	Low
Nolie Lake North Dam	29	12	Low
Nolie Lake South Dam	25	14	Low
Papin Lake Dam	33	8	High
Ploch Lake Dam	25	3	High
Possum Hollow Dam	39	60	Low
Ramstein lake Dam	20	8	Low
Reed Lake Dam	47	4.3	Significant
Reilly Lake Dam	32	4	Low
River Oaks Ranch Dam	32	4	Significant
Rutz Lake Dam	25	3	High
Seidl Lake Dam	25	3	Low
Skinner-Sorth-Koch-Kreider Lake Dam	30	8	Low
Smith Lake Dam	23	1	Low
Stubblefield Lake Dam	30	18	High
Sutter Lake Dam	32	9	High

Name of Dam	Dam Height (feet)	Lake Area (acres)	Hazard Risk
Thunder Valley Farm Dam	30	22	High
Weisel Lake Dam	25	3	Low

Source: Crawford County Emergency Operations Plan and Missouri Department of Natural Resources – website: http://www.dnr.mo.gov/env/wrc/damsft/Crystal_Reports^{ix}

An insufficiency exists in the data for dams in Crawford County. Although there are topographical and aerial photography maps available, no information on failed dam inundation areas exists. Topographic and aerial photographic maps were studied and compared to try to illustrate the likely areas that would be affected. However, until better data can be developed and confirmed, the information illustrated in Figures 3-3 through 3-5 should be considered a representation of potential impact areas. The county will continue to strive to improve the data on dam inundation. Twenty-six of the dams are classified by MDNR as high hazard dams. Those include Ballard Lake Section 14 Dam, Big Lake Dam, Brummet Lake Dam, City Park Lake Dam, Cobine’s Folly Dam, Durbin Lake Dam, Eickhoff Lake Dam, Elders Lake Dam, Field Lake Dam, Forester Lake Dam, Frerichs Section-4 Lake Dam, Geisz Lake Dam, Green Dam, Haas, R. & Heck, A. Dam, Haladale Dam, Holiday Lake Dam, J. Bristow Lake Dam, Jellystone Park Dam, Keeven Dam, Kemp Lake Dam, Papin Lake Dam, Ploch Lake Dam, Rutz Lake Dam, Stufflefield Lake Dam, Sutter Lake Dam and Thunder Valley Farm Dam. Many of these high hazard dams have structures or infrastructure located below the dam. The aerial maps included in Figure 3-3 through 3-5 better illustrate the impact areas should any of these dams fail and show the high hazard dams and the probable impact area should the dam fail. This impact area has been drawn in, based on analysis of topographic maps and aerial photos.

Two of the high hazard dams are located in or very near the City of Cuba. The Rutz Lake Dam is located on the east side of the city on the city limits boundary. Two commercial structures are located near the dam but outside the inundation zone. A failure of this dam might affect Hood Drive which provides access to Hood Park. Otherwise it appears that the affected area is a wooded, uninhabited portion of Hood Park. Directly “downstream” from Rutz Lake is Brummet Lake – which is dry. During heavy rainfall the lake may hold enough water long enough to pose a threat should the dam fail. If this occurred, the inundation zone might include a section of State Highway PP and Marisa Lane which provides access to three homes/farms. Two to three homes and associated outbuildings might also be affected if the Brummet Lake Dam failed at a time when the lake was holding water. Dubin Lake Dam lies just within the southern tip of the City of Cuba. The inundation zone for this dam appears to flow out of the city limits into a wooded area. A dam failure at this location would likely affect a major power line right-of-way and possibly a home and associated outbuildings located east of the dam. Shady Oak Lane, which provides access to approximately two to four homes might also be affected by a failure of Durbin Lake Dam. Elders Lake Dam is located south of Cuba and just east of Highway 19. Like Brummet Lake, Elders Lake is generally dry or holds very little water. Failure of this dam would have little or no impact on any homes or businesses. In regards to infrastructure, it might cause damage to an abandoned rail line that runs parallel to the inundation area and likely would damage an access road that crosses the dam itself. Papin Lake Dam lies approximately three and one half miles southwest of Cuba in a rural area. Were it to fail, it would damage an electric power line that runs immediately below the dam as well as a private drive that provides access to at least

two properties. The inundation zone remains in uninhabited areas and would affect forests and pasture lands but no structures. These dams and potential impact areas are shown in Figure 3-2.

Jellystone Park Dam is located northeast of Cuba and west of State Highway UU. It is part of a commercial campground and recreation area. No portions of the campground are in the inundation zone for this dam. Should the dam fail, water would flow into two other lakes that lie immediately below the dam. If these dams failed or overflowed, the water would have to travel approximately a mile before reaching a farm located in the potential inundation zone. It would also likely affect Road Runner Lane, which provides access to two homes. Sutter Lake Dam is located just west of Highway 19, approximately 1 mile north of Cuba's northern border. The inundation zone for this dam includes only forest, cultivated land and pasture. Evans Road lies approximately two miles downstream from the dam and could be impacted if the dam failed. These dams and potential impact areas are shown in Figure 3-3.

Frerich's Section 4 Lake Dam is located northwest of Cuba and west of Highway 19. This dam is located in a rural area. Should it fail, the water would flow through forest land, possibly damage Spurgeon Road and flow into Frerich's Lake Section 22. If this caused the Lake Section 22 Dam to fail or overflow, water could travel 1.3 miles through forest and pasture before it reached Four Mile Road and High Point Road where it might cause damage. No structures lie within the inundation zone. Eickhoff Lake Dam is located north of Cuba, east of Highway 19 and just north of Bailey Road. If the dam failed, it would flood forested area. The closest structures are a home and outbuilding located three quarters of a mile away and these appear to be elevated above the inundation zone. Stubblefield Lake Dam is located less than half a mile northeast of Eickhoff Lake Dam. Taylor Road lies less than 200 yards below Stubblefield Lake Dam and would certainly be damaged should a failure occur. In addition, a large barn lies immediately below the dam, as well as a home and outbuildings along Taylor Road. An electric power line and Oak Hill Road might also be affected should a dam failure occur. Forrester Lake is located on the northern border of Crawford County, approximately 1.2 miles west of Highway 19 and just south of County Road 625/Foster Road. If the dam should fail, it would flood pasture and woodlands to the east of the lake. It might affect Ward Road and/or County Road 625. No structures or homes lie within the estimated inundation zone. These dams and potential impact areas are shown in Figure 3-3.

City Park Lake is located on the southern border of the City of Sullivan. Should this dam fail, it would cause damage to an unoccupied, wooded area. Approximately 1.25 miles downhill from the dam lies two homes and Thatcher Road. It is doubtful that there would be a significant impact on this area this far from the dam but it is possible. Kemp Lake Dam lies 1.63 miles southwest of Bourbon, east of Grotemac Lake Road and north of McWilliams Road. The dam is seven tenths of a mile from Interstate 44. Should this dam fail, there is a farm within one quarter mile of the dam whose structures could be damaged, and an additional home and outbuildings and commercial structure on the south outer road of I-44 that could be vulnerable. The drainage stream that would carry the majority of the water flows under both the north and south outer roads and I-44. These areas could also sustain damage depending on the volume of water flow. Should a failure occur, the highway would likely act somewhat like a dam. Grotemac Road lies two tenths of a mile from the dam and would likely sustain damage. Haladale Dam is located approximately one half mile east of Leasburg and approximately one quarter mile north of Old

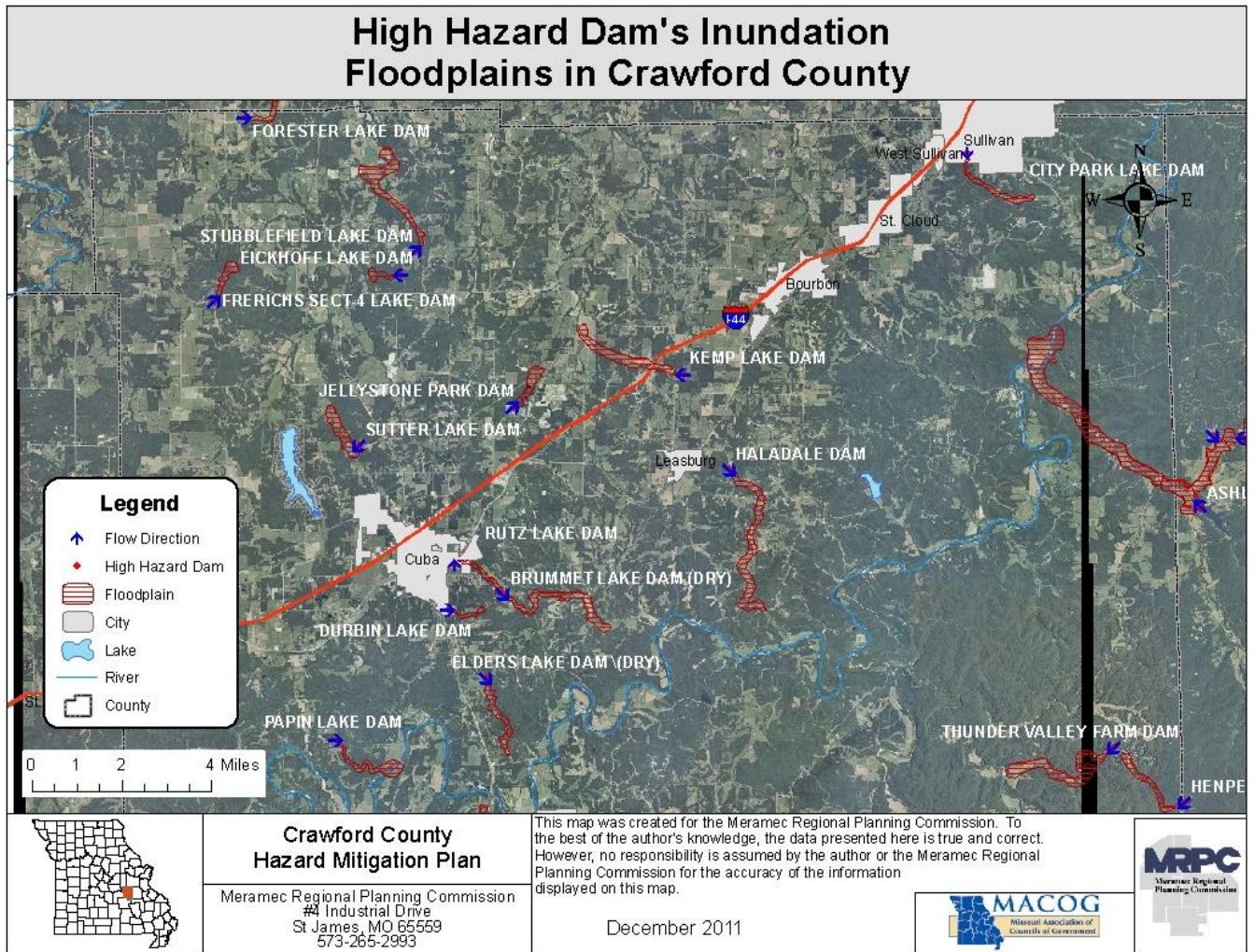
Leasburg Road. Several structures are at risk from dam failure at this location. A farm and a number of outbuildings are located within 100 yards below the dam and could be at risk. Another home and outbuildings are located within half a mile just south of Old Leasburg Road which would likely be damaged. Another two tenths of a mile below Old Leasburg Road, another home and outbuildings could be impacted by dam failure at this site. State Highway H is located six tenths of a mile southeast of Haladale Dam, along with four more homes and associated outbuildings, all of which could be impacted by a failure of this dam. These dams and potential impact areas are shown in Figure 3-3.

Thunder Valley Farm Dam is located on the eastern side of Crawford County, 1.25 miles from the Washington County line and approximately five and one half miles north of Berryman. There is a farm and associated outbuildings located approximately one half mile below the dam in the potential inundation zone. Following the contours of the land for approximately one and one half miles, additional homes, outbuildings and Echo Valley Lake could be impacted by a failure of Thunder Valley Farm Dam. These dams and potential impact areas are shown in Figure 3-3.

Two dams located in Washington County have the potential to affect areas of Crawford County – Ashley Branch Dam and Henpeck Hollow Dam. Henpeck Hollow Dam is located approximately one and one half miles southeast of Thunder Valley Farm Dam, just over the border with Washington County. The inundation zone for this dam is mainly in Crawford County and runs approximately two miles through uninhabited forest and pasture lands until reaching Thunder Valley Farm Lake. Ashley Branch Dam lies just south of State Highway N and east of State Highway W, on the east side of Washington County. On the Crawford County side of the county boundary, State Highway N would likely be affected. At least one home and a number of farm buildings lie approximately one mile east of the dam within the potential inundation zone. These dams and potential impact areas are shown in Figure 3-3.

J. Bristow Lake Dam is located three quarters of a mile east of Steelville, between Highways 19 and 8. The potential inundation zone runs for over three quarters of mile before encountering an outbuilding which would likely not be impacted due to the broad valley between it and the dam. Big Lake Dam is located southeast of Steelville approximately one mile west of State Road BB. Field Lake Dam is located approximately six tenths of a mile due south of Big Lake Dam. The inundation zones for both dams intersect at State highway BB so that roadway might sustain damage if a dam failure occurred, although it is a mile from both dam sites. There are two homes and associated outbuildings located in the Big Lake Dam inundation zone west of Highway BB and one home just east of Highway BB. The closest home is three quarters of a mile from the dam. There is one farm structure located within the inundation zone for Field Lake Dam west of Highway BB. Cobine's Folly Dam is located four and one half miles east of Highway 19 and two and one half miles south of Highway 8 in east central Crawford County. It is located in a wooded area one half mile north of State Highway BB. If this dam failed it would likely damage Kobunkel Road, which lies immediately below the dam, as well as a home and associated farm buildings which are located two tenths of a mile below the dam in the potential inundation zone. These dams and potential impact areas are shown in Figure 3-4.

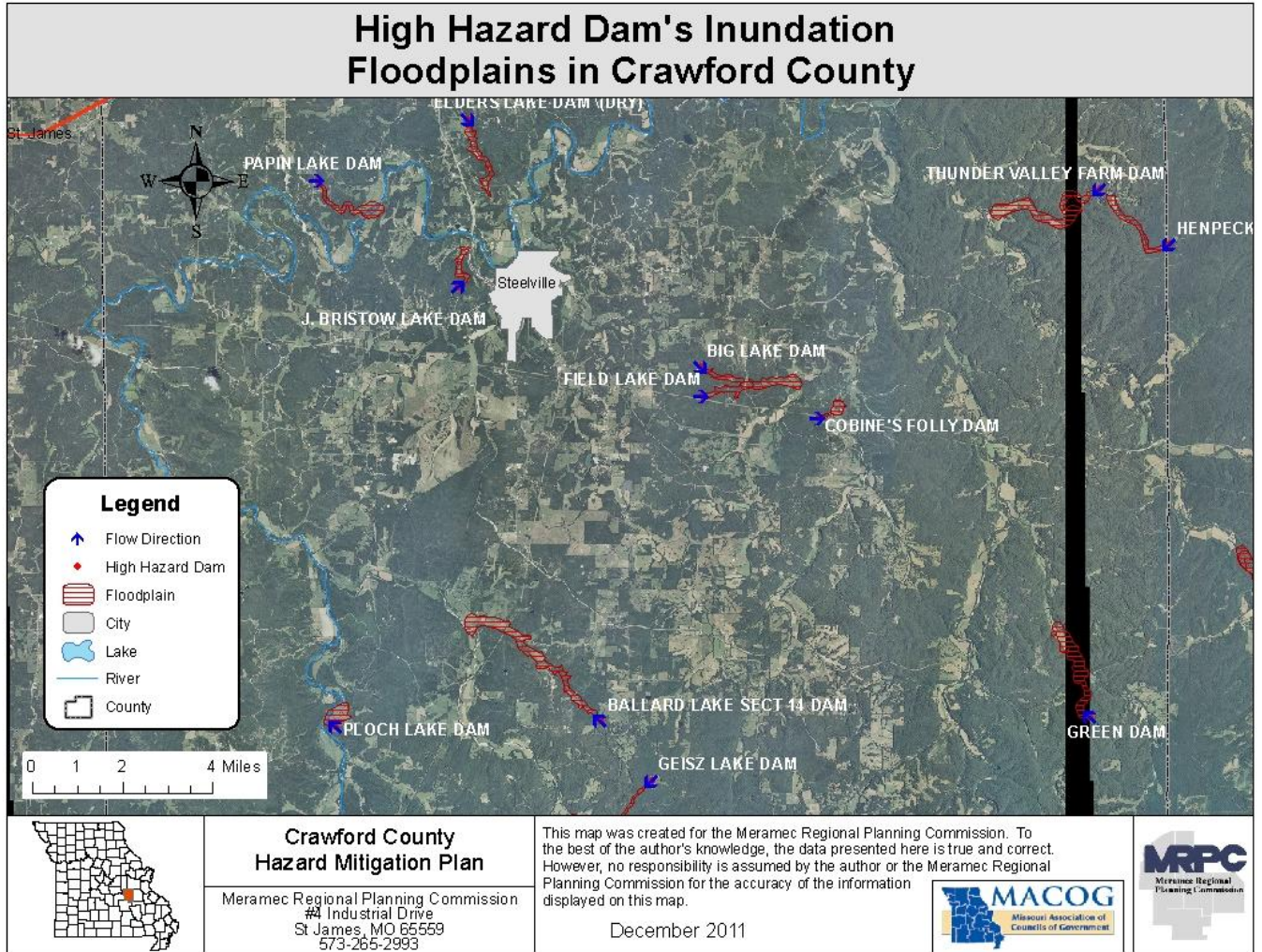
Figure 3-3



Keevan Dam is located in the southeast portion of Crawford County, just 300 yards north of the Dent County line and one half mile west of Cook Station Road. There are some farm outbuildings located just east of Cook Station Road that would likely be affected if the dam failed. Otherwise the affected areas would be limited to forest and cultivated bottomlands. Ploch Lake Dam is located approximately three miles northeast of Keevan Dam, east of State Highway M. If Ploch Lake Dam were to fail it would likely affect State Highway M as this roadway lies less than 200 yards below the dam. There are no other structures that would be affected by a dam failure at this site. Ballard Lake Section 14 Dam is located one quarter mile west of Highway 19, approximately three miles southwest of Cherryville. There is a barn approximately three quarters of a mile downstream from the dam that might be affected by a dam failure. The next structures are more than a mile and a half down the drainage area and would likely not be affected. Geisz Lake Dam is located one and one half miles southeast of Ballard Lake Section 14 Dam and approximately one mile east of Highway 19. County road 805 is less than one half mile from the dam and might sustain damage should the dam fail. The closest structures located in the potential

inundation zone are almost two miles downstream from the dam and not likely to be affected. These dams and potential impact areas are shown in Figure 3-5.

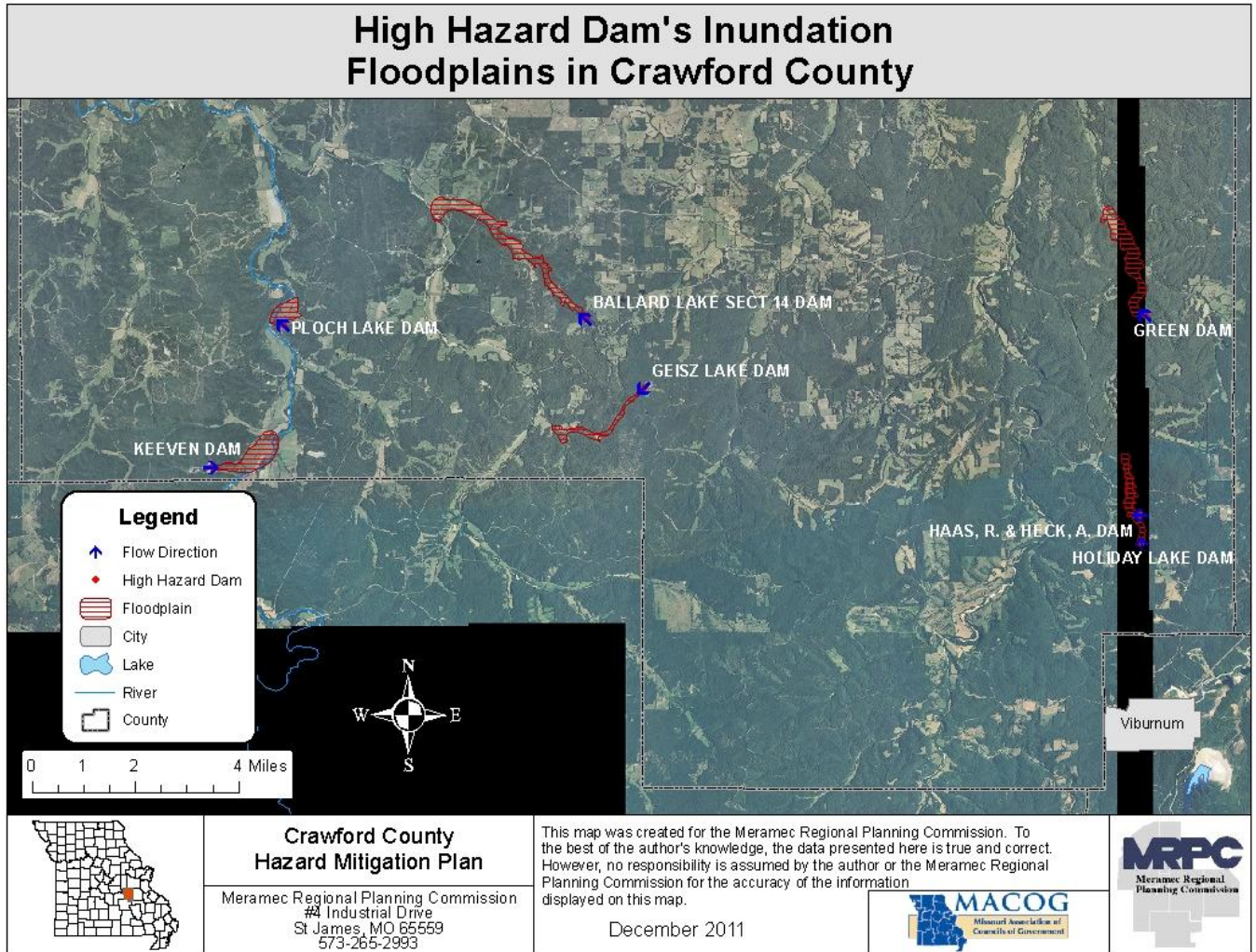
Figure 3-4



Holiday Lake Dam is located in the southeast corner of the county and is part of a commercial campground and recreation area located on Arlie Barr Road. Should Holiday Lake Dam fail, it could affect two homes that lie approximately 100 yards below the dam, as well as three lagoons located below the dam. Arlie Barr road would likely sustain damage and would affect access to several homes located along it. Haas, R. & Heck, A. Dam is located one half mile north of Holiday Lake Dam and shares the same drainage basin. If it failed, it too would likely damage Arlie Barr Road. There is a home and outbuildings located approximately one half mile down the inundation zone that might be affected. State Highway V lies .65 miles below the dam. Green Lake Dam is located due north of these two dams approximately four miles, one and one half miles from the Washington County line and eight miles from Cherryville. There is a farm and associated structures located 250 yards below the dam that would like be damaged should the dam fail, as well as County Road 713 which is located just beyond the farm structures. There is

another home located .3 miles down County Road 713 that is located in the potential inundation zone for this dam. These dams and potential impact areas are shown in Figure 3-5.

Figure 3-5



The majority of the dams located in Gasconade County are on small farm lakes and not a serious threat. However, some of the high hazard dams are on larger lakes. The high hazard dams that serve lakes of 25 acres of surface area or more include: Ballard Lake Section 14 Dam – 28 acres; and Haladale Dam – 28 acres.

Based on the locations of the dams in Crawford County, and in particular the high hazard dams, the jurisdictions most vulnerable to dam failure are the cities of Cuba and Sullivan and Crawford County. The only affect any dam failures might cause any other jurisdictions, including school districts, would be possible damage to some roads and/or bridges that might result in adjustments made to travel or bus routes. In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly

uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Type of Damage

Dam failure leads to the cascading emergency of flash flooding. When a dam fails, the pent-up water can be suddenly unleashed and have catastrophic effects on life and property downstream. Homes, bridges and roads can be demolished in minutes. There have been at least 27 recorded dam failures in 20 Missouri counties in the last 100 years. Fortunately, only one drowning has been associated with a dam failure in the state^x, and until the Taum Sauk Reservoir dam failure, there had previously been little consequence to property. The Taum Sauk Reservoir breach destroyed a state park and cost millions to remediate.

Hazard Event History

Out of 75 dams, 26 are rated as High risk and four are rated as Significant risk. While dam failure is a disaster that has never occurred in Crawford County or any of its jurisdictions, there are two high hazard rated dams within the City of Cuba and one in the City of Sullivan, that might cause property damage if they failed. There are an additional twelve high hazard dams located within or just outside of the county with the potential to cause property losses if they are not properly maintained. Most of these dams also have the potential to damage roadways and other public infrastructure such as power lines.

Statement of Severity/Magnitude

For the cities of Cuba and Sullivan and portions of Crawford County – Limited (2) – 10-24 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses do not result in permanent disability. Because there are two high hazard dams located within the city limits of Cuba and one high hazard dam located in Sullivan and a failure could result in damage to homes and businesses, we have given the cities of Cuba and Sullivan, as well as the county, a higher rating than the rest of the jurisdictions. Roads, bridges and homes could be demolished if a catastrophic dam failure occurred.

For the cities of Bourbon, Leasburg, St. Cloud, West Sullivan and Steelville, and the Crawford County R-I, Crawford County R-II, Steelville R-III and Sullivan C-2 school districts - Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. None of these jurisdictions have critical facilities that would be affected by a failure of any of the high hazard dams in the county.

Statement of Probable Likelihood of Future Occurrence

Unlikely (1) – Event is possible within the next 10 years; event has up to one in 10 years chance of occurring; history of events is less than or equal to 10 percent likely per year. As there have been no catastrophic dam failures in Crawford County, the probability of dam failure is unlikely in the foreseeable future.

Warning Time and Duration

The speed with which a dam may fail depends mainly upon the cause of the failure. A dam may fail in a matter of a few minutes or the process may take days, weeks or months. Because of this warning time can vary radically from incident to incident. If there is a catastrophic failure of a large dam, there could be very little or no warning for people living in the impact area. Based on history, warning time is typically less than six hours. The duration of the event will depend on how quickly and completely the dam fails and the volume of water being held back by the dam. Generally the duration will be less than one week.

Probable warning time of six hours or less (4). Duration of less than a week (3).

Statement of Next Disaster’s Likely Adverse Impact on the Community

Due to the locations of dams in Crawford County, a dam failure would have little impact on the daily operations of the community. Families living near the dam may experience washed out roadways or possibly even a demolished home. Although the Taum Sauk Reservoir incident had a great impact on the local economy of that area, there are no dams in Crawford County that are economically significant enough to have a similarly adverse economic impact. Indian Hills Lake, the largest lake in Crawford County, is the centerpiece of a large subdivision. Failure of this dam could result in significant economic problems for residents of the subdivision as home values are tied to the lake.

Recommendation

Encourage land use management practices to decrease the potential for damage from a dam collapse, including discouragement of development in areas with the potential for sustaining damage from a dam failure. Install public education programs to inform the public of dam safety measures and preparedness activities. Offer training programs for dam owners to encourage them to inspect their dams and so that they may learn how to develop and exercise emergency action plans.

Hazard Summary – Dam Failure – Cities of Cuba and Sullivan, Crawford County

Calculated Priority Risk Index	Planning Priority
1.95	Low

Hazard Summary – Dam Failure – Cities of Bourbon, Leasburg, St. Cloud, Steelville, West Sullivan, Crawford County R-I, Crawford County R-II, Steelville R-III and Sullivan C-2 School Districts

Calculated Priority Risk Index	Planning Priority
1.65	Low

3.2.3 Drought

Description

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary aberration; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate.

Drought is an insidious hazard of nature. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as “normal”. It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity.

Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected resulting from natural climatic variability) and the demand people place on water supply. Human beings often exacerbate the impact of drought. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this “natural” hazard.^{xi}

Hazard Characteristics

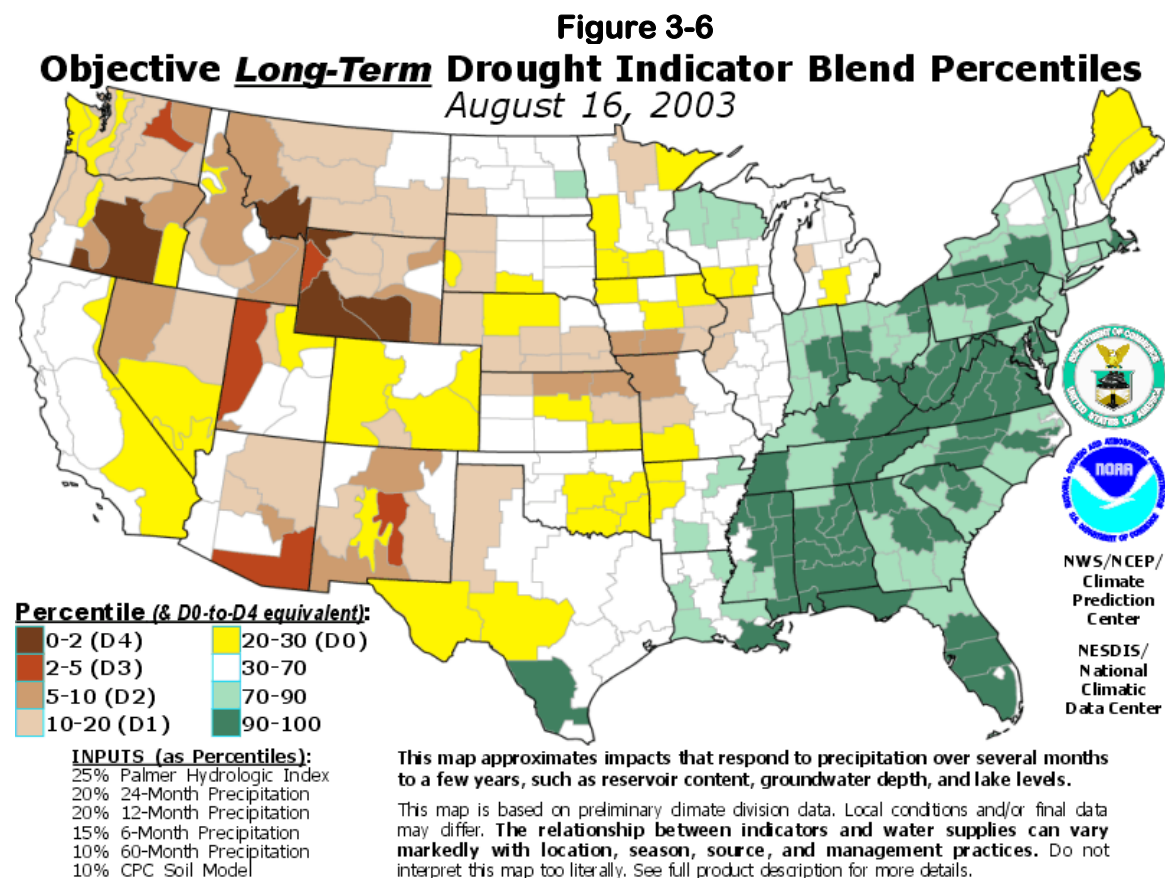
Drought is not limited to a hazard that affects just farmers, but can extend to encompass the nation’s whole economy. Its impact can adversely affect a small town’s water supply, the corner grocery store, commodity markets and a big city’s tourism. On average, drought costs the U.S. economy about \$7 billion to \$9 billion a year, according to the National Drought Mitigation Center. The dictionary definition of drought is a period of prolonged dryness. Current drought literature commonly distinguishes between three “categories” of drought, all of which define drought in simplified terms:

1. **Agricultural Drought**, defined by soil moisture deficiencies.
2. **Hydrological Drought**, defined by declining surface and groundwater supplies, and
3. **Meteorological Drought**, defined by precipitation deficiencies.

Each of these definitions relates the occurrence of drought to water shortfall in some component of the hydrological cycle. Each affects patterns of water and land use, and each refers to a repetitive climatic condition. In urban areas, drought can affect those communities dependent on reservoirs for their water, as decreased water levels due to insufficient rain can lead to the restriction of water use. In agricultural areas, drought during the planting and growing season can have a significant impact on yield. To take the definition of drought even further, the U.S.

Government definition of an agricultural drought incorporates specific parameters based upon historical records. Agricultural drought is "a combination of temperature and precipitation over a period of several months leading to a substantial reduction in yield (bushels per acre) of one or more of the three major food grains (wheat, soybean, corn). A substantial reduction is defined as a yield (bushels per acre) less than 90 percent of the yield expected with temperature/precipitation equal to long term average values."

Figure 3-6 shows the areas of the United States that are most susceptible to long-term drought conditions and the percentage of precipitation related to drought conditions.



Regardless of the specific definition, droughts are difficult to predict or forecast both as to when they will occur, and how long they will last. According to Dr. Grant Darkow, Department of Atmospheric Science, University of Missouri-Columbia, there is a recognizable "upper air flow pattern and simultaneous surface pattern associated with abnormal dryness over Missouri." When the upper airflow pattern is typified by air flowing in a broad arc over the central plains with higher speeds in southern Canada than over the U.S., then the air over the southern plains will be "characterized by a weak clockwise circulation." "Storm systems coming off the Pacific Ocean" will cross the extreme northwestern states and southern Canada, thus bypassing the Midwestern states. When this flow pattern persists, the result can be a prolonged period of drought.^{xii}

Likely Locations

All areas and jurisdictions in Crawford County are susceptible to drought, but particularly cities where thousands of residents are served by the same source of water. These cities use deep hard rock wells that are 1,100 to 1,800 feet deep and can experience drought when recharge of these wells is low. However, rural residences with individual wells will likely also be affected.

Type of Damage

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services.

Impacts are commonly referred to as direct or indirect. Reduced crop, rangeland and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of direct impacts. The consequences of these impacts illustrate indirect impacts. For example, a reduction in crop, rangeland, and forest productivity may result in reduced income for farmers and agribusiness, increased prices for food and timber, unemployment, reduced tax revenues because of reduced expenditures, increased crime, foreclosures on bank loans to farmers and businesses, migration, and disaster relief programs. Direct or primary impacts are usually biophysical. Conceptually speaking, the more removed the impact from the cause, the more complex the link to the cause. In fact, the web of impacts becomes so diffuse that it is very difficult to come up with financial estimates of damages. The impacts of drought can be categorized as economic, environmental, or social.

Not all impacts of drought are negative. Some agricultural producers outside the drought area or with surpluses benefit from higher prices, as do businesses that provide water-related services or alternatives to water-dependent services; these types of businesses were among the “winners” in the 1987–89 U.S. drought.

Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and diseases to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk.

Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected. Reduced income for farmers has a ripple effect. Retailers and others who provide goods and services to farmers face reduced business. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue for local, state, and federal government. Less discretionary income affects the recreation and tourism industries. Prices for food, energy, and other products increase as supplies are reduced. In some cases, local shortages of certain goods result in the need to import these goods from outside the stricken region. Reduced water supply impairs the navigability of rivers and results in increased transportation costs because products must be transported by rail or truck.

Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

Social impacts mainly involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief. Many of the impacts specified as economic and environmental have social components as well. Population out-migration is a significant problem in many countries, often stimulated by greater availability of food and water elsewhere. Migration is usually to urban areas within the stressed area or to regions outside the drought area; migration may even be to adjacent countries, creating refugee problems. However, when the drought has abated, these persons seldom return home, depriving rural areas of valuable human resources necessary for economic development. For the urban area to which they have immigrated, they place ever-increasing pressure on the social infrastructure, possibly leading to greater poverty and social unrest.^{xiii}

Hazard History

Missouri's average annual rainfall ranges from about 34 inches in the northwest to about 48 inches in the southeast. Even the driest areas of Missouri have enviable rainfall, compared to most western states. But lack of rainfall impacts certain parts of the state more than others because of alternate sources and usage patterns. Most of the southern portions of Missouri are less susceptible to problems caused by prolonged periods of non-rain, since there are abundant groundwater resources. Even with decreased stream flow or lowered reservoir levels, groundwater is still a viable resource in southern Missouri. Row-crop farming is not extensive and therefore agricultural needs aren't as great as in other parts of the state. The only exception is in the southwestern and southeastern areas where irrigation is used.^{xiv}

According to the National Climatic Data Center and the Missouri Department of Natural Resources, there have been five drought events reported for Crawford County. The first three separately reported events were actually all related and occurred between 1999 and 2000. The second two – February 2006 and October 2007 were much milder and were also related.

Drought of 1999-2000. Most of Missouri was in a drought condition during the last half of 1999, along with other states in the Midwest and the nation. The dryness did not begin to evolve until July 1999, but rapidly developed into a widespread drought by September. At that time, Missouri was placed under a Phase I Drought Advisory level by the Department of Natural Resources (DNR), and Governor Carnahan declared an Agricultural Emergency for the entire State. Agricultural reporting showed a 50 percent crop loss from the drought in 50 counties, with severe damage to pastures for livestock, corn crops, and Missouri's top cash crop—soybean. On

Oct. 13, 1999, U.S. Agriculture Secretary Dan Glickman declared all Missouri counties agricultural disaster areas, making low-interest loans available to farmers in Missouri and contiguous states. The drought intensity increased through autumn and peaked at the end of November 1999. In fact, the five-month span between July and November became the second driest July-November period in Missouri since 1895, averaging only 9.38 inches of rain.

A wetter than normal winter diminished dry conditions in central and southern Missouri, but long-term moisture deficits continued to exist. At the same time, the remainder of the state (roughly north of the Missouri River) continued under drought conditions. Overall dry conditions returned through much of the state in March 2000, and costly wildfires and brush fires (70) erupted in many counties. By May, the entire state was under a Phase II Drought Alert level, and on May 23, 2000, then Gov. Mel Carnahan announced activation of the Missouri Drought Assessment Committee (DAC), made up of state and federal agencies and chaired by the director of the Missouri Department of Natural Resources. At a May 25th meeting, the DAC selected a subcommittee (guided by the Missouri Drought Response Plan) to determine the drought status of each county. Based on observations across the state and projections of future rainfall, the committee in June upgraded the drought status for 27 northern Missouri counties to Phase III, Conservation. This was based on concerns for water supplies and agricultural impacts. The City of Milan in Sullivan County was among the most severely affected for water supplies. In June, a total of 80 Missouri counties remained under the Phase II alert level, while seven counties in Southeast Missouri (Butler, Dunklin, Mississippi, New Madrid, Pemiscot, Scott and Stoddard) remained under Phase I advisory conditions.

By mid-July 2000, some areas of northern Missouri benefited from additional rainfall, while drier conditions prevailed in other areas. At its July 12, 2000 meeting, the DAC revised its assessment, placing 30 counties under Phase III Conservation, including Crawford County and nine other counties in the south central area. The remaining 84 counties in the state were all under Phase II, Drought Alert. This included seven counties in northern Missouri downgraded from Phase III Conservation, and seven counties in Southeast Missouri previously assessed as Phase I, Advisory. To ease the agricultural impact of the drought during the summer months, Gov. Carnahan gained release of over 1 million acres from the Conservation Reserve Program (CRP) to allow farmers and ranchers in 21 counties an additional source to cut hay for livestock feed. Also, livestock producers in 16 counties were released from CRP contracts to allow cattle grazing on certain idle lands.^{xv} Total crop damages from the 1999-2000 drought were estimated at \$660,000 for the entire state.^{xvi}

The event of 2006-2007 was far milder, with a drought alert being issued during February 2006 and again in October 2007, but no significant damage occurred. Other than the more severe circumstances of 1999-2000, drought has historically not been a hazard in Crawford County. Large amounts of groundwater resources make this region of the state less susceptible to drought conditions, however prolonged lack of rainfall could result in a more serious drought event.

Seasonal Pattern

Drought can be caused by both lack of rain during the spring, summer and fall and lack of snow during the winter months because both are necessary for the recharging of groundwater sources. The driest months are typically January and February.

Speed of Onset and Existing Warning Systems

Drought is a hazard that evolves slowly and may not cause danger for months or years. Warning systems are important to drought conditions as city and county officials must inform residents of water conservation efforts or provide other information about the drought emergency.

Warning Time and Duration

A drought evolves slowly and can last for months or even years. Probable warning time of more than 24 hours (1). Duration of more than one week (4).

Statement of Severity/Magnitude

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. Because of its geographical location and characteristic weather patterns, Missouri is vulnerable to drought conditions. According to the Missouri State Hazard Mitigation Plan, in regards to drought susceptibility, Crawford County is located in Region B which is considered moderately susceptible to drought. Groundwater resources are adequate to meet domestic and municipal water needs and the topography is generally unsuitable for row-crop irrigation. Based on historical information, future drought events in Crawford County will most likely have a negligible effect on residents.

Statement of Probable Risk/Likelihood of Future Occurrence

Unlikely (1) – Event is possible within the next 10 years; event has up to one in 10 years chance of occurring; history of events is less than or equal to 10 percent likely per year. In the past decade, Missouri has experienced drought conditions that have affected a large portion of the state. Future occurrence of mild drought in Crawford County is likely but severe drought is very unlikely.

Statement of Next Disaster’s Likely Adverse Impact on the Community

The next drought to affect Crawford County will likely have no or little impact on the daily activities of Crawford County residents and businesses. If a major drought should occur, farmers may suffer low crop yields.

Recommendation

All cities and the county commission should adopt water conservation ordinances that limit the amount of water that residents may use during a period of drought. The county and its sectors should develop water monitoring plans as an early warning system. Each sector should inventory and review their reservoir operation plans. A water conservation awareness program should be presented to the public either through pamphlets, workshops or a drought information center. Voluntary water conservation should be encouraged to the public. The county and its jurisdictions should continually look for and fund water system improvements, new systems and new wells.

Hazard Summary – Drought – All Jurisdictions in Crawford County

Calculated Priority Risk Index	Planning Priority
1.3	Low

3.2.4 Earthquake

Description

Earthquakes can be defined as shifts in the earth's crust causing the surface to become unstable. This instability can manifest itself in intensity from slight tremors to large shocks. The duration can be from a few seconds up to five minutes. The period of tremors (and shocks) can last up to several months. The larger shocks can cause ground failure, landslides, liquefaction, uplifts and sand blows.

The earth's crust is made up of gigantic plates, commonly referred to as tectonic plates. These plates form what is known as lithosphere and vary in thickness from 6 1/2 miles (beneath oceans) to 40 miles (beneath mountain ranges) with an average thickness of 20 miles. These plates "float" over a partly melted layer of crust called the asthenosphere. The plates are in motion and where a plate joins another, they form boundaries. Where the plates are moving toward each other is called convergent plate boundary and when they are moving away from each other is called a divergent plate boundary. The San Andreas Fault in California is a horizontal motion boundary, where the Pacific plate is moving north while the North American plate is moving west. These movements release built up energy in the form of earthquakes, tremors and vulcanism (volcanoes). Fault lines such as the San Andreas come all the way to the surface and can be readily seen and identified. There are fault lines that do not come all the way to the surface, yet they can store and release energy when they adjust. Many of the faults in the Central United States can be characterized this way.

The subterranean faults were formed many millions of years ago on or near the surface of the earth. Subsequent to that time, these ancient faults subsided, while the areas adjacent were pushed up. As this fault zone (also known as a rift) lowered, sediments then filled in the lower areas. Under pressure, they hardened into limestones, sandstones, and shales - thus burying the rifts. With the pressures on the North Atlantic ridge affecting the eastern side of the North American plate and the movements along the San Andreas Fault by the Pacific plate, this pressure has reactivated the buried rift(s) in the Mississippi embayment. This particular rift system is now called the Reelfoot Rift.

There are eight earthquake source zones in the Central United States, two of which are located within the state of Missouri—the New Madrid Fault and the Nemaha Uplift. Other zones, because of their close proximity, also affect Missourians. These are the Wabash Valley Fault, Illinois Basin, and the Nemaha Uplift. The most active zone is the New Madrid Fault, which runs from Northern Arkansas through Southeast Missouri and Western Tennessee and Kentucky to the Illinois side of the Ohio River Valley.

The Nemaha Uplift is of concern to Missourians because it runs parallel to the Missouri/Kansas border from Lincoln, NE to Oklahoma City, OK. Its earthquakes are not as severe as the historic New Madrid fault zone, but there have been several earthquakes that have affected the Missouri side of the line.^{xvii}

Type of Damage

Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.^{xviii}

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place. After the occurrence of widely-felt earthquakes, the Geological Survey mails questionnaires to postmasters in the disturbed area requesting the information so that intensity values can be assigned. The results of this postal canvass and information furnished by other sources are used to assign an intensity within the felt area. The maximum observed intensity generally occurs near the epicenter.

The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above. The following Table 3.6 is an abbreviated description of the Modified Mercalli Scale.

Large earthquakes in Missouri could trigger additional hazards such as soil liquefaction, lateral spreading, landslides and sinkhole collapse – specifically in the karst topography present in much of southeast Missouri. Liquefaction is a site soil response to strong earthquake ground motion. Strong earthquake waves cause water pressure to increase within sandy soils, forcing sand grains apart, and the material will behave as a dense liquid. Sandblows form in the areas where liquefied sand is overlain by heavier clay rich silts, causing a geyser-like eruption of sand onto the land surface. Liquefaction causes land to lose its load-bearing capacity, which can lead to differential settlement and associated building foundation failures. Lateral spreading can occur on even gentle slopes and seriously damage buried utilities and road networks. Landslides could be triggered in steep slopes and road cuts through unstable geologic materials, potentially damaging and closing roads and railroads. Earthquakes could exacerbate existing problems and cause landslides where none have occurred before.^{xix}

Table 3.6 Modified Mercalli Intensity (MMI) Scale

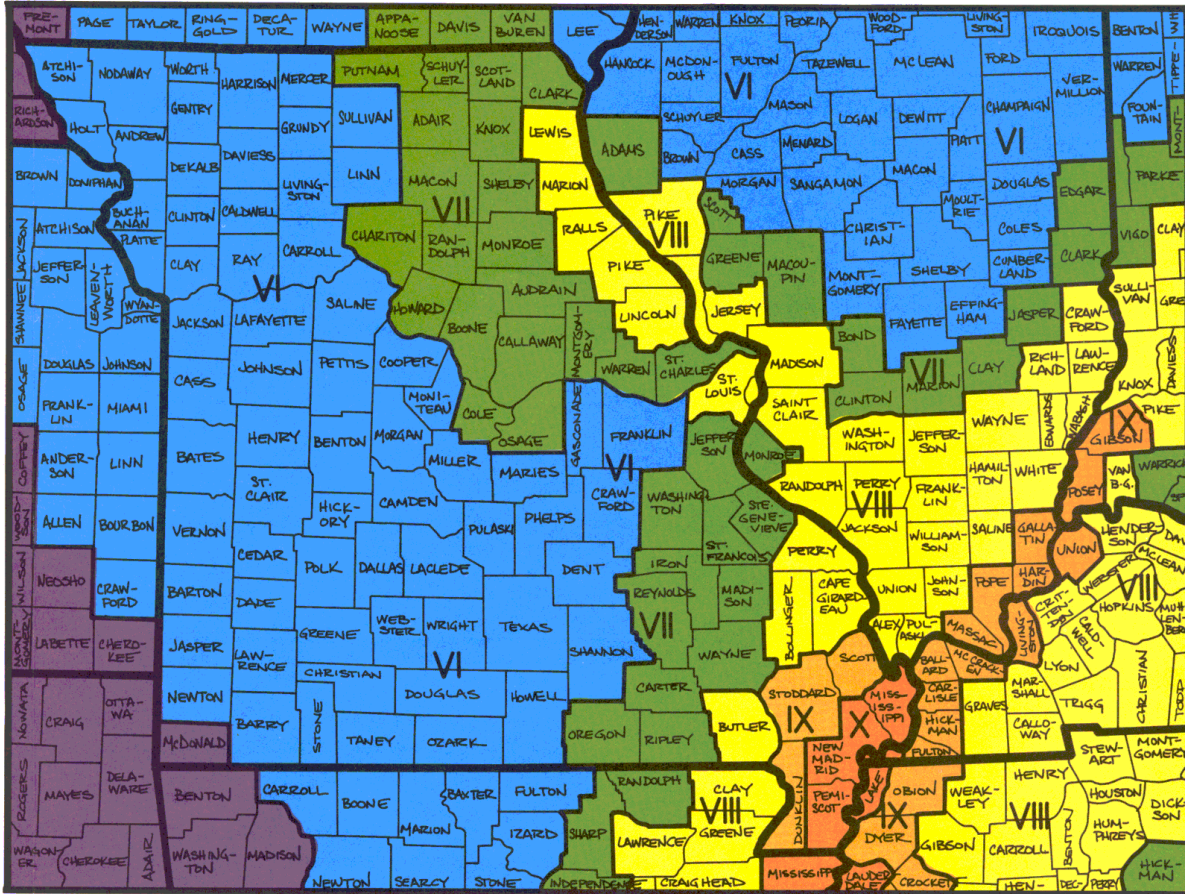
MMI	Felt Intensity
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air. ^{xx}

Figure 3-7 shows projected earthquake intensities for Missouri and the surrounding states that are affected by the New Madrid Fault.

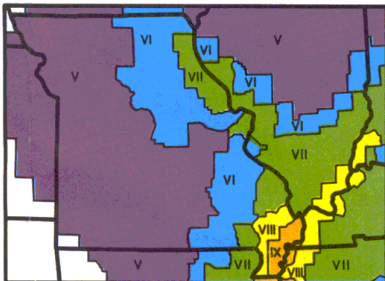
Hazard History

Most of Missouri's earthquake activity has been concentrated in the southeast corner of the state, which lies within the New Madrid seismic zone. The written record of earthquakes in Missouri prior to the nineteenth century is virtually nonexistent; however, there is geologic evidence that the New Madrid seismic zone has had a long history of activity. The first written account of an earthquake in the region was by a French missionary on a voyage down the Mississippi River. He reported feeling a distinct tremor on Christmas Day 1699 while camped in the area of what is now Memphis, TN.

Figure 3-7
PROJECTED EARTHQUAKE INTENSITIES

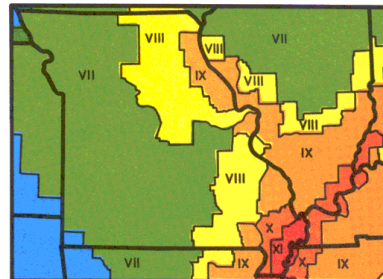


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 8.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



Source: Missouri State Emergency Management Agency website: <http://sema.dps.mo.gov>

Whatever the seismic history of the region may have been before the first Europeans arrived, after Dec. 16, 1811, there could be no doubt about the area's potential to generate severe earthquakes. On that date, shortly after 2 AM, the first tremor of the most violent series of earthquakes in the United States history struck southeast Missouri. In the small town of New Madrid, about 290 kilometers south of St. Louis, residents were aroused from their sleep by the rocking of their cabins, the cracking of timbers, the clatter of breaking dishes and tumbling furniture, the rattling of falling chimneys, and the crashing of falling trees. A terrifying roaring noise was created as the earthquake waves swept across the ground. Large fissures suddenly opened and swallowed large quantities of river and marsh water. As the fissures closed again, great volumes of mud and sand were ejected along with the water. The earthquake generated great waves on the Mississippi River that overwhelmed many boats and washed others high upon the shore. The waves broke off thousands of trees and carried them into the river. High river banks caved in, sand bars gave way, and entire islands disappeared. The violence of the earthquake was manifested by great topographic changes that affected an area of 78,000 to 130,000 square kilometers.

On Jan. 23, 1812, a second major shock, seemingly more violent than the first, occurred. A third great earthquake, perhaps the most severe of the series, struck on Feb. 7, 1812.

The three main shocks probably reached intensity XII, the maximum on the Modified Mercalli scale, although it is difficult to assign intensities, due to the scarcity of settlements at the time. Aftershocks continued to be felt for several years after the initial tremor. Later evidence indicates that the epicenter of the first earthquake (Dec. 16, 1811) was probably in northeast Arkansas. Based on historical accounts, the epicenter of the Feb. 7, 1812, shocks was probably close to the town of New Madrid.

Although the death toll from the 1811-12 series of earthquakes has never been tabulated, the loss of life was very slight. It is likely that if at the time of the earthquakes the New Madrid area had been as heavily populated as at present, thousands of persons would have perished. The main shocks were felt over an area covering at least 5,180,000 square kilometers. Chimneys were knocked down in Cincinnati, Ohio, and bricks were reported to have fallen from chimneys in Georgia and South Carolina. The first shock was felt distinctly in Washington, D.C., 700 miles away, and people there were frightened badly. Other points that reported feeling this earthquake included New Orleans, 804 kilometers away; Detroit, 965 kilometers away; and Boston, 1,769 kilometers away.

The New Madrid seismic zone has experienced numerous earthquakes since the 1811-12 series, and at least 35 shocks of intensity V or greater have been recorded in Missouri since 1811. Numerous earthquakes originating outside of the state's boundaries have also affected Missouri. Five of the strongest earthquakes that have affected Missouri since the 1811-12 series are described below.

On Jan. 4, 1843, a severe earthquake in the New Madrid area cracked chimneys and walls at Memphis, Tennessee. One building reportedly collapsed. The earth sank at some places near New Madrid; there was an unverified report that two hunters were drowned during the formation of a lake. The total felt area included at least 1,036,000 square kilometers.

The Oct. 31, 1895, earthquake near Charleston, MO probably ranks second in intensity to the 1811-12 series. Every building in the commercial area of Charleston was damaged. Cairo, Illinois, and Memphis, Tennessee, also suffered significant damage. Four acres of ground sank near Charleston and a lake was formed. The shock was felt over all or portions of 23 states and at some places in Canada.

A moderate earthquake on April 9, 1917, in the Ste. Genevieve/St. Mary's area was reportedly felt over a 518,000 square kilometer area from Kansas to Ohio and Wisconsin to Mississippi. In the epicentral area people ran into the street, windows were broken, and plaster cracked. A second shock of lesser intensity was felt in the southern part of the area.

The small railroad town of Rodney, MO experienced a strong earthquake on Aug. 19, 1934. At nearby Charleston, windows were broken, chimneys were overthrown or damaged, and articles were knocked from shelves. Similar effects were observed at Cairo Mounds and Mound City, IL, and at Wickliff, KY. The area of destructive intensity included more than 596 square kilometers.

The Nov. 9, 1968, earthquake centered in southern Illinois was the strongest in the central United States since 1895. The magnitude 5.5 shock caused moderate damage to chimneys and walls at Hermann, St. Charles, St. Louis, and Sikeston, Missouri. The felt areas include all or portions of 23 states.^{xxi}

Several area residents observed a small seismic occurrence during the early morning hours of July 8, 2003, near Rolla, located in Phelps County, which is adjacent to Crawford County. According to information from the USGS, a micro-earthquake happened about 20 miles northeast of Rolla and measured 2.9 on the Richter scale. The earthquake originated at a depth of about 3.1 miles beneath the earth's surface. In southern parts of Missouri, earthquakes of this magnitude happen frequently, but are an unusual event in Crawford County. The nearest faults are the Leasburg Fault and the Cuba Fault.

Small earthquakes continue to occur frequently in Missouri. An average of 200 earthquakes are detected every year in the New Madrid Seismic Zone alone. Most are detectable only with sensitive instruments, but on an average of every 18 months, southeast Missouri experiences an earthquake strong enough to crack plaster in buildings.^{xxii}

Large amounts of damage caused by an earthquake can lead to cascading natural disasters. Dam structures could be weakened and even potentially destroyed by massive shaking of the earth. The potential failure of the dam could cause the structure to release its contents and cause a flash flooding emergency as well. The earthquake may also cause electrical lines to break, which could potentially start fires that spread into wildfires.

Crawford County is located in south central Missouri, a good distance from the southeast corner of the state that has the potential for catastrophic damage should a significant earthquake occur. According to the Earthquake Intensity Map provided through state agencies, Crawford County would experience only slight damage in the event of a severe quake in southeast Missouri. The greater impact would be the result of damage to transportation and communications systems. In regards to unique construction characteristics or other conditions that may differentiate between

jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Warning Time and Duration

Earthquakes may occur at any time and are very difficult to predict, making timely warnings nearly impossible.

Probable warning time of less than six hours (4). Duration of more than one week (4).

Statement of Severity/Magnitude

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. Crawford County is located in the south central part of the state and Figure 3-7 – Earthquake Intensity Map shows that the county, at a Mercalli rating of VI, would have relatively mild damage compared to counties located closer to the New Madrid region. Another consideration is that if a catastrophic earthquake were to occur, Crawford County would suffer consequences from damage to communications and transportation infrastructure in the higher impact seismic zones. In addition, the county would likely be affected by the staging of state and federal response resources to the event and the impact of refugees from the affected area.

Statement of Probable Risk/Likelihood of Future Occurrence

Occasional (2): An event is probable within the next five years—a 20 percent probability of occurring. In much the same way as meteorologists forecast rain, earth scientists present forecasts of earthquakes as the chance or “probability” of an earthquake occurring in a specific time interval. It is generally accepted that earthquakes can be expected in the future as frequently as in the recent past. The USGS and the Center for Earthquake Research and Information of the University of Memphis now estimate that for a 50-year time period: the probability of a repeat of the 1811-1812 earthquakes is between seven and 10 percent. The probability of an earthquake with magnitude 6.0 or larger is between 25 and 40 percent.^{xxiii}

Statement of Next Disaster’s Likely Adverse Impact on the Community

Since Crawford County is not near the New Madrid shock zone, it will most likely endure mild effects from the earthquake, minor damage to buildings, utility disruption, environmental impacts and economic disruptions/losses. If a major earthquake should occur, Crawford County could be impacted by the number of refugees traveling through the area seeking safety and assistance.

Recommendation

Encourage purchase of earthquake hazard insurance. Establish structurally sound emergency shelters in several parts of the county.

Hazard Summary – Earthquake – All Jurisdictions in Crawford County

Calculated Priority Risk Index	Planning Priority
2.05	Moderate

3.2.5 Extreme Heat

Description

The National Weather Service defines a heat wave as three consecutive days of 90° F plus temperatures. These high temperatures generally occur from June through September, but are most prevalent in the months of July and August. Missouri experiences about 40 days per year above 90 degrees, based on a 30-year average compiled by the NWS from 1961-1990. July leads this statewide mean with 15 days above 90 degrees, followed by August with an average of 12 days over 90. June and September average six days and four days respectively for temperatures above 90 during the same 30-year period. This is based on local climatological data from NWS stations at Kansas City, Columbia, Springfield, and St. Louis. As these regional reports indicate, all of Missouri is subject to heat wave during the summer months. Ambient temperature however, is not the only factor to consider when assessing the likely effect of heat. Relative humidity must also be considered, along with exposure, wind, and activity.^{xxiv}

High humidity, a common factor in Missouri, can magnify the effects of extreme heat. While heat-related illness and death can occur from exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the threat to public health.

Type of Damage

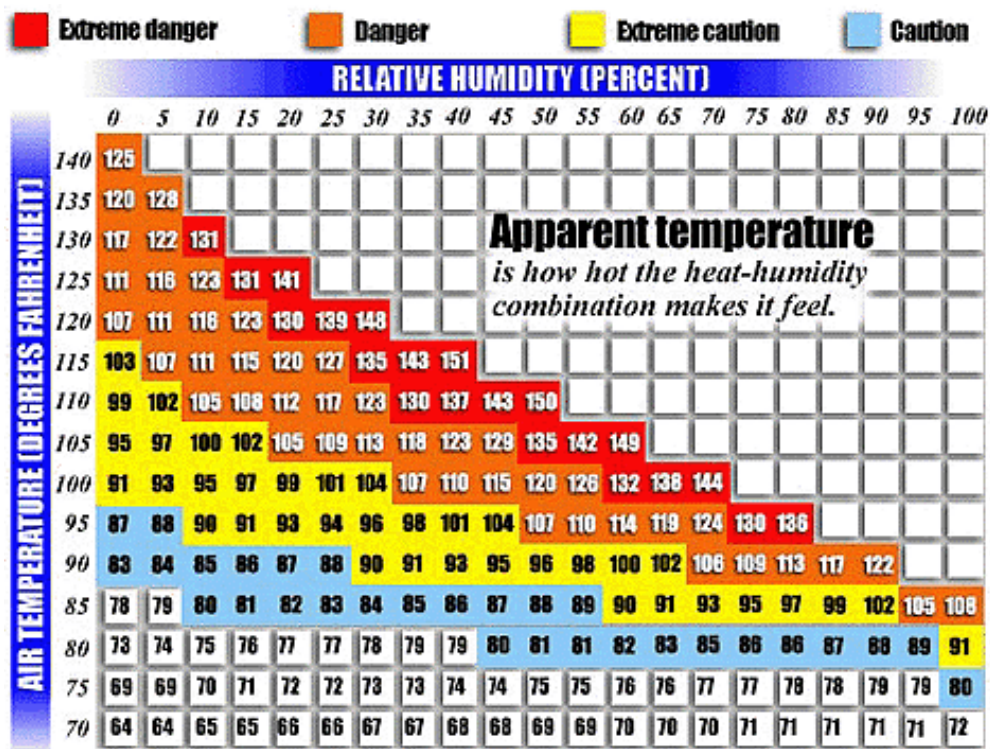
Heat can kill by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Elderly people, young children, and those who are sick or overweight are more likely to become victims of extreme heat. Because men sweat more than women, they are more susceptible to heat illness because they become more quickly dehydrated. The duration of excessive heat plays an important role in how people are affected by a heat wave. Studies have shown that a significant rise in heat-related illnesses happens when excessive heat lasts more than two days. Spending at least two hours per day in air conditioning significantly cuts down on the number of heat-related illnesses.^{xxv}

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating, or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop. Ranging in severity, heat disorders share one common feature: the individual has overexposed or over-exercised for his/her age and physical condition in the existing thermal environment. Sunburn, with its ultraviolet radiation burns, can significantly retard the skin's ability to shed excess heat.^{xxvi}

Air temperature is not the only factor to consider when assessing the likely effects of a heat wave. High humidity, which often accompanies heat in Missouri, can increase the harmful effects. Relative humidity must also be considered, along with exposure, wind and activity. The Heat Index devised by the NWS combines air, temperature and relative humidity. Also known as the apparent temperature, the Heat Index is a measure of how hot it really feels. For example, if air temperature is 102 degrees and the relative humidity is 55% then it feels like 130 degrees; 28 degrees hotter than the actual ambient temperature.

To find the Heat Index from the table shown below, find the air temperature along the left side of the table and the relative humidity along the top. Where the two intersect is the Heat Index for any given time of day.

Figure 3-8
Heat Index



In addition to the affects of a heat wave on humans, heat can also affect animals. Livestock often respond to heat by reducing their food intake. This in turn affects milk production, reproduction and muscle (meat) building. All of these things can have a negative impact on agriculture.^{xxvii}

Heat waves can also be a major contributing factor to power outages (brownouts, etc.), as the high temperatures result in exceptionally high demand for electricity for cooling purposes. Power outages for prolonged periods increase the risk of heat stroke and subsequent fatalities due to the loss of air conditioning or fans and proper ventilation.^{xxviii}

Hazard History

Twenty-four instances of excessive heat were recorded in Crawford County between 1994 and 2009. None of these events caused a death in the county, however several people were treated for heat-related illnesses and heat related deaths were reported throughout Missouri for most of those events. According to the Missouri State Hazard Mitigation Plan, the summer of 1980 was the deadliest year for heat-related deaths in the state. 295 people died of heat related illnesses during the heat wave that gripped the state that summer. More recently, in 1999, 42 Missouri residents died of hyperthermia. Statewide, heat wave deaths most often occur in urban areas and people age 65 and older are most susceptible.

In addition to human losses, a heat wave has the possibility of cascading into other natural disasters. Severe heat can lead to drought conditions if no rain is present for a lengthy period of time. This lack of rain and presence of hot temperatures can also encourage the spreading of wildfires. As mentioned earlier, another serious cascading emergency is power disruptions as demand exceeds the power grids ability to supply electricity. Specific property or crop damage estimates are unknown, though it may be presumed that periods of high heat were detrimental to crop yields. Temperatures in Crawford County have been recorded at reaching just over 100 degrees Fahrenheit and heat indices have ranged between 115 and 120 during instances of extreme heat.

Season Pattern and Existing Warning Systems

Excessive heat is most common in the summer months of June through August. Education is the most preventive warning system available in Crawford County. The Crawford County Health Department provides information to residents about preparing for heat waves. The National Weather Service (NWS) is able to predict periods of high heat with good accuracy and this information is disseminated to the population through various forms of media.

Warning Time and Duration

Due to improvements in meteorology, the heat waves can be predicted several days in advance of onset. Table 3.7 shows the three response levels developed by the NWS, based on the Heat Index, to alert the public to the potential heat hazards:

Table 3.7 National Weather Service Heat Index Response Levels

Heat Index	Response Level
130 degrees F or higher	Warning
105 degrees F to 129 degrees F	Watch
90 degrees F to 104 degrees F	Advisory

Source: Missouri State Hazard Mitigation Plan May 2007

The Missouri Department of Health and Senior Services will announce a statewide hot weather health alert (Table 3.8) when conditions are as follows:

Table 3.8 MO Dept. of Health & Senior Services Hot Weather Alerts

Type of Alert	Conditions of Alert
Hot Weather Health Alert	Heat indices of 105 degrees F in a large portion of the state are first reached (or predicted).
Hot Weather Health Warning	Heat indices have been 105 degrees F or more for two days in a large portion of the state, or weather forecasts call for continued heat stress conditions for at least 24 to 48 hours over a large portion of the state.
Hot Weather Health Emergency	When extensive areas of the state meet the following criteria: (1) high sustained level of heat stress (HI 105 degrees F for three days) (2) increased numbers of heat-related illnesses and deaths statewide and (3) the NWS predicts hot, humid temperatures for the next several days for a large portion of the state.

Source: Missouri Department of Health and Senior Services.

Probable warning time of 24 hours or more (1). Duration of less than one week (3).

Statement of Severity/Magnitude

Negligible (1) – Injuries and/or illness are treatable with first aid; minor quality of life lost; shutdown or critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. Extreme heat has the potential for causing deaths in Crawford County – and so could be classified as catastrophic. But historically, heat-related deaths have not occurred in Crawford County. However, the possibility is one to be considered when heat indices are above 100 degrees F. Based on information from the Department of Health and Senior Services and the NWS, the state rates the probability of a heat wave as moderate and severity as moderate, but the probability could be upgraded to severe.^{xxix}

Statement of Probable Risk/Likelihood of Future Occurrence

Highly Likely (4) – event is probable within one year—a near 100 percent probability of occurring. Based on historical evidence, the occurrence of extreme heat is a yearly phenomenon in Crawford County. It can be assumed with reasonable security that high temperatures will be seen in the county on an annual or biannual basis.

Statement of Next Disaster’s Likely Adverse Impact on the Community

When extreme heat next strikes Crawford County the impact will probably have a low impact on the community. Some agricultural producers may see a crop loss and water suppliers may see an increase amount of water consumption. Mental and physical stress may be caused by the extreme heat. Heat waves place stress on the power grid as well. But historically, the county has not had deaths occur due to heat waves.

Recommendation

Many people do not realize how deadly a heat wave can be. Extreme heat is a natural disaster that is not as dramatic as floods or tornados. However, based on the hazard summary table below, it is evident that extreme heat is a high planning priority.

Working with the Crawford County Health Department and EMD, local governments should encourage residents to reduce the level of physical activity, wear lightweight clothing, eat fewer protein-rich foods, drink plenty of water, minimize their exposure to the sun and spend more

time in air-conditioned places. People who work outdoors should be educated about the dangers and warning signs of heat disorders. Buildings, ranging from homes (particularly those of the elderly) to factories, should be equipped with properly installed, working air conditioning units or have fans that can be used to generate adequate ventilation. Charitable organizations and the health department should work together to provide fans to at-risk residents during times of critical heat.

Hazard Summary – Extreme Heat – All Jurisdictions in Crawford County

Calculated Priority Risk Index	Planning Priority
2.55	High

3.2.6 Flood (Riverine and Flash)

Description

Floods are the number one weather-related killer in the United States. Between 1993 and 1999, Missouri recorded more than 75 deaths attributed to flooding. A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains and lakes due to excessive rainfall, rapid snowmelt or ice. There are several types of riverine floods—including headwater, backwater, interior drainage and flash flooding, which is characterized by rapid accumulation or runoff of surface waters from any source. This type of flooding impacts smaller rivers, creeks and streams, and can also occur as a result of dams being breached or overtopped. Because flash floods can develop in just a matter of hours, most flood related deaths result from this type of flooding event.

The areas adjacent to rivers and stream banks that serve to carry excess flood water during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat areas adjoining rivers and streams. The term base flood, or 100-year flood is the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year, based upon historical records. Floodplains are a vital part of a larger entity called a basin—defined as all the land drained by a river and its branches.

The land that forms the state of Missouri is contained within either the Mississippi, Missouri, Arkansas or White River basins. The Mississippi River Basin drains the eastern part of the state; the Missouri River Basin drains most of the northern and central part of the state; the White River Basin drains the south central part of the state; while, the Arkansas River Basin drains the southwest part of the state. The Missouri River Basin drains over half the state, as the river moves west to east across the state. When the Missouri River joins the Mississippi at St. Louis, it becomes part of the Mississippi River Basin—the largest basin in terms of volume of water drained on the North American continent.

The fact that most of the land that comprises the state of Missouri is part of the Mississippi-Missouri River drainage basin means that a significant portion of the land area of the state lies in flood-plains. For example, some 43 percent of the land in St. Charles County is in floodplains. In terms of agricultural land in Missouri, 34 percent of Missouri's cropland lies in a floodplain. This

leaves much of the Missouri population and economic resources extremely vulnerable to flooding.^{xxx}

In some cases, flooding may not be directly attributable to a river, stream or lake overflowing its banks. It may simply be the combination of excessive rainfall or snowmelt, saturated ground and inadequate drainage. With no place to go, the water will find the lowest elevations—areas that are often not in a floodplain. This type of flooding is called sheet flooding and is becoming increasingly more common as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

Flooding can also occur outside the floodplain when combined storm and sanitary sewers cannot handle the extremely heavy flow of water that often accompanies storm events. The result of this problem is flooded basements.

Flash floods occur within six hours of a rain event, or after a dam or levee failure, or following a sudden release of water held by an ice or debris jam, and flash floods can catch people unprepared. Residents usually have little or no notice of these sudden and dangerous flood events.

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise very rapidly and peak with violent force.

Because flooding along rivers is generally characterized as a slow moving disaster, communities downstream often have sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, these flood disasters extract a heavy toll in terms of human suffering and extensive losses to public and private property. By contrast, flash flood events, which are characterized by a rapid water rise with little warning time, have caused a higher number of deaths and major property damage in many areas of Missouri in recent years.^{xxxii}

Type of Damage

Riverine flooding in Crawford County typically affects areas of the county along the Meramec River and Huzzah and Courtois creeks. However, flash flooding has occurred in all of the communities at some time. While the flooding mainly affects low water bridges on county-maintained roads and letter roads, it has also flooded low lying areas of Steelville, causing damage to homes and businesses and forcing residents to be evacuated from their homes. Drivers who travel on the county maintained roads have dealt with closed roads numerous times due to flash flooding. A portion of the City of Steelville, which is located on the banks of Yadkin and Whitenburg creeks, is located in the 100 year floodplain.

Typical damages caused by Crawford County floods can range from destroyed crops to floating cars and damaged homes and businesses. Propane gas tanks and chain-link fences have also been lifted from their anchored positions and carried downstream. Some county roads have

experienced severe erosion caused by flash floods. The county has had low water crossings over the Meramec River completely destroyed by flood waters.

Geographic Location

Of the seven participating jurisdictions in the Crawford County Hazard Mitigation Plan, six are members of the National Flood Insurance Program (NFIP). Those are Crawford County and the cities of Bourbon, Cuba, Leasburg, Steelville and Sullivan. The village of West Sullivan is not currently a member of the NFIP. According to FEMA, there are Flood Insurance Rate Maps (FIRMs) for the unincorporated areas of Crawford County and for the cities of Bourbon, Cuba, Leasburg, Steelville and Sullivan. Digitized FIRM data is currently not available for the county.

The Crawford County Hazard Mitigation Plan contains maps created with FEMA's Hazards U.S. Multi-Hazard (HAZUS-MH) database. This software program is a nationally applicable standardized methodology for estimating potential losses from earthquakes, hurricane winds and floods. HAZUS-MH uses Geographic Information Systems (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure, as well as allowing users to estimate the impacts of specific types of hazards. This software is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this plan and the actual social and economic losses following a specific flood.

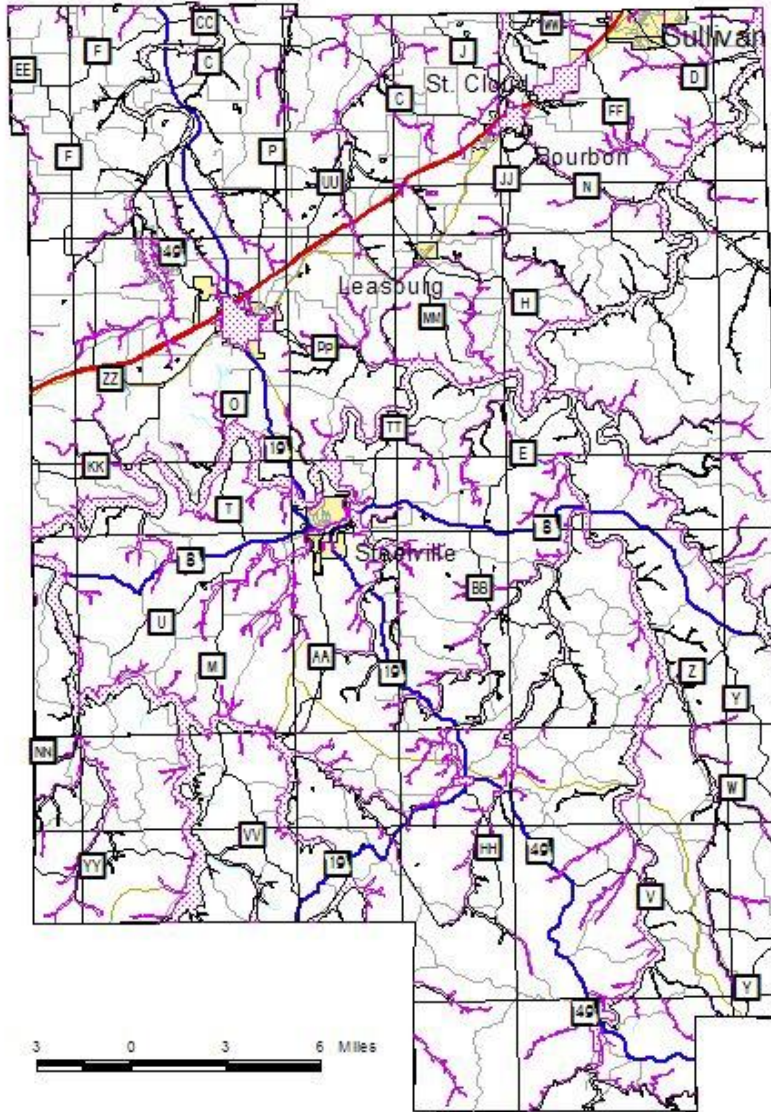
HAZUS-MH was used in the maps found later in this chapter to estimate potential losses from a 100 year flood in the planning area. As DFIRM was not available to generate maps for flood planning purposes, all of the maps included here have been generated with HAZUS-MH and/or GIS information provided by the Missouri Spatial Data Information System (MSDIS). All maps are for planning purposes only.

There are two watersheds located in Crawford County: the Meramec River watershed and the Bourbeuse River watershed. The river with the potential to cause the most flood damage in the county is the Meramec River. This river is 220 miles long and drains an estimated 3,980 square miles of south central and eastern Missouri. Unlike many of the other rivers in the region that drain to the Missouri River, the Meramec drains to the Mississippi River. The Bourbeuse River watershed covers a portion of Crawford County, but the river itself lies just outside the county boundaries and so does not have a great impact. Various floodplain maps are included at the end of this section for each jurisdiction. Figure 3-9 is a flood plain map for the county.

In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Figure 3-9

Crawford County Flood Plain Map



Legend

- River
- Flood Zone A
- Lake
- Municipal Boundary
- County Boundary
- Interstate
- State Highway
- State Route
- County Road
- Rail Road



Crawford County Hazard Mitigation Plan

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 St. James, MO 65689
 673.266.2993



This map was created by the Meramec Regional Planning Commission Planning and Development Department. To the best of the author's knowledge, the data presented here is true and correct. However, no responsibility is assumed by the author or the Meramec Regional Planning Commission for the accuracy of the information displayed on this map.

January 2004



Hazard History

Crawford County has several rivers and small tributaries in both unincorporated and incorporated areas that are susceptible to flooding. Because there are neither major rivers traversing the county nor any major rivers near incorporated areas, flash flooding is historically the county's most prevalent flood related disaster. However, although not classified as a major river, the Meramec River and its tributaries frequently flood and cause damage in the county.

A total of 22 floods and flash floods have affected the county since August 1993. The county, on average, experiences one flooding event every year. Of the 22 reported events, eleven events caused property damage ranging from \$1,000 per event to \$5 million in November 1993. Half of the 22 flood events caused no property damage or injuries. There has been one injury attributed to flash flooding in Cuba. The Meramec River has a reputation for rising rapidly and catching people unprepared. In November of 1993 a flash flood event trapped over 100 campers and hunters in Huzzah State Forest and Onondaga Cave State Park. Victims had to be rescued by boat and helicopter. Local ranchers reported losses from drowned livestock. Table 3.9 illustrates flood events in the county from September 1993 to May 2009.

Table 3.9 Crawford County Flood Events and Locations (1993-2009)

Location or County	Date	Type	Property Damage	Crop Damage
Cuba	08/12/1993	Flash Flood	\$50,000	0
Argo	09/23/1993	Flash Flood	\$50,000	\$5,000
Steelville	09/23/1993	River Flood	\$5,000	\$1,000
Crawford County	11/14/1993	Flash Flood	\$5,000,000	0
Multiple County	04/11/1994	Flash Flood	\$5,000,000	\$5,000,000
Cuba and Steelville	04/11/1994	Flash Flood	\$50,000	0
Cuba	04/28/1994	Flash Flood	\$5,000	0
Crawford County	04/19/1996	Flash Flood	0	0
Crawford County	07/26/1998	Flash Flood	\$100,000	0
Steelville	09/08/2001	Flash Flood	0	0
Multi-County	05/08/2002	Flood	0	0
Crawford County	05/12/2002	Flash Flood	0	0
Cuba	07/18/2002	Flash Flood	0	0
Western Crawford County	08/18/2002	Flash Flood	0	0
North Crawford County	06/10/2003	Flash Flood	0	0
Crawford County	05/01/2004	Flash Flood	0	0
Crawford County	03/12/2006	Flash Flood	0	0

Location or County	Date	Type	Property Damage	Crop Damage
Steelville	01/13/2007	Flood	0	0
Leasburg	09/08/2007	Flash Flood	\$1,000	0
Fox Springs	02/05/2008	Flash Flood	0	0
Jakes Prairie	06/106/2008	Flash Flood	\$1,000	0
Berryman	05/08/2009	Flash Flood	0	0

Source: National Climactic Data Center

Of the eight local government jurisdictions participating in this plan, six are currently participating in the National Flood Insurance Program (NFIP): Crawford County, Bourbon, Cuba, Leasburg, Steelville and Sullivan. The villages of West Sullivan and St. Cloud do not participate in the NFIP. According to repetitive loss data provided by SEMA, there are five properties in Crawford County that have had repetitive losses. All of these properties are located in unincorporated areas of the county. One is a single-family dwelling and the other four are nonresidential properties. Flooding occurred between 1994 and 2008. Two of the properties have flooded three times, while the remaining three have only flooded twice. None of the properties have been mitigated.

Seasonal Patterns

Riverine flooding has historically occurred most frequently in the spring when a combination of wet weather and spring thaw have resulted in flood conditions in the large river basins of the Missouri and Mississippi. However, flash floods can occur at any time of the year and are generally caused by severe thunderstorms with heavy rainfall. From August 1993 through May 2009, flood events have occurred in Crawford County in every month of the year with the exception of October and December.

Warning Time and Duration

While floods are known to grow slowly and allow adequate time for warning, the flash flooding that is often associated with Crawford County can rapidly develop into an emergency for which residents are unprepared. While it may seem prudent to estimate that most residents can predict probable flooding by witnessing large amounts of rain, many residents are still swept downstream in their cars while trying to cross bridges inundated by water. Radio and television stations in the area can provide warnings to residents based on missives from the National Weather Service. If adequate warning is available, county or city enforcement officials can help residents evacuate from potentially dangerous flooding areas. Because Crawford County is so near the headwaters of the Meramec River, flood stages in this area are not always predictable. Furthermore, the river has a reputation for quickly flooding and catching people unprepared. The river can rise very swiftly. According to the Missouri State Hazard Mitigation Plan, in recent years, flash flooding rather than riverine flooding has actually caused more deaths and property damage in many parts of the state. Due to flood prone areas running through the city and the proximity of critical facilities to flood prone areas, the community of Steelville and portions of the Steelville R-III School district are vulnerable to riverine flooding of the Meramec River

tributaries that flow through that community. The county is also vulnerable to flooding from the Meramec River and its tributaries, although no critical facilities located in the county are located in or in close proximity to flood prone areas. The rest of the jurisdictions – Bourbon, Cuba, Leasburg, St. Cloud, Sullivan, West Sullivan, Bourbon R-I, Cuba R-II and Sullivan C-2 school districts are vulnerable to flash flooding, but not riverine flooding. Riverine floods generally have several days of warning, but for the purposes of this assessment, all jurisdictions will be scored based on flash flooding for warning time and both types of flooding for duration.

For Crawford County, City of Steelville and Steelville R-III School District: Probable warning time of less than six hours for most common flash flooding (4). Duration of less than one week (3).

For the cities of Bourbon, Cuba, Leasburg, St. Cloud, Sullivan, West Sullivan and the Crawford County R-I, Crawford County R-II and Sullivan C-2 school districts: Probably warning time of less than six hours for most common flash flooding (4). Duration of less than one day (2).

Statement of Severity/Magnitude

For Crawford County and all jurisdictions: Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. The Missouri State Hazard Mitigation Plan states that in terms of overall damage, Missouri’s most severe single hazard is flooding. Flooding has resulted in more federal disaster declarations in Missouri than any other hazard in the past three decades. However, much of this flood damage has occurred in the two major river basins – the Missouri River and the Mississippi River. Of the 22 flood events reported, only two resulted in significant damage in Crawford County. On November 1993 and April 1994, there was \$5,000,000 in damages reported for Crawford County. In April 1994, a multiple county flood event also resulted in \$5,000,000 in property damage. There are five properties listed by the NFIP that have had repetitive losses with the most recent loss in 2008. Based on the CPRI and historical information of flood events and flood damages in Crawford County, the severity of a future flood would be negligible. While some county residents may be delayed in their traveling, damages are usually low or nonexistent. Some schools may be affected by flooding for short periods of time and adjustments made to the routes driven by busses, but these would be short-lived and not considered a significant problem. Loss of life and injuries are also typically limited. Historically, the most impacted areas have been in unincorporated areas of the county and the cities of Steelville and Cuba. The City of Steelville has some critical facilities located in or adjacent to the floodplain, including the elementary and middle schools, but historically the magnitude of flash flooding has been negligible.

Statement of Probable Risk/Likelihood of Future Occurrence

Highly Likely (4) – Event is probable within one year—a near 100 percent probability of occurring. All past information regarding flooding in Crawford County leads to the assessment that flooding will occur in the Meramec River basin and flash flooding will happen again in the county. It can be safely assumed that this type of flooding will happen at least once every year and will likely average twice per year, depending on weather conditions and precipitation. There are specific areas of the county and the communities that can be expected to be impacted as evidence in Table 3.6. Homes and businesses located in Steelville have been impacted by

flooding of Yadkin Creek in the past and will likely be impacted in the future. Several campground and canoe rental business located on the Meramec River are also vulnerable to future flood events. Some school bus routes may be affected by flooding for short periods of time and adjustments made to the routes driven by busses, but these would be short-lived and not considered a significant problem.

Statement of Next Disaster’s Likely Adverse Impact on the Community

The next flash flood in Crawford County will most likely have little impact on the day-to-day activities of the county overall. Most roads in the county including highways, interstates and county roads are not threatened by this hazard except in extreme circumstances. With the exception of the City of Steelville, which has a number of homes and businesses located in flood prone areas of Yadkin and Whitenburg creeks, and campgrounds located on the Meramec River, few buildings lie in the floodplain. Temporary road closures might affect some of the jurisdictions.

Recommendation

The county has already adopted a Floodplain Management Ordinance concerning construction in the floodplain. The county should consider doing buyouts of properties that are flood prone and have had repetitive losses to mitigate future disasters. Local governments should make a strong effort to further improve warning systems to insure that future deaths and injuries do not occur. Local governments should consider making improvements to roads and low water crossings that consistently flood by placing them on a hazard mitigation projects list and actively seek funding to successful complete the projects.

Hazard Summary – Flood – Crawford County, City of Steelville, Steelville R-III School District

Calculated Priority Risk Index	Planning Priority
3.0	High

Hazard Summary – Flood – Cities of Bourbon, Cuba, Leasburg, St. Cloud, Sullivan, West Sullivan, Crawford County R-I, Crawford County R-II, Sullivan C-2 School Districts

Calculated Priority Risk Index	Planning Priority
2.9	High

3.2.7 Landslide

Description

The term landslide encompasses a broad range of land disturbances including rock falls—where rocks fall or bounce down-slope; slides—where deep failure of slopes causes rock and/or sediment to slide along the Earth’s surface; and shallow debris flows—where sediment and the material it collects as it moves, flows across the Earth’s surface.^{xxxii}

Falls: Due to weathering, steep mountain slopes and rock outcrops are constantly going through the process of erosion, often in the form of rocks falling or bouncing down slopes. Such falls can be triggered by the freezing of water within crevasses in the stone, the growth of plants and expansion of their root systems, earthquakes or by people moving around on the slope or outcrop. This type of landslide is generally easy to identify by looking for talus—a buildup of loose rocks at the base of a steep slope. Talus is typically cone shaped and is found at the base of many mountain ranges and rocky outcroppings.^{xxxiii} This is perhaps the most common type of landslide activity in the Ozark region. As the slopes in the Ozarks are not as dramatic or large as those in regions like the Appalachians or Rockies, the rock falls are also smaller.

Slides: A mass of slope material, generally soil, moving as a cohesive block. There are several different types of slides but the most common is a slump. A slump occurs when a portion of hillside moves down-slope under the influence of gravity. A slope has a definitive shape, with a scarp or cliff at the top of the slump and a bulge of material—also called the toe—at the base.^{xxxiv}

Flows: In this type of landslide, the material moving down-slope is typically being transported as a very thick fluid—a river of debris, rock and/or soil. Water is generally the transport agent for flows. When heavy rains contribute to a landslide, material on the slope that becomes saturated with water may develop a debris flow or mud flow. This slurry of rock and mud may pick up trees, houses and cars and cause catastrophic damage to the area covered by the debris flow. These flows can cause additional flooding damage by blocking bridges and tributaries.^{xxxv}

The type of flow that most people are likely to be familiar with are lahars, which are formed when volcanoes erupt. The heat from the eruption rapidly melts the snowcap on the volcano and the water rushing down the sides of the already unstable slope gathers ash, mud and other debris. A primary example of this type of landslide is the destruction following the eruption of Mount St. Helens, when the resulting lahars caused extensive damage to rivers, lakes, forests, roads and bridges and other human development in the area.^{xxxvi}

According to the U.S. Geological Survey, the primary reason for landslides is gravity acting on an over-steepened slope. But there are many naturally occurring factors that can lead to landslides, including:

- Erosion by rivers, glaciers or ocean waves;
- Rock and soil slopes are weakened through saturation by snowmelt or heavy rains;
- Earthquakes create stresses that make weak slopes fail;
- Earthquakes of a magnitude of 4.0 and greater have been known to trigger landslides;
- Volcanic eruptions produce loose ash deposits, heavy rain and debris flows;
- Excess weight from accumulation of rain or snow, stockpiling of rock or ore from waste piles or from man-made structures may stress weak slopes to failure.

Human development on or at the base of areas that are prone to landslides contributes to the cost of landslides in property damage and human life. Losses can be reduced by avoiding development on unstable slopes or at the base of these areas.

Likely Locations. Landslides occur in all 50 states and every U.S. territory. Mountainous regions, such as the Appalachian Mountains, Rocky Mountains and Pacific Coastal Ranges are all highly susceptible to landslides. But any area composed of weak or fractured materials resting on a steep slope can experience landslides.^{xxxvii} Areas that are most prone to landslides include:

- On existing old landslides.
- On or at the base of slopes.
- In or at the base of minor drainage hollows.
- At the base or top of an old fill slope.
- At the base or top of a steep cut slope.
- Developed hillsides where leach field septic systems are used.^{xxxviii}

The most likely type of landslide to occur in Crawford County would be a rock slide caused by weathering of stone outcrops. The region has many areas where fractured, eroding bedrock is exposed, including bluffs cut for highways. Rock slides are common in these areas but rarely cause damage to property or infrastructure. In most cases, residents avoid building in areas where rock falls occur. In rock fall prone areas, where highways have cut through bedrock, the roads are usually built far enough from the bluff to avoid damage to the actual road bed. The rock falls are generally small and the talus forms in the ditches where it is easily removed.

The map in Figure 3-10 shows the landslide potential for the United States. Missouri has areas of moderate landslide potential in the northern half of the state and some areas of very high potential along the eastern border in the Mississippi floodplain. The USGS states that although landslides can occur in the black portions of the map, which includes Crawford County, they are unlikely.^{xxxix}

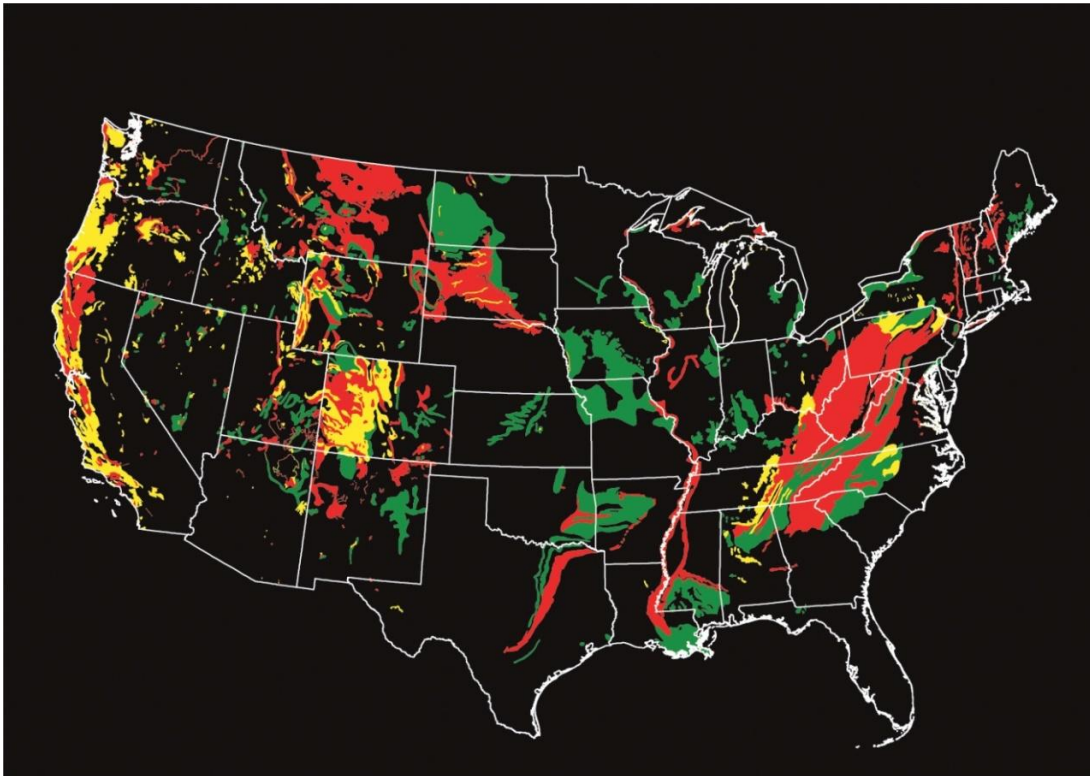
Type of Damage

It is estimated that, in the United States, landslides cause 25 to 50 deaths and \$3.5 billion dollars in property damage every year. Worldwide the figures are staggering – hundreds of billions of dollars in damages and hundreds of thousands of deaths and injuries every year.^{xl}

Landslides lead to lost human, industrial, agricultural and forest productivity and can cause significant environmental damage.^{xli} Landslides destroy homes, businesses and infrastructure such as utilities, bridges and roads. This hazard can gather enough momentum and debris to completely destroy anything in its path. Landslides can not only cause substantial damage, this hazard also makes permanent changes to the terrain that can affect future development and use of the land.^{xlii} Although landslides are frequently caused by another natural disaster, such as earthquakes, floods or volcanic eruptions, the resulting landslide often causes more damage than the triggering event. For example, the Alaska earthquake of 1964 and the eruption of Mount St. Helens in 1980 had far more damage from the landslides that occurred than from the initial hazard event.^{xliii}

Destruction caused by large landslides is frequently catastrophic – buildings crushed and buried by debris, bridges and utilities swept away. The loss of human life can be significant. It is critical that citizens be informed of the dangers and the warning signs of an impending landslide.

Figure 3-10
Landslide Potential of the Conterminous United States^{xliv}



Landslide potential of the conterminous United States: Red areas have very high potential, yellow areas have high potential and green areas have moderate potential. Landslides can and do occur in the black areas but the potential is low. Map not to scale. Sources: the National Atlas and the USGS.

Warning signs include:

- Springs and seeps forming in areas where they did not exist before.
- New cracks or unusual bulges in the ground, street pavements or sidewalks.
- Soil moving away from foundations.
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house.
- Tilting or cracking of concrete floors and foundations.
- Broken water lines and other underground utilities.
- Leaning telephone poles, trees, retaining walls or fences.
- Offset fence lines.
- Sunken or down-dropped road beds.
- Rapid increase in creek water levels, possibly accompanied by increased turbidity.
- Sudden decrease in creek water levels though rain is still falling or has just ceased.
- Sticking doors and windows and visible open spaces indicating jambs and frames are out of plumb.
- A faint rumbling sound that increases in volume is noticeable as the landslide nears.
- Unusual sounds such as trees cracking or boulders slamming together could indicate moving debris.^{xlv}

In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Hazard History

Landslides occur throughout the United States and cause an estimated \$3.5 billion in damages and as many as 50 deaths each year. There have been a number of dramatic, well publicized landslide events in recent years, mostly located on the West Coast in California and the Pacific Northwest. A large landslide damaged a number of homes in LaConchita, Calif., on March 4, 1995. Ten years later, a portion of the same landslide became a debris flow during a period of heavy rain. The debris flow damaged a number of additional homes and killed 10 people.^{xlvi} The largest landslide in recorded history occurred when Mount St. Helens erupted on May 18, 1980. In a dramatic explosion that blew off the top 1,300 feet of the mountain, the volcano devastated 240 square miles. The rock slide and debris avalanche that resulted from the eruption traveled 14 miles, destroying nine highway bridges, numerous private and public buildings and many miles of highways, roads and railroads. The volume of material in the landslide was large enough to fill 250 million dump trucks.^{xlvii}

However, as illustrated by the map in Figure 3-10, Crawford County lies within an area of low probability for landslides. Rock falls do occur in the area, but are typically small and do not have a significant impact. Some roads, including major highways such as Interstate 44 and Highway 19, have areas where the road has cut through bedrock and created bluffs. Rock falls occur frequently along these bluffs as a result of natural weathering. There have been no reports of property damage or injuries due to these small rock falls and the talus created is easily removed during the course of regular highway maintenance.

Warning Time and Duration

Probable warning time of less than six hours (4). Duration of less than six hours (1).

Statement of Severity/Magnitude

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. Due to past history and reports developed by the USGS, the severity of any future landslides in Crawford County would be low. To date there have been no reports of damage or injury from landslides. Development typically avoids areas that have the potential of incurring damage from rock falls and other types of landslides.

Statement of Probable Risk/Likelihood of Future Occurrence

Unlikely (1) – Event is possible within the next 10 years; event has up to one in 10 years chance of occurring; history of events is less than or equal to 10 percent likely per year. It is unlikely that there will be property damage, injuries or loss of life due to landslides in Crawford County. There will continue to be small rock falls in areas where normal weathering of rock results in this type of landslide. However, because of the small size of these rock falls they are a low priority for hazard mitigation planning.

Statement of Next Disaster’s Likely Adverse Impact on the Community

Crawford County will likely continue to see small rock slides in areas that are prone to these types of landslides, however, the probability that these rock slides will have an adverse impact on the county and communities is very low. In areas where roadways may be affected, the clearing of debris is part of the normal operations and maintenance of these roads. There are certain sections of highways where rock falls are expected due to normal weathering. But in most cases the rock falls and debris do not actually fall onto the roadway itself and so do not adversely impact transportation routes in the county.

Recommendation

The county would certainly benefit from an education program to inform citizens, community leaders and developers of the causes, likely locations and dangers of landslides. In addition, those communities that have building codes should review those codes and update them, if necessary, to include the avoidance of building in landslide prone areas.

Hazard Summary – Landslide – All Jurisdictions in Crawford County

Calculated Priority Risk Index	Planning Priority
1.45	Low

3.2.8 Land Subsidence/Sinkholes

Description

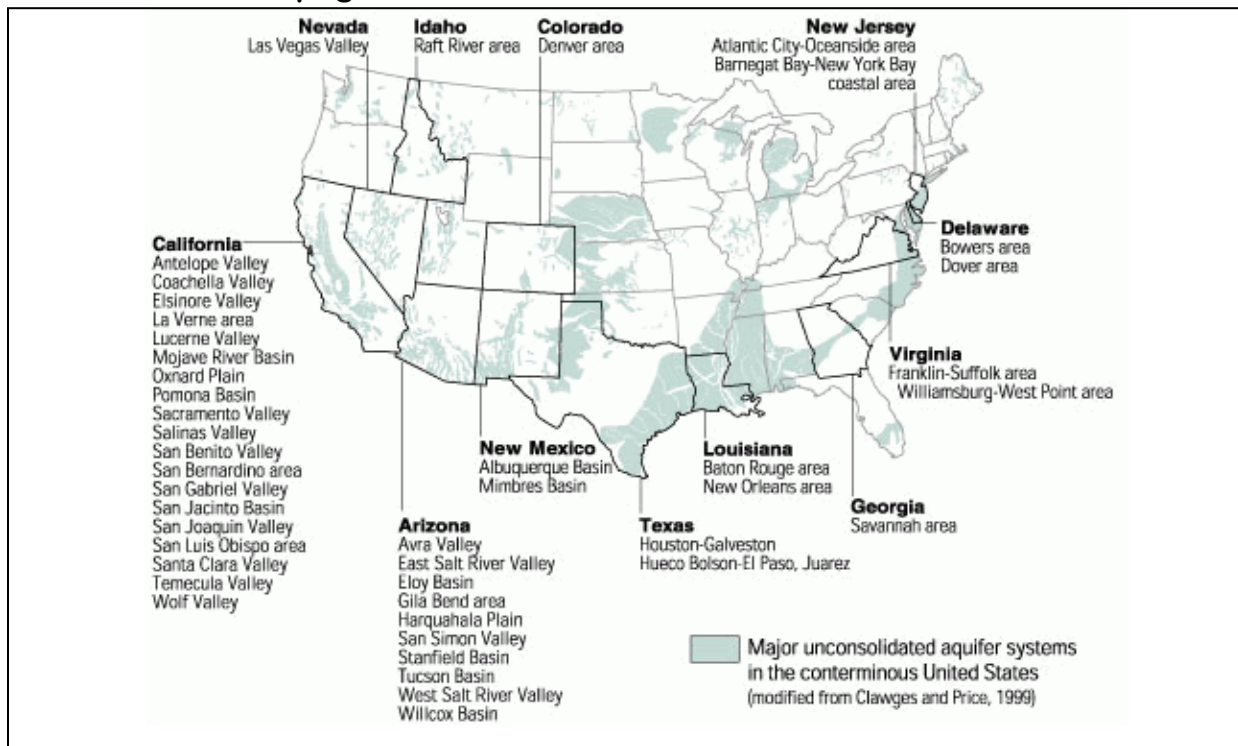
According to the US Geological Survey, land subsidence is the lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction). Land subsidence occurs in nearly every state of the United States.^{xlviii}

Land subsidence occurs when large amounts of ground water have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rock collapses in on itself. Land subsidence typically occurs over large areas rather than in a localized area as a sinkhole does. One of the largest problems associated with land subsidence is the resulting permanent reduction in the total storage capacity of the affected aquifer system. Figure 3-11 shows areas of the country where excessive pumping of groundwater has resulted in land subsidence and possible permanent damage to the local aquifer.^{xlix}

Historically, land subsidence, which is generally attributed to human activities, does not impact the central Ozarks region. The related hazard of sinkholes is the more evident hazard for this part of the state.

A sinkhole is a surface area usually formed when bedrock slowly dissolves, creating voids below ground that can cause depressions on the surface or even result in openings in the ground when

Figure 3-11 Areas of United States Affected by Subsidence Caused by Groundwater Pumpage



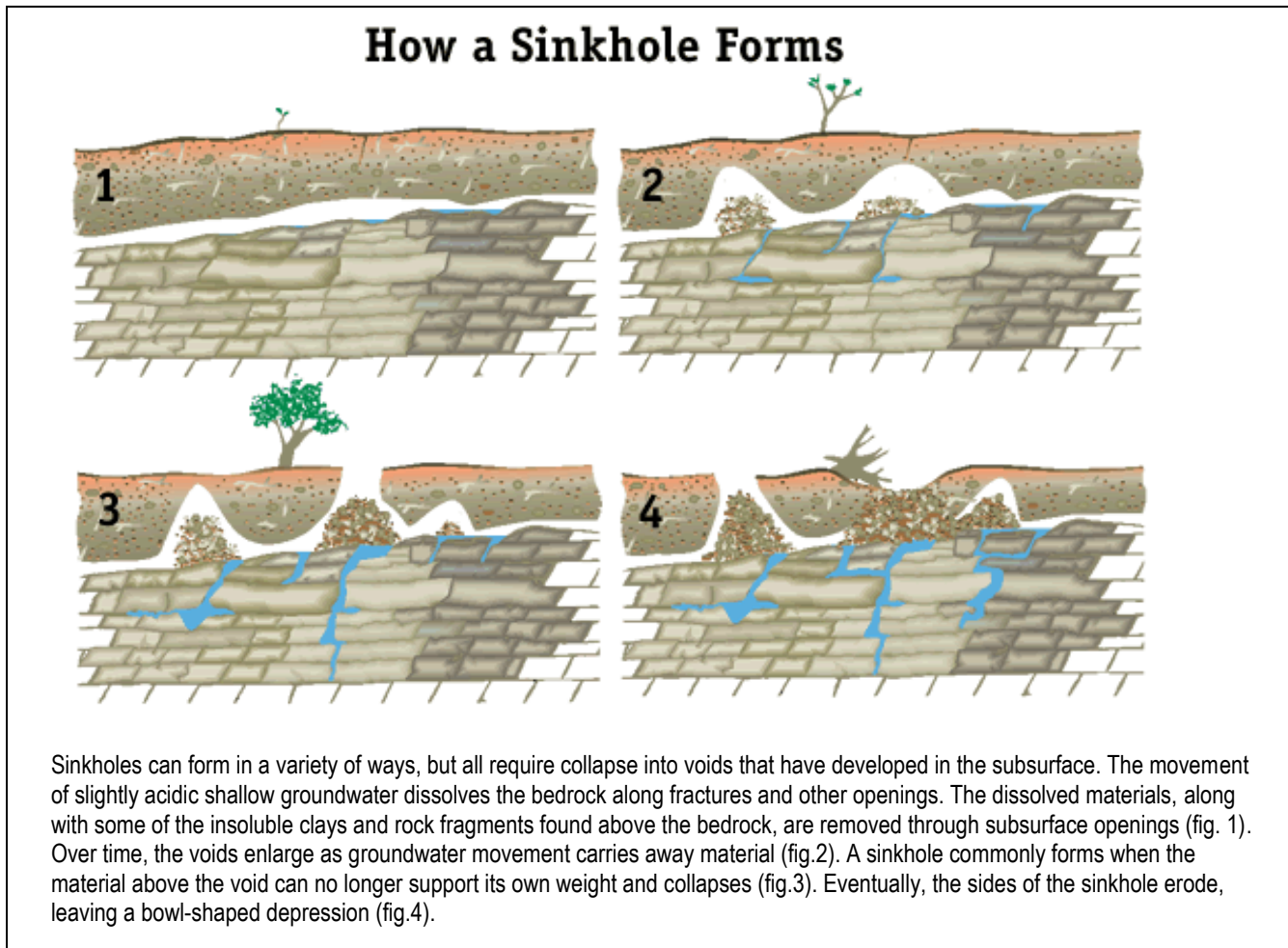
Source: US Geological Survey- <http://ga.water.usgs.gov/edu/earthgwlandsubside.html>

the ceiling of an underlying cave collapses. Typically sinkholes appear as conical depressions in the ground. These geologic features can be very shallow and nondescript or may cover acres of ground and be hundreds of feet deep. Sinkholes are places where water drains into underground fissures and can be direct conduits to an area's groundwater. Springs are typically recharged from sinkholes and losing streams. The illustration in Figure 3-12 shows how sinkholes typically form in the Ozarks region.¹

Although there have not been any reported incidents of sinkholes collapsing and causing personal injury or damage to property in Crawford County, it is not an uncommon occurrence in Missouri. "Sinkhole collapses are a common geologic hazard in areas such as the Ozarks," said Mimi Garstang, former Geological Survey and Resource Assessment (GSRA) division director and state geologist. "Fortunately, most occur in areas away from development and typically don't cause serious damage."^{li}

Most sinkholes are formed by natural processes: the movement of water through soluble rock causing erosion and the formation of voids, but human activity can speed up the process and cause sinkholes to form. Examples include drilling, leaking water and sewer lines, drainage modifications, and leaking lagoons and lakes. In 1948 an incident occurred in St. Francis County where a drilling rig caused numerous sinkholes to form.

Figure 3-12



Sinkholes can form in a variety of ways, but all require collapse into voids that have developed in the subsurface. The movement of slightly acidic shallow groundwater dissolves the bedrock along fractures and other openings. The dissolved materials, along with some of the insoluble clays and rock fragments found above the bedrock, are removed through subsurface openings (fig. 1). Over time, the voids enlarge as groundwater movement carries away material (fig.2). A sinkhole commonly forms when the material above the void can no longer support its own weight and collapses (fig.3). Eventually, the sides of the sinkhole erode, leaving a bowl-shaped depression (fig.4).

Source: "Missouri Resources" magazine, Spring/Summer 2003 – Volume 20 – Number 1, "That Sinking Feeling – a Void, a Collapse" by Jim Van Dyke.

The event was documented by J. Harlen Bretz in the book "Caves of Missouri." Sinkholes began developing around the drilling rig when it encountered voids in the bedrock. By the time the drilling was completed there were an estimated 20 sinkholes in the area around the drill hole. Some were up to 90 feet long and 20 feet wide. It was conjectured that the drilling caused water that was in voids closer to the surface to drain into voids encountered at deeper levels. This resulted in the collapse of the voids closer to the surface as loss of buoyancy and removal of sediments caused the surface collapses.ⁱⁱⁱ

There have been a number of incidents in Missouri where sinkholes have formed and drained lakes. In the 1960s, a lake was built in northern Howell County near the Eleven Point River. A sinkhole formed in the lake bed and drained it. Although attempts were made to repair the hole, the lake has never held water for more than short periods of time. A well publicized sinkhole collapse in the St. Louis region occurred in 2004 when Lake Chesterfield, the centerpiece of an

upscale subdivision in St. Charles County, drained in a matter of days due to a sinkhole collapse. Some \$650,000 was spent to repair the lake, but it continues to leak.^{liii}

Several sewage lagoons in southern Missouri have also been adversely affected by sinkholes, including an incident in West Plains that completely drained the lagoon. In most cases, the communities are forced to abandon the original lagoon site and rebuild elsewhere or use alternate methods of sewage treatment.^{liv}

There have been incidents of damage to homes and property in other parts of the state, such as Springfield and Farmington, when sinkholes formed near or under existing buildings. In some cases the sinkhole was stabilized and the damage to property repaired. However, due to the instability of sinkhole areas, the damage and process are often not reversible and losses can be substantial, as illustrated by the incident involving Lake Chesterfield.

Likely Locations. Sinkholes are a characteristic of karst which is defined as “a landscape characterized by the presence of caves, springs, sinkholes and losing streams, created as groundwater dissolves soluble rock such as limestone or dolomite.”^{lv} As illustrated by Figure 3-13 below, much of the southern half of Missouri has karst topography and has areas conducive to the development of caves and potential sinkholes.

Figure 3-13 Cave Bearing Areas of Missouri

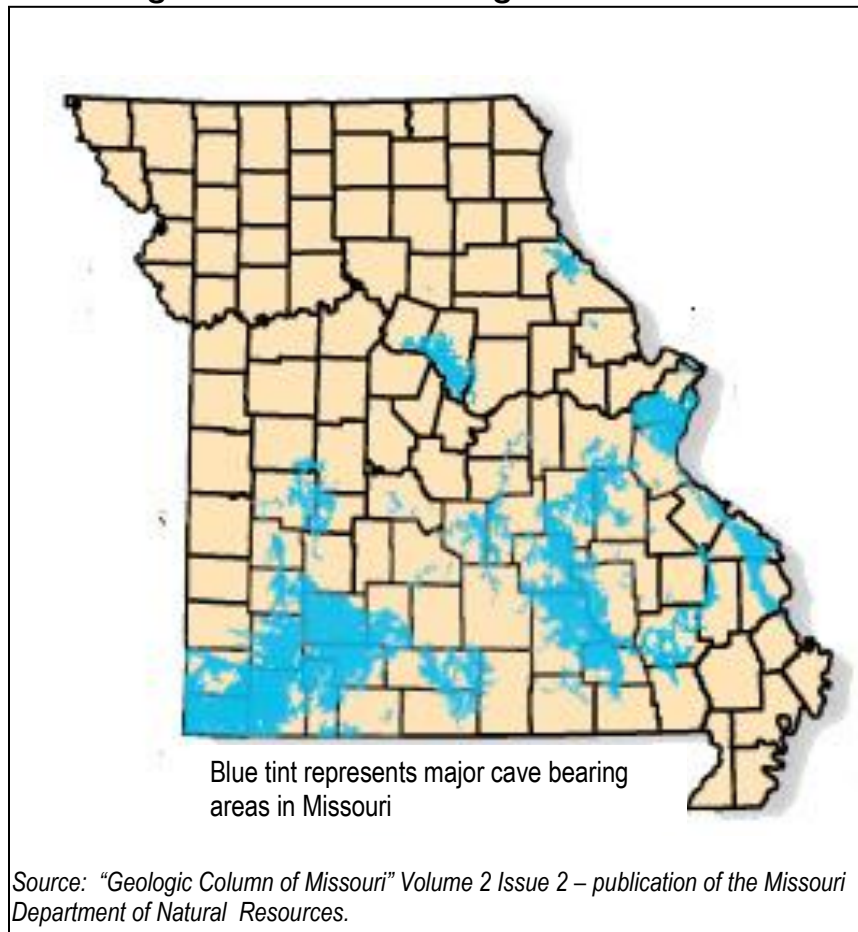
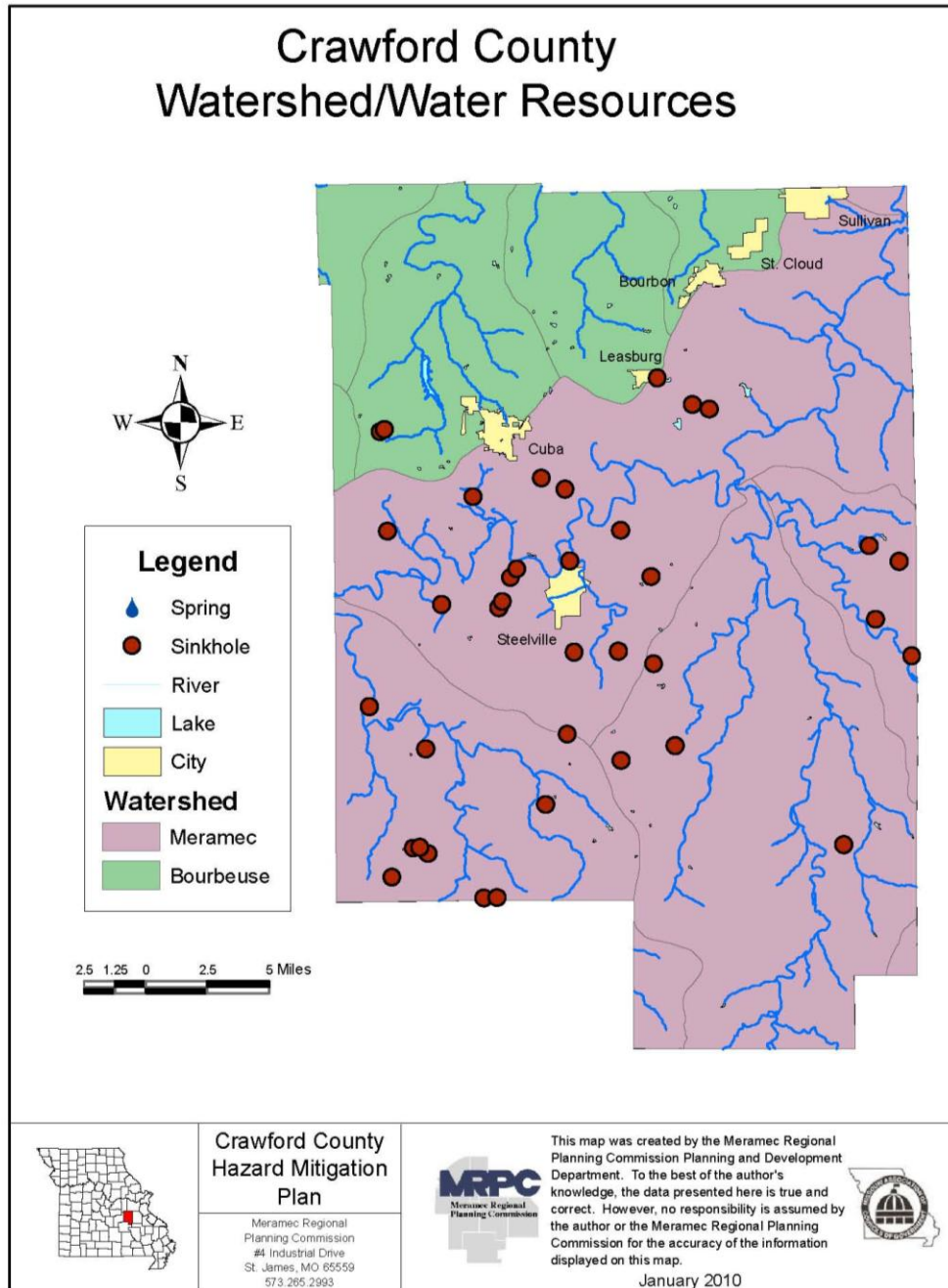


Figure 3-14 is a map of Crawford County water resources, including springs, lakes, rivers, streams, watersheds, and marked in red—sinkholes. As is evidenced by this map, there are a significant number of sinkholes in Crawford County – 37 known sinkholes. The jurisdictions most likely to be impacted by sinkholes are Steelville and Leasburg, which have sinkholes located within or immediately adjacent to their borders. The Steelville R-III School District would also have a slightly higher risk. The other jurisdictions, both cities and school districts, are located in areas of the county where the concentration of sinkholes is lower.

Figure 3-14



Type of Damage

The most likely type of damage to occur in conjunction with a sinkhole collapse is property damage related to foundation disturbance. Signs include cracks in interior and exterior walls; doors and windows that no longer sit square or open and close properly; depressions forming in the yard; cracks in the street, sidewalk, foundation or driveway; and turbidity in local well water. All of these can be early indicators that a sinkhole is forming in the vicinity.^{lvi} In the event of a sudden collapse, an open sinkhole can form in a matter of minutes and swallow lawn, automobiles and homes. This has occurred in some parts of Missouri, particularly in the southwest part of the state, but there have been no dramatic incidents like this in Crawford County.

In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Hazard History

Although there are numerous sinkholes and sinkhole areas in Crawford County, and incidents have occurred in other counties in southern Missouri, there have been no recorded incidents of property damage or injuries due to sinkholes in Crawford County. Based on the map of sinkholes in Crawford County, some of the communities may be more vulnerable to this hazard than the unincorporated parts of the county due to population density and the likelihood of future development. The communities of Steelville and Leasburg each have a sinkhole within their boundaries. The remaining communities appear to lie outside the zone of sinkhole occurrences in the county.

Warning Time and Duration

Sinkhole collapses have historically been sudden and dramatic. In some cases, as in a sinkhole forming under a structure, there are warning signs such as cracks in foundations and obvious shifts in the structure itself. But most sinkhole collapses in Missouri have been characterized as abrupt and with little or not warning. The initial collapse may be immediate, but the area will often remain unstable for more than a few days.

Probable warning time of less than six hours for sink hole collapse (4). Duration of less than one week (3).

Statement of Severity/Magnitude

This hazard appears to have varying magnitude for the jurisdictions. Crawford County's risk would be considered negligible due to lower population density and the lack of public facilities that might be vulnerable – such as waste water treatment facilities. The risk to the communities of Bourbon, Cuba, St. Cloud, Sullivan and West Sullivan, as well as the Crawford County R-I, Crawford County R-II and Sullivan C-2 school districts would also be negligible as there are no sinkholes in close proximity to these jurisdictions or jurisdiction facilities:

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged.

Even though no sinkhole collapses have occurred in the county, the communities of Steelville and Leasburg, as well as the Steelville R-III School District, could be considered at higher risk. Both communities have a sinkhole within their boundaries. The magnitude would be rated as:

Limited (2) – Injuries and/or illnesses do not result in permanent disability; complete shutdown of critical facilities for more than one week; 10-24 percent of property is severely damaged.

This difference in magnitude does not change their overall planning priority—that still remains low. But as the possible severity of an incident could be greater, it was necessary to highlight the differences between these jurisdictions.

There is certainly the possibility of damage occurring in the future from this hazard because sinkholes are a common feature in parts of Crawford County. However, as there have been no



Snake Pit Sink, Crawford County

incidents to date, development typically avoids areas with sinkholes, and the incident would be localized, the severity of a sinkhole collapse would likely not be great. The exception would be if a sinkhole damaged a critical public facility such as a water treatment plant or sewage lagoon. This has occurred in other parts of the state and had a sizeable negative impact on the community that suddenly lost its water or sewage treatment facility. In this type of situation, the entire population served by that public facility would be dramatically affected and would likely have to cover the cost of repairing or replacing the facility.

Statement of Probable Risk/Likelihood of Future Occurrence

Unlikely (1) – Event is possible within the next 10 years; event has up to one in 10 years chance of occurring; history of events is less than or equal to 10 percent likely per year. From a historical point of view, Crawford County has not had problems with sinkholes and the likelihood of a future occurrence would be considered unlikely based on the CPRI. However, there is potential for this type of hazard to occur in Crawford County. There are portions of the county where sinkholes and underground caverns exist. This risk can be reduced by educating the public about sinkholes and discouraging development in areas where sinkholes are likely to occur.

Statement of Next Disaster’s Likely Adverse Impact on the Community

If a sinkhole collapse should occur in a developed area of Crawford County, the incident itself would be localized and would affect a relatively small area. If it occurs in a residential

neighborhood, one or two homeowners could be affected. If the collapse should occur under public infrastructure, such as a road or sewer treatment facility, the impact could be far greater. The sewer treatment facilities in West Plains and Republic, Missouri were eventually abandoned and new facilities had to be built with public funds, which affected all of the residents of those communities.^{lvii} Even in a situation where the collapse would affect a residential area, costs could be considerable. The draining of Lake Chesterfield had a significant negative impact on the value of the homes in that area. Residents spent \$650,000 in an effort to repair the lake, but in the end were not successful in stopping the lake from leaking.^{lviii}

Recommendation

Sinkholes and sinkhole areas are well documented by both the US Geological Survey and the Missouri Department of Natural Resources Geologic Resources Section. The risk of sinkhole collapse can be lessened by avoiding the construction of structures in these areas and avoiding those activities that significantly alter the local hydrology, such as drilling and mining. In addition, communities should avoid leaking water and sewer lines through appropriate maintenance and monitoring. Local residents should be educated on the risks associated with sinkholes and advised to avoid placing themselves and their property in danger by building in sinkhole areas. Communities with building codes should include prohibitions on building in known sinkhole areas.

Hazard Summary – Sinkhole – Crawford County, Cities of Bourbon, Cuba, St. Cloud, Sullivan and West Sullivan, and Crawford County R-I, Crawford County R-II and Sullivan C-2 School Districts

Calculated Priority Risk Index	Planning Priority
1.45	Low

Hazard Summary – Sinkhole – Cities of Leasburg and Steelville, Steelville R-III School District

Calculated Priority Risk Index	Planning Priority
1.95	Low

3.2.9 Severe Storms (Hail Storm/Wind Storm)/Tornado

Description

Despite their small size, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornados. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornados are also dangers associated with some thunderstorms. Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles in diameter and lasts an average of 20 to 30 minutes. Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe.

Tornados are cyclical windstorms often associated with the Midwestern areas of the United States. According to the National Weather Service, Missouri ranks 8th in the nation for frequency of tornados.^{lix} Weather conditions which are conducive to tornados often produce a wide range of other dangerous storm activities, including severe thunderstorms, downbursts, straight line winds, lightning, hail, and heavy rains.

Essentially, tornados are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles an hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside. Although tornados have been documented in every state, most of them occur in the central United States. The unique geography of the central United States allows for the development of the thunderstorms that spawn tornados. The jet stream, which is a high velocity stream of air, determines which area of the central United States will be prone to tornado development. The jet stream normally separates the cold of the north from the warm of the south. During the winter, the jet stream flows west to east over Texas to the Carolina coast. As the sun "moves" north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move north in the spring and its recession south during the fall, it crosses Missouri causing the large thunderstorms that breed tornados.

Tornados spawn from the largest thunderstorms. These cumulonimbus clouds can reach heights of up to 55,000 feet above ground level and are commonly formed when moist gulf air is warmed by solar heating. The moist warm air is overridden by the dry cool air provided by the jet stream. This cold air presses down on the warm air preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air and the cool air moves downward past the rising warm air. Adding to all this is the deflection of the earth's surface, and the air masses will start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky, it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

A typical tornado can be described as a funnel shaped cloud that is "anchored" to a cloud, usually a cumulonimbus that is also in contact with the earth's surface. This contact is, on the average, for 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards wide. However, tornados can stay on the ground for upward of 300 miles and can be up to a mile wide. The National Weather Service, in reviewing tornados occurring in Missouri between 1950 and 1996, calculated the mean path length was 2.27 miles and the mean path area was 0.14 square miles.

The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornados have been known to move in any direction. Tornados are most likely to occur between 3 p.m. and 9 p.m. in the afternoon and evening, but have been known to occur at all hours of the day or night.^{lx}

The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado. Thunderstorms may occur singly, in clusters or in lines. Some of the most severe

weather occurs when a single thunderstorm affects one location for an extended time. Lightning is a major threat during a thunderstorm. It is the lightning that produces thunder in a thunderstorm. Lightning is very unpredictable, which increases the risk to individuals and property. In the United States, 75 to 100 people are killed each year by lightning, although most lightning victims do survive.^{lxi}

Tornados are the most concentrated and violent storms produced by the earth's atmosphere. They are created by a vortex of rotating winds and strong vertical motion, which possess remarkable strength and cause widespread damage. Wind speeds in excess of 300 mph have been observed within tornados, and it is suspected that some tornado winds exceed 400 mph. The low pressure at the center of a tornado can destroy buildings and other structures it passes over. Most are caused by intense local thunderstorms. Most tornados are just a few dozen yards wide and only briefly touch down, but highly destructive violent tornados may carve out paths over a mile wide and more than 50 miles long.^{lxii}

Seasonal Pattern

In Missouri, tornados occur most frequently between April and June, with April and May usually producing the most tornados. However, tornados can occur at any time of the year. While tornados can occur at any time of the day or night, they are most likely to occur between 3 p.m. and 9 p.m. Missouri averages 24 tornados per year and has recorded 1,383 tornados from 1950 through 2008. Missourians have a high probability that tornados will continue to affect their lives.

Type of Damage

Every tornado is a potential killer and many are capable of great destruction. Tornados can topple buildings, roll mobile homes, uproot trees, hurl people and animals through the air for hundreds of yards, and fill the air with lethal, windblown debris. Sticks, glass, roofing material, and lawn furniture all become deadly missiles when driven by a tornado's winds. Tornados do their destructive work through the combined action of their strong rotary winds and the impact of windblown debris. In the simplest cases, the force of the tornado's winds pushes the windward wall of a building inward. The roof is lifted up and the other walls fall outward. Until recently, this damage pattern led to the incorrect belief that the structure had exploded as a result of the atmospheric pressure drop associated with the tornado.^{lxiii}

A system of measurement has been developed to define the severity of a tornado based on wind speed and damage. This is known as the Fujita Scale, first proposed by Dr. Theodore Fujita in 1971. This scale is used by meteorologists to estimate the speed of winds after a tornado by studying the damage caused by the tornado to structures, not the appearance of the tornado. Different points on the scale are measured using the definitions in Table 3.10.

Table 3.10
The Fujita Scale of Tornado Definitions

Status	Definition
F0	(Light Damage) 40-72 mph. Chimneys are damaged, tree branches are broken, shallow-rooted trees are toppled.
F1	(Moderate Damage) 73-112 mph. Roof surfaces are peeled off, windows are broken, some tree trunks are snapped, unanchored manufactured homes are over-turned, attached garages may be destroyed.
F2	(Considerable Damage) 113-157 mph. Roof structures are damaged, manufactured homes are destroyed, debris becomes airborne (missiles are generated), large trees are snapped or uprooted.
F3	(Severe Damage) 158-260 mph. Roofs and some walls are torn from structures, some small buildings are destroyed, non-reinforced masonry buildings are destroyed, most trees in forest are uprooted.
F4	(Devastating Damage) 207-260 mph. Well-constructed houses are destroyed, some structures are lifted from foundations and blown some distance, cars and large objects are blown some distance.
F5	(Incredible Damage) 261-318 mph. Strong frame houses are lifted from foundations, reinforced concrete structures are damaged, automobile-sized debris becomes airborne, trees are completely debarked.

Source: <http://www.disastercenter.com/tornado/fujita.htm>

In February 2007, an enhanced version of the Fujita Scale was adopted by meteorologists in the U.S. Table 3.11 shows both the Fujita Scale and the Enhanced Fujita Scale.

Storm winds can damage buildings, power lines and other property and infrastructure due to falling trees and branches. Severe thunderstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric service and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from severe thunderstorms related to both physical damages and interrupted services.

**Table 3.11
Enhanced F Scale for Tornado Damage**

An update to the original F-scale by a team of meteorologists and wind engineers, implemented in the U.S. on 1 February 2007.

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

IMPORTANT NOTE ABOUT ENHANCED F-SCALE WINDS: The Enhanced F-scale still is a set of wind estimates (not measurements) based on damage. Its uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed below. These estimates vary with height and exposure. **Important:** The three second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures, using a directly measured, "one minute mile" speed.

Source: National Oceanic and Atmospheric Administration - <http://www.spc.noaa.gov/efscale/ef-scale.html>

Falling trees are a major cause of power outages. Strong winds can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Utility lines brought down by summer thunderstorms have also been known to cause fires, which start in dry roadside vegetation. Falling trees can bring electric power lines down to the pavement, creating the possibility of lethal electric shock. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from severe thunderstorms as more life and property are exposed to risk.

Hail is another hazard associated with thunderstorms. A hailstorm forms when updrafts carry raindrops into extremely cold portions of the atmosphere where the drops condense and freeze. Hail falls when it becomes heavy enough to overcome the strength of the updraft and gravity

takes over. The onset of hailstorms is generally very rapid and difficult to predict. The following table illustrates the different sizes and intensities of hail as well as the type of damage associated with each category.

Table 3.12 Hailstorm Intensity Scale

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2 - 0.4	Pea	No damage.
Potentially Damaging	10-15	0.4 – 0.6	Mothball	Slight general damage to plants, crops.
Significant	16-20	0.6 – 0.8	Marble, grape	Significant damage to fruit, crops, vegetation.
Severe	21-30	0.8 – 1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored.
Severe	31-40	1.2 – 1.6	Pigeon’s egg > Squash ball	Widespread glass damage, vehicle bodywork damage.
Destructive	41-50	1.6 – 2.0	Golf ball > Pullet’s egg	Wholesale destruction of glass, damage to tiles roofs, significant risk of injuries.
Destructive	51-60	2.0 – 2.4	Hen’s egg	Bodywork of grounded aircraft dented, brick walls pitted.
Destructive	61-70	2.4 – 3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries.
Destructive	71-80	3.0 – 3.5	Large orange > softball	Severe damage to aircraft bodywork.
Super Hailstorm	81-90	3.6 – 3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open.
Super Hailstorm	> 100	4.0 +	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open.

Source: Tornado and Storm Research Organization.

In regards to unique construction characteristics or other conditions which may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Hazard History

Crawford County lies along the eastern edge of tornado alley and received on average a tornado every four years. From 1950 to 2010 Crawford County recorded 16 tornados from F0 to F2 in strength. One tornado event caused damage in excess of \$25 million. Recorded tornados in Crawford County since 1950 are shown in Table 3.13. No deaths have occurred in Crawford County due to tornados. However, two people have been injured.

Table 3.13 Tornado History – Crawford County^{lxiv}

Date	Location	Magnitude	Number injured/killed	Property Damage
April 14, 1974	Crawford Co	F2	0 injured, 0 killed	\$250,000
April 15, 1982	Crawford Co	F2	0 injured, 0 killed	\$250,000
December 2, 1982	Crawford Co	F2	1 injured, 0 killed	\$250,000
November 15, 1988	Crawford Co	F1	1 injured, 0 killed	\$25,000,000

Date	Location	Magnitude	Number injured/killed	Property Damage
June 7, 1990	Crawford Co	F1	0 injured, 0 killed	\$0
September 13, 1993	Crawford Co	F1	0 injured, 0 killed	\$500,000
September 13, 1993	Leasburg	F0	0 injured, 0 killed	\$5,000
September 13, 1993	Cooks Station	F0	0 injured, 0 killed	\$5,000
September 13, 1993	Steelville	F0	0 injured, 0 killed	\$5,000
December 23, 1996	Dillard	F0	0 injured, 0 killed	\$0
June 17, 1997	Cuba	F0	0 injured, 0 killed	\$0
June 1, 1999	Steelville	F0	0 injured, 0 killed	\$1,000
September 22, 2006	Leasburg	F0	0 injured, 0 killed	\$0
September 22, 2006	Leasburg	F1	0 injured, 0 killed	\$0
April 30, 2010	Cooks Station	F1	0 injured, 0 killed	\$0
December 31, 2010	Jake Prairie	F1	0 injured, 0 killed	\$0
TOTALS			2 injured, 0 killed	\$26,266,000

Source: National Oceanic and Atmospheric Administration - <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

Historical data furnished by the National Climatic Data Center show tornados have touched down in unincorporated parts of the county as well as Leasburg, Cooks Station, Steelville, Dillard and Cuba since 1950. Over the past 60 years, Crawford County has had approximately \$26,266,000 in property damage attributed to tornados.

Thunderstorm winds, while not as powerful as tornados, are still a cause for concern in Crawford County. The damaging winds of thunderstorms include downbursts, microbursts and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.^{lxv}

The National Oceanic and Atmospheric Administration reports 90 incidences of thunderstorms with high winds in Crawford County since 1950, typically occurring two to five times per year. These thunderstorm winds often result in the uprooting of trees, which may cause damage to nearby power lines, buildings or homes. Crawford County has been fortunate that despite the large number of damaging windstorms, only seven incidents resulted in reported property damage. Since 1950, the county has suffered \$172,000 in property damage due to strong winds and thunderstorms.

Another hazard associated with thunderstorms is lightning. Lightning kills 75 to 100 people in the United States each year. On August 11, 1993, two people were struck by lightning and killed in Crawford County.

Hail is a fairly common weather activity in Crawford County, having occurred 81 times in the last 59 years. As hail is a hazard typically covered by individual insurance, damage data is not well documented for hail storms. Large hail can reach the size of grapefruit. Hail causes several

hundred millions of dollars in damage annually to property and crops across the nation. The size of hailstones in Crawford County has been recorded as large as 2.75 inches in diameter in 1959, 1971 and again in 2006, but typically hail stones are much smaller. While hail can be damaging, it has typically been mild in Crawford County and only caused \$5,000 in property damages since 1950.^{lxvi}

Table 3.14 lists those thunderstorm and high wind events that caused damage in Crawford County, as well as all hail events recorded for Crawford County.

Table 3.14 List of All Hail Storms and Thunderstorms/High Winds Resulting in Property Damage or Injuries in Crawford County 1950-2009

Location	Date	Type	Magnitude	Property Damage
County	June 7, 1957	Hail	1.00 in.	0
County	September 26, 1959	Hail	2.75 in.	0
County	March 25, 1963	Hail	1.00 in.	0
County	June, 2, 1965	Hail	1.50 in.	0
County	July 15, 1971	Hail	2.75 in.	0
County	April 24, 1975	Hail	0.75 in.	0
County	May 6, 1975	Hail	1.50 in.	0
County	April 28, 1977	Hail	1.75 in.	0
County	April 29, 1981	Hail	1.75 in.	0
County	July 20, 1981	Hail	1.00 in.	0
County	June 2, 1985	Hail	0.75 in.	0
County	May 16, 1990	Hail	1.75 in.	0
Bourbon	April 19, 1993	Hail	0.75 in.	0
County	August 11, 1993	Lightning	2 Deaths	0
Steelville	April 10, 1994	Hail	0.75 in.	0
Cuba	April 26, 1994	Thndstrm Wind	0 kts.	\$60,000
Cooks Station	June 26, 1994	Hail	1.75 in.	\$5,000
Cuba	May 18, 1995	Hail	1.75 in.	0
Sullivan	May 18, 1995	Hail	1.75 in.	0
Steelville	July 8, 1995	Thndstrm Wind	0 kts.	\$3,000
Ellington	July 8, 1995	Hail	0.75 in.	0
Bourbon	July 25, 1995	Hail	0.75 in.	0
Cuba	April 19, 1996	Hail	1.75 in.	0
Steelville	April 28, 1996	Hail	0.88 in.	0
Bourbon	July 28, 1996	Hail	1.75 in.	0
Cuba	October 17, 1996	Hail	0.75 in.	0
Cuba	April 13, 1998	Hail	0.75 in.	0
Cuba	February 27, 1999	Hail	1.75 in.	0
Bourbon	February 27, 1999	Hail	1.00 in.	0
Steelville	March 5, 1999	Hail	0.75 in.	0
Steelville	June 27, 1999	Thndstrm Wind	56 kts.	\$35,000
Steelville	February 13, 2000	Hail	0.75 in.	0
Cherryville	April 7, 2000	Hail	1.00 in.	0
Cuba	May 12, 2002	Hail	0.75 in.	0

Location	Date	Type	Magnitude	Property Damage
Steelville	May 12, 2002	Hail	0.88 in.	0
Steelville	July 10, 2002	Thndstrm Wind	55 kts.	\$100,000
Cuba	December 18, 2002	Hail	1.00 in.	0
Bourbon	June 10, 2003	Hail	0.75 in.	0
Bourbon	August 2, 2003	Hail	0.88 in.	0
Leasburg	August 6, 2003	Hail	0.88 in.	0
Cuba	August 21, 2003	Hail	0.88 in.	0
Cherryville	April 22, 2004	Hail	1.75 in.	0
Bourbon	April 20, 2005	Hail	0.88 in.	0
Bourbon	April 21, 2005	Hail	0.88 in.	0
Cuba	April 21, 2005	Hail	0.88 in.	0
Cuba	June 13, 2005	Hail	0.75 in.	0
Bourbon	June 13, 2005	Hail	0.75 in.	0
Davisville	February 16, 2006	Hail	1.00 in.	0
Davisville	March 11, 2006	Hail	1.00 in.	0
Steelville	March 11, 2006	Hail	2.75 in.	0
Cherryvill	March 11, 2006	Hail	1.00 in.	0
Wesco	March 11, 2006	Hail	1.75 in.	0
Cooks Station	March 11, 2006	Hail	1.75 in.	0
Cuba	April 2, 2006	Hail	1.75 in.	0
Bourbon	April 2, 2006	Hail	0.88 in.	0
Steelville	April 2, 2006	Hail	1.00 in.	0
Steelville	April 22, 2006	Hail	1.00 in.	0
Bourbon	April 23, 2006	Hail	1.75 in.	0
Cuba	September 22, 2006	Hail	1.00 in.	0
Bourbon	September 22, 2006	Hail	1.75 in.	0
Leasburg	September 22, 2006	Hail	0.88 in.	0
Cuba	March 31, 2007	Hail	0.75 in.	0
Steelville	May 25, 2008	Thndstrm Wind	50 kts.	\$5,000
Cuba	May 25, 2008	Thndstrm Wind	52 kts.	\$5,000
Bourbon	May 25, 2008	Thndstrm Wind	50 kts	\$2,000
Cuba	August 28, 2008	Hail	1.00 in.	0
Steelville	August 28, 2008	Hail	0.75 in.	0
Cuba	May 8, 2009	Hail	1.00 in.	0
Bourbon	May 8, 2009	Hail	1.00 in.	0

Source: National Oceanic and Atmospheric Agency, National Climatic Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.dll?wwevent~storms>

Seasonal Patterns

Thunderstorms, high winds, hail and tornados are typically associated with spring and summer weather patterns. However, these types of storms can occur at any time during the year provided the conditions are right, as evidenced in the table above.

Warning Time and Duration

Significant advances have occurred over the past decade in predicting and tracking severe storms and tornados. Severe thunderstorms can develop and change direction quickly, making it difficult

to adequately inform both heavily populated and sparsely populated areas. While a thunderstorm may be predicted, its severity and the chance of tornado development are less predictable. Tornado warning sirens exist in Bourbon, Cuba, Leasburg, Steelville and Sullivan, but not in West Sullivan. Several radio stations in the area and television stations in the region provide updates when severe weather threatens Crawford County. Weather radios also provide an early warning.

Probable warning time of less than six hours (4). Duration of less than six hours (1).

Statement of Severity/Magnitude

Because the severity or magnitude is different for severe storms and tornados, each of these hazards has been rated on the CPRI separately to provide a more complete hazard analysis.

Tornados

Limited (2) - Injuries and/or illnesses do not result in permanent disability; complete shutdown of critical facilities for more than one week; 10-24 percent of property is severely damaged.

Each class of tornado will cause different degrees of damages and will only strike certain parts of the county. For example, a lower strength tornado may cause limited damage in a larger portion of the county while a high strength tornado may cause significant damage in a smaller area of the county. Based on past history of almost 60 years for Crawford County, there have been two injuries in 15 incidents and no deaths. Out of 16 tornados, three were rated as F2 tornados – all the rest were F1 or smaller. However, as can be evidenced by tornados like the one that struck Greenville, KS, tornados have the potential to exact catastrophic damage and this knowledge should be factored into the assessment. Based on historical data and the potential magnitude of damage that tornados can inflict, the probably magnitude of future events is rated as limited.

Severe Storms

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. Despite the frequency of severe thunderstorms in Crawford County, storms causing damage in regards to high winds and hail have been relatively few. In almost 60 years the county has sustained a total of \$215,000 in property damage from thunder and hail storms. In that same timeframe, two people have died from lightning strikes.

Statement of Probable Risk/Likelihood of Future Occurrence

Because the probability of future occurrence is different for severe storms and tornados, each of these two hazards has been rated on the CPRI separately to provide a more complete hazard analysis.

Tornados

Occasional (2) – Event is probable within the next five years; event has up to one in five years chance of occurring; history of events is greater than 10 percent but less than or equal to 20 percent likely per year. The probability of tornados is low, with tornados occurring in the county on an average of every three to four years. Historically, the county has been fortunate that these storms have not caused extensive damage.

Severe Storms

Highly Likely (4) – event is probable within one year—a near 100 percent probability of occurring. Severe thunderstorms are virtually guaranteed to occur in the future in Crawford County. On average several severe storms occur each year. Based on historic information, it is highly likely that a severe storm, possibly including high winds and hail will occur at least once each year and affect a majority of the county. However, the strength of these thunderstorms is generally low with little or no damage.

Statement of Next Disaster’s Likely Adverse Impact on the Community

It is likely that the next disaster’s impact on Crawford County will be limited based on data for previous severe thunderstorms and tornados. While there is a slight possibility of strong winds, there has been little damage done to commercial or residential structures in the past. The county has had a total of \$26,266,000 in damages from nine tornados. One tornado, in 1988, accounted for \$25 million of that total. No lives were lost in the past 60 years from tornados. Two people died in the same lightning strike in 1993. Mitigation activities may provide a more secure prediction that loss of life will be negligible in the future.

Recommendation

Early warnings are possibly the best hope for residents when severe weather strikes. While more than two hours warning is not possible for tornados, citizens must immediately be aware when a city will be facing a severe weather incident. Cities that do not already possess warning systems should plan to purchase a system. Storm shelters are another important means of mitigating the effects of tornados and severe thunderstorms. A community-wide shelter program should be adopted for residents who may not have adequate shelter in their homes. Residents should also be encouraged to build their own storm shelters to prepare for emergencies. Local governments should encourage residents to purchase weather radios to ensure that everyone has sufficient access to information in times of severe weather.

Hazard Summary – Tornado For All Jurisdictions in Crawford County

Calculated Priority Risk Index	Planning Priority
2.2	Moderate

Hazard Summary – Thunderstorm/High Wind/Hail For All Jurisdictions In Crawford County

Calculated Priority Risk Index	Planning Priority
3.0	High

3.2.10 Severe Winter Weather

Description

Severe winter weather, including snowstorms, ice storms and extreme cold, can affect any area of Missouri. The greatest threat is likely to occur in the area north of the Missouri River, as was

the case with the devastating Kansas City area ice storm on January 31, 2002, which stretched into central Missouri and led to a Presidential Disaster Declaration. However, there have been several ice storms in the past ten years that have affected the Ozarks. Severe weather, such as snow, ice storms and extreme cold can cause injuries, deaths and property damage in a variety of ways.^{lxvii}

A winter storm can range from a moderate snow over a few hours to blizzard conditions with blinding wind-driven snow that lasts several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely reduce visibility.

Winter storms can be defined differently in various parts of the country. Heavy snow in the south can be a dusting in the mountains. Sleet is raindrops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects; however, it can accumulate like snow and cause a hazard to motorists. Freezing rain is rain that falls onto a surface with a temperature below freezing; this causes it to freeze to surfaces, such as trees, cars, and roads, forming a glaze of ice. Even small accumulations of ice can cause a significant hazard. An ice storm occurs when freezing rain falls and freezes immediately on impact; communications and power can be disrupted for days or weeks, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Likely Locations. While severe winter weather is more prevalent north of the Missouri River, it frequently strikes all of Crawford County during its seasonal pattern and often takes the form of ice storms, which are often more destructive than snow storms. No part of the county or the communities located within the county is exempt from this natural hazard.

Type of Damage

Winter storms are considered deceptive killers. This is because most deaths are indirectly related to the storm. Causes of death range from traffic accidents due to adverse driving conditions such as icy roads, to heart attacks caused by overexertion while shoveling snow and other related activities. Hypothermia or frostbite may be considered the most direct cause of death and injuries, which can be attributed to winter storms and/or severe cold. Economic costs are also difficult to measure. Heavy accumulations of ice can bring down trees, electric power lines and poles, telephone lines and communications towers. Such power outages create an increased risk of fire, as home occupants seek use of alternative fuel sources (wood, kerosene, etc. for heat, and fuel burning lanterns or candles for emergency lighting). Crops, trees and livestock can be killed or injured due to deep snow, ice or severe cold. Buildings and automobiles may be damaged from falling tree limbs, power lines and poles. Local governments, home and business owners and power companies can be faced with spending millions of dollars for restoration of services, debris removal and landfill hauling.^{lxviii} In regards to unique construction characteristics or other conditions which may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

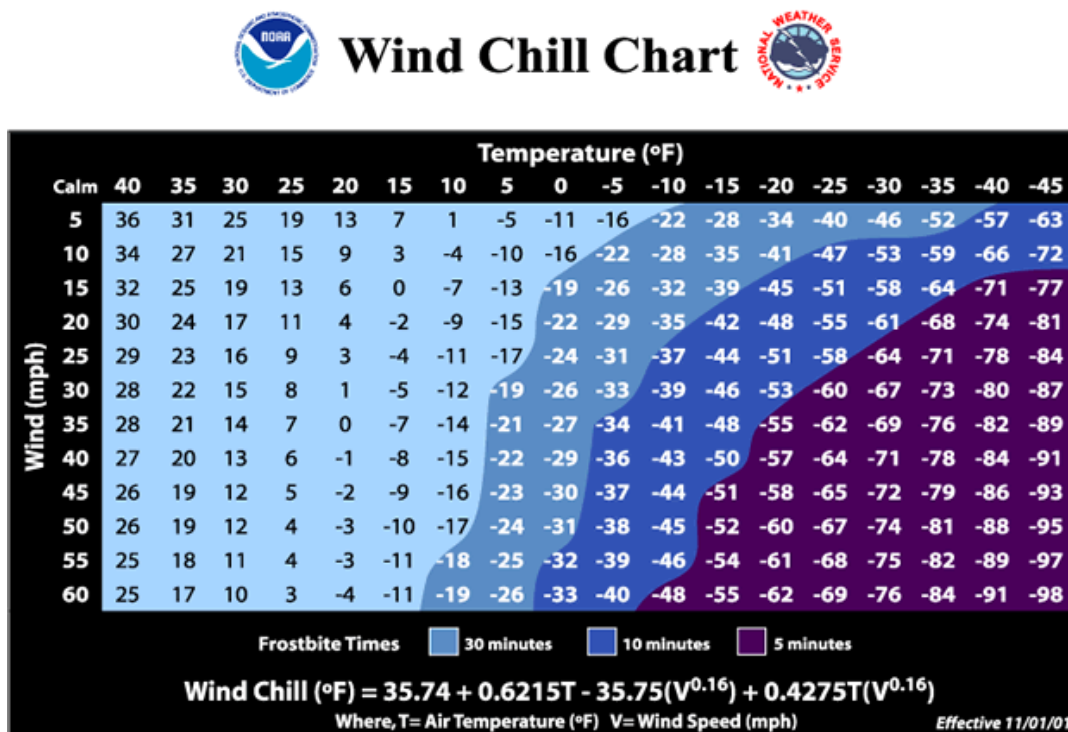
Winter weather warnings are set up in stages of severity by the National Weather Service. These stages are as follows:

- **Winter Weather Advisory:** Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If caution is exercised, these situations should not become life threatening. The greatest hazard is often to motorists.
- **Winter Storm Watch:** Severe winter conditions have begun or are about to begin.
- **Blizzard Warning:** Snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill.
- **Frost/Freeze Warning:** Below freezing temperatures are expected and may cause significant damage to plants, crops, or fruit trees. In areas unaccustomed to freezing temperatures, people who have homes without heat need to take added precautions.

In addition to snow, the effects of temperature and wind chill increase the severity of a winter storm. Wind blowing across exposed skin drives down the skin temperature and eventually the internal body temperature. The faster the wind blows, the faster the heat is carried away, the greater the heat loss and the colder it feels. Exposure to low wind chills can be life threatening to humans and animals.

A new Wind Chill Temperature Index took effect on November 1, 2001, replacing the original wind chill index that was devised in 1945. To find the Wind Chill Temperature Index from the table that follows, find the air temperature along the top of the table and the wind speed along the left side. The point where the two intersect is the wind chill temperature.

Figure 3-15



Source: National Oceanic and Atmospheric Administration

Hazard History

Severe winter weather typically strikes Missouri more than once every year. Crawford County receives the gamut of winter weather events from heavy snows to freezing rain. Major snowstorms happen at least once each year causing multiple school closings and suspended business and government activity. Anywhere from one to fifteen inches of snow is possible and one to three inches of ice. Storms can last from less than an hour to several days. Damages are usually minimal and no deaths are attributed to severe weather in Crawford County. However, icy conditions often make roads hazardous and automobile accidents are frequent occurrences.

Since 1994, more than \$5.8 million in property damage has been reported from winter storms and extreme cold weather that affected the southern half of the state, including Crawford County. However, only a small portion of that overall damage can be attributed to Crawford County.

A major winter storm on November 30, 2006, caused a combination of freezing rain, sleet, and heavy snow to fall over sections of southwest and central Missouri. The frozen precipitation began on the 30th and fell as freezing rain and sleet, with ice accumulations up to four inches in some areas. The second wave of precipitation occurred overnight causing large amounts of snow to accumulate over the ice. Crawford County was one of several counties affected. Downed power lines resulted in widespread power outages. Many residents went without power for several days.

According to the National Climatic Data Center, there have been a total of 36 extreme cold, snow or ice events reported in Crawford County since 1950. Table 3.15 shows the dates, type of storm, magnitude and property damage estimates for each event.

Table 3.15 Snow and Ice Storms in Crawford County 1994-2009

Location	Date	Type	Magnitude	Property Damage
Multi-County	1/14/1994	Extreme Cold	0 Deaths, 15 Injuries	\$5,000,000
Multi-County	4/5/1994	Winter Storm	0 Deaths, 0 Injuries	\$500,000
Multi-County	1/3/1995	Extreme Cold	2 Deaths, 6 Injuries	0
Multi-County	1/06/1995	Glaze of Ice	0 Deaths, 0 Injuries	\$300,000
Multi-County	12/18/1995	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/2/1996	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	11/25/1996	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	1/8/1997	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/15/1997	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/27/1997	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/8/1997	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/12/1998	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	3/8/1998	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/21/1998	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/1/1999	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/13/1999	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	3/13/1999	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/28/2000	Winter Storm	0 Deaths, 0 Injuries	0

Location	Date	Type	Magnitude	Property Damage
Multi-County	3/11/2000	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/13/2000	Heavy Snow	0 Deaths, 0 Injuries	0
Multi-County	2/21/2001	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	2/25/2002	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/4/2002	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/24/2002	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	2/23/2003	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/13/2003	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/25/2004	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	11/24/2004	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/8/2005	Winter Storm	2 Deaths, 0 Injuries	0
Multi-County	11/30/2006	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/1/2006	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	1/12/2007	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	12/8/2007	Winter Weather	0 Deaths, 0 Injuries	0
Multi-County	12/15/2007	Heavy Snow	0 Deaths, 0 Injuries	0
Multi-County	2/23/2008	Winter Weather	0 Deaths, 0 Injuries	0
Multi-County	1/26/2009	Winter Storm	0 Deaths, 0 Injuries	0
TOTALS			4 Deaths, 21 Injuries	\$5,800,000

Source: NOAA, National Climatic Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.dll?wwwevent-storms>

Seasonal Patterns

Winter storms typically occur from November through February. However, winter weather can occur as late as May or as early as October in Crawford County.

Warning Time and Duration

Meteorologists predict most winter weather more than 24 hours before it happens. While the extent of the severity may not always be completely accurate, the prediction at least provides some warning to residents. Residents mainly learn about severe winter weather from local radio and television stations that provide advanced notice of this hazard.

Probable warning time of more than 24 hours (1). Duration of less than one week (3).

Statement of Severity/Magnitude

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. Although severe winter weather can affect the entire county during a single storm, this hazard will most likely be negligible because major roads and facilities are usually rarely shut down for more than 24 hours. While some public schools may experience closing for up to two weeks, these facilities are not critical and cause little disturbance in day-to-day business or government activities. Injuries are usually limited to residents falling on icy sidewalks or cars sliding into each other on frozen thoroughfares. The most significant disruption in the past few years has been power outages associated with ice storms that can last for several days for some locations. Following the severe ice storms of the past five years and the associated

power outages that affected portions of southern Missouri, communities and utility companies have become much more aggressive in their tree trimming programs. This activity has mitigated a substantial portion of the power outage problem associated with winter storms.

Statement of Probable Risk/Likelihood of Future Occurrence

Highly Likely (4) – Event is probable within one year—a near 100 percent probability of occurring. Severe winter weather can be predicted with a great degree of certainty to occur in the future. Based on past history, this hazard will likely occur at least once or twice every year and has occurred as frequently as four times during one winter season.

Statement of Next Disaster’s Likely Adverse Impact on the Community

The next severe winter storm will most likely close schools for one or more days and decrease the speed of travel throughout the county for residents traveling to work and visitors traversing through the county. Some residents may miss a day of work due to road conditions. Heavy ice may cause power outages in some areas.

Recommendation

The county and cities should enhance their weather monitoring to be better prepared for severe weather hazards. If the jurisdictions monitor winter weather, they can dispatch road crews to prepare for the hazard. County and city crews can also trim trees along power lines to minimize the potential for outages due to snow and ice.

Hazard Summary – Severe Winter Weather For All Jurisdictions in Crawford County

Calculated Priority Risk Index	Planning Priority
2.55	High

3.2.11 Wildfire

Description

A wildland fire is any fire occurring on grassland, forest, or prairie, regardless of ignition source, damages or benefits. According to the National Fire Plan issued by the U.S. Departments of Agriculture and Interior, the urban/wildland interface is defined as “... the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.” Spawned by increases in population, urban expansion, creative land management decisions that place neighborhoods next to wildland preserves, parks and greenbelts, and the ever-present desire to intermingle with nature, the interface problem has grown dramatically over the last twenty years. This marriage between humans and their property of value with wildland areas has significantly increased the human exposure to wildfires.

Forest fires have had a major impact on Missouri's forests. Burning the woods was a deep-rooted tradition in the Ozarks. It took many years of education to reduce the annual spring burning. Even now, some areas of the state still experience problems with fires deliberately set by arsonists. Humans cause most of the fire in Missouri: 50 percent start from escaped debris and trash fires and 31 percent are started by arsonists. These fires cause millions of dollars worth of

damage to forests, wildlife habitat, watersheds, and property. The Department of Conservation and Forest Service rely on lookout towers, airplane patrol, and telephone reports to locate wildfires. Rural fire departments help these agencies suppress forest and grass fires in many parts of the state.^{lxix}

More and more people are making their homes in woodland settings in or near forests and rural areas. There, homeowners enjoy the beauty of the environment but they also face the very real danger of wildfire. Crawford County is primarily comprised of wooded, rural areas and is also home to a sizeable portion of the Mark Twain National Forest. The southeast quarter of the county is part of the National Forest. The county is also home to Onondaga Cave State Park, Huzzah Conservation Area and portions of Woodson K. Woods Conservation area. All of these tree-filled areas are significant possibilities for wildfire disasters. Figure 3-16 is a land cover map for Crawford County and which demonstrates the potential areas for wildfires.

In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Type of Damage

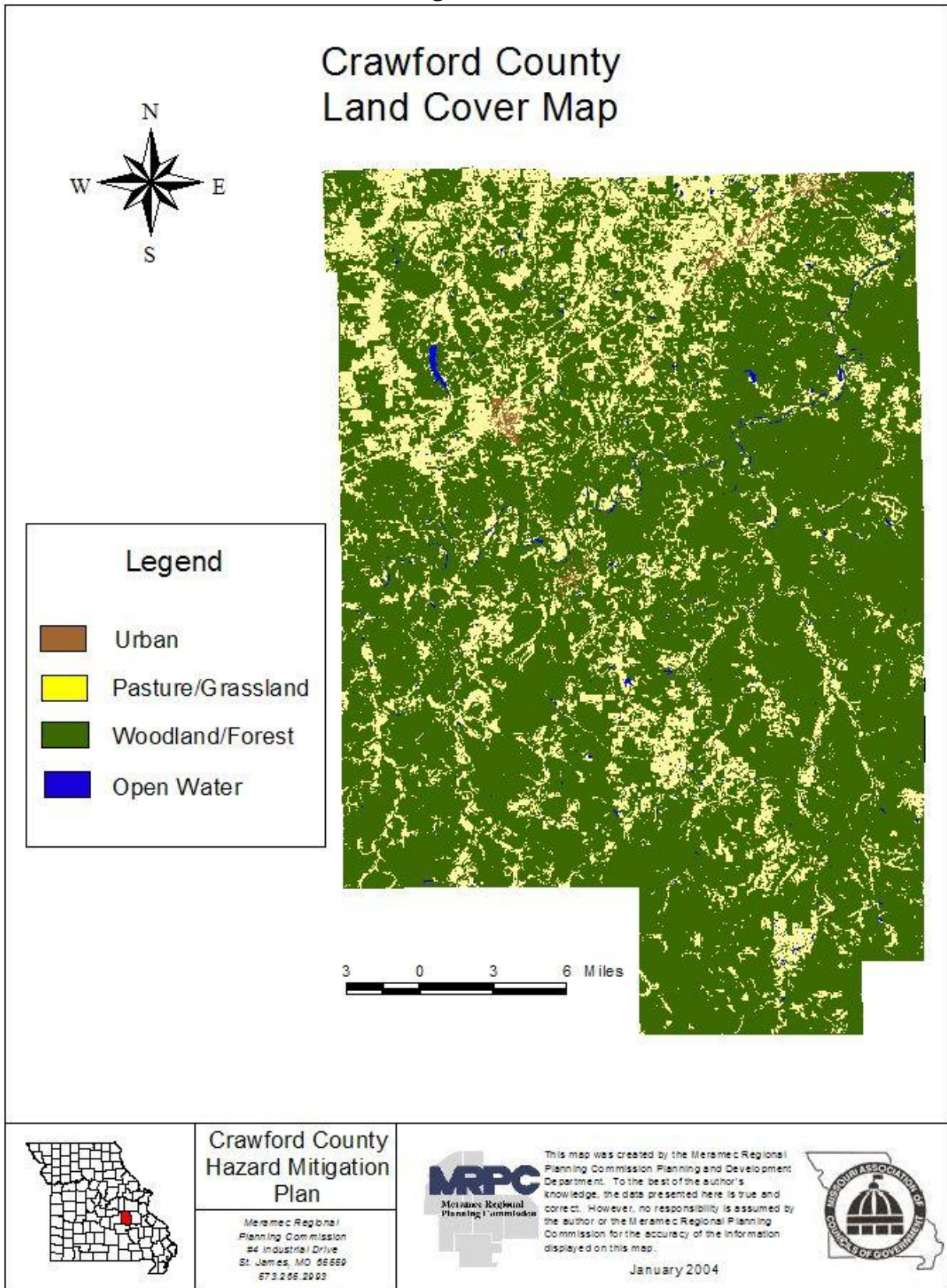
Wildfires destroy existing vegetation – forests, pastures, croplands, as well as structures such as homes, barns and businesses. The initial burn can be catastrophic – completely destroying whatever is involved. The aftermath can cause long term problems and can include crop and habitat losses. Deforested hillsides are more prone to erosion and landslides. Erosion can damage watersheds and cropland.

Hazard History

Because building structures exist anywhere people live and work, fires can occur at any time and anywhere throughout the state. The frequency of events depends on a wide range of factors. These factors could include and are not limited to: population/building density, building use, lack of fire codes, lack of enforcement when fire codes exists, fire safety practices or lack of by building occupants, lack of adequately equipped fire departments and criminal intent related to arson. Frequency of structural fire data may include the National Fire Incident Reporting System Statistics data provided by the Division of Fire Safety. According to Fire Safety, about 250 out of approximately 900 fire departments report the data utilized to compile the Missouri Incident Report statistics. For this reason, definitive conclusions are not possible. However, it is readily apparent that fire departments, law enforcement and other agencies spent considerable manpower and funding to respond to and investigate structural fires.

The Forest Division of the Missouri Department of Conservation is responsible for protecting the privately owned and state-owned woods and grasslands from wildfires. To accomplish this task, intensive forest fire protection districts have been established in the more heavily-timbered southern part of the state. At the present time, 18 forest districts afford intensive fire protection to approximately one-half of the state or about 16 million acres. Within these districts fairly accurate forest and grassland fire statistics are available from the Missouri Department of

Figure 3.16



Conservation. In a typical year, there are approximately 3,500 wildfires. From July 1999 to June 30, 2000, there were some 4,000 wildfires in Missouri, burning over 132,000 acres.^{lxx}

Spring 2000 Brush and Wildfires. Due to extreme dry conditions, brush and wildfires whipped by 50 mph winds burned more than 17,000 acres in south-central Missouri in March 2000. In Camden County alone, there were 6,000 acres engulfed by flames and 40 structures destroyed by these fires. Some 200 homes were threatened by the approaching wildfires, prompting evacuations and shelters to be opened in Camdenton and Laurie. The brush and wildfires also erupted in the counties of: Morgan, Miller, Dallas, Laclede, Benton, Hickory, St. Clair, and Henry, causing considerable damage to thousands of acres. The State Fire Marshall's Mutual Aid was activated with 480 volunteer fire personnel from 31 fire departments responding from neighboring areas. The Missouri Department of Conservation also provided key assistance. To help these fire departments recover their expenses, Missouri applied for a federal Fire Suppression Grant through the Federal Emergency Management Agency, with \$135,000 approved as a result. This was the first such grant ever awarded to the state, and also the first within FEMA's four-state Region VII, which includes Missouri, Iowa, Kansas and Nebraska.^{lxxi} Crawford County saw a small amount of wild-land fire during this major disaster, but did not suffer any significant damage. Smaller brush fires have plagued the county on multiple occasions.

According to the Missouri Department of Conservation Forest Fire Reporting, there have been 564 fires reported between January 1, 2000 and January 1, 2010. The total acreage burned from those incidents was 6,017.03 acres. Five residences and six outbuildings were damaged. Seven residences, 15 outbuildings and one commercial business were destroyed during the course of these fires.

Seasonal Patterns

Forest and grassland fires can and have occurred on any day throughout the year. The majority of the fires, however, and the greatest acreage loss will occur during the spring fire season, which is normally between February 15 and May 10. The length and severity of this burning period depends on the weather conditions. Spring in Missouri is noted for its low humidity and high winds. These conditions, together with below normal precipitation and high temperatures, result in extreme high fire danger. Not only is this the time of the year when fires are most difficult to control and suppress, it is also the time when most fire starts occur. Spring is the time of the year when rural residents normally burn their garden spots, brush piles, etc. Many landowners also still believe it is necessary to burn the woods in the spring of the year in order to get more grass, kill ticks, and "get rid of" the brush. Therefore, with the possibility of extremely high fire danger and the chances of a large number of fires starting, the spring months are the most dangerous for a wildfire standpoint. The second most critical period of the year is in the late fall. Depending on the weather conditions, there is a possibility of a sizeable number of fires occurring between mid-October and late November.^{lxxii}

Climatic conditions such as severe freezes and drought can significantly increase the intensity of wildland fires since these conditions kill vegetation, creating a prime fuel source for these types of fires. Disease and insect infestation of forests can also lead to more dry fuel in wooded areas. The intensity of fires and the rate at which they spread are directly related to wind speed, temperature, and relative humidity.

Warning Time and Duration

Warning times for wildfires are often minimal or none. Existing warning systems include local television and radio stations and weather radios. The warning time and duration for all jurisdictions in Crawford County is:

Probable warning time of less than six hours (4). Duration of less than one day (2).

Statement of Severity/Magnitude

Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. The severity of wildfire in Crawford County and for all its jurisdictions should be considered negligible.

Statement of Probable Risk/Likelihood of Future Occurrence

Wildfire is another hazard where there is a difference in the probability of occurrences in incorporated and unincorporated areas of the county. Although fires that erupt in rural areas may burn longer and damage more acreage, the risk to property is lower because of the lower density of homes and businesses. The greater risk for property damage and injuries lies in those areas where developed areas meet densely vegetated areas. Figure 3-17 is a map showing the urban/wildland interface for Crawford County. All of the communities in the county show a medium density interface with portions of Steelville, Bourbon Leasburg and Sullivan illustrated as medium density intermixed with vegetation. There are also small portions of the unincorporated area of the county that are shaded in yellow where there are no incorporated communities, but there is a higher density of population and structures. These include the development around Indian Hills Lake and areas along I-44 between Bourbon and Sullivan. These areas in the county would be considered at higher risk. According to the map, no areas of Crawford County or its jurisdictions would be considered to have a high density interface. The probability of wild fires is considered likely, but may increase to high during certain periods, such as spring, late fall, or under conditions of excessive heat, dryness, and/or drought.

The likelihood of wildfire occurring in unincorporated areas of Crawford County is as follows:

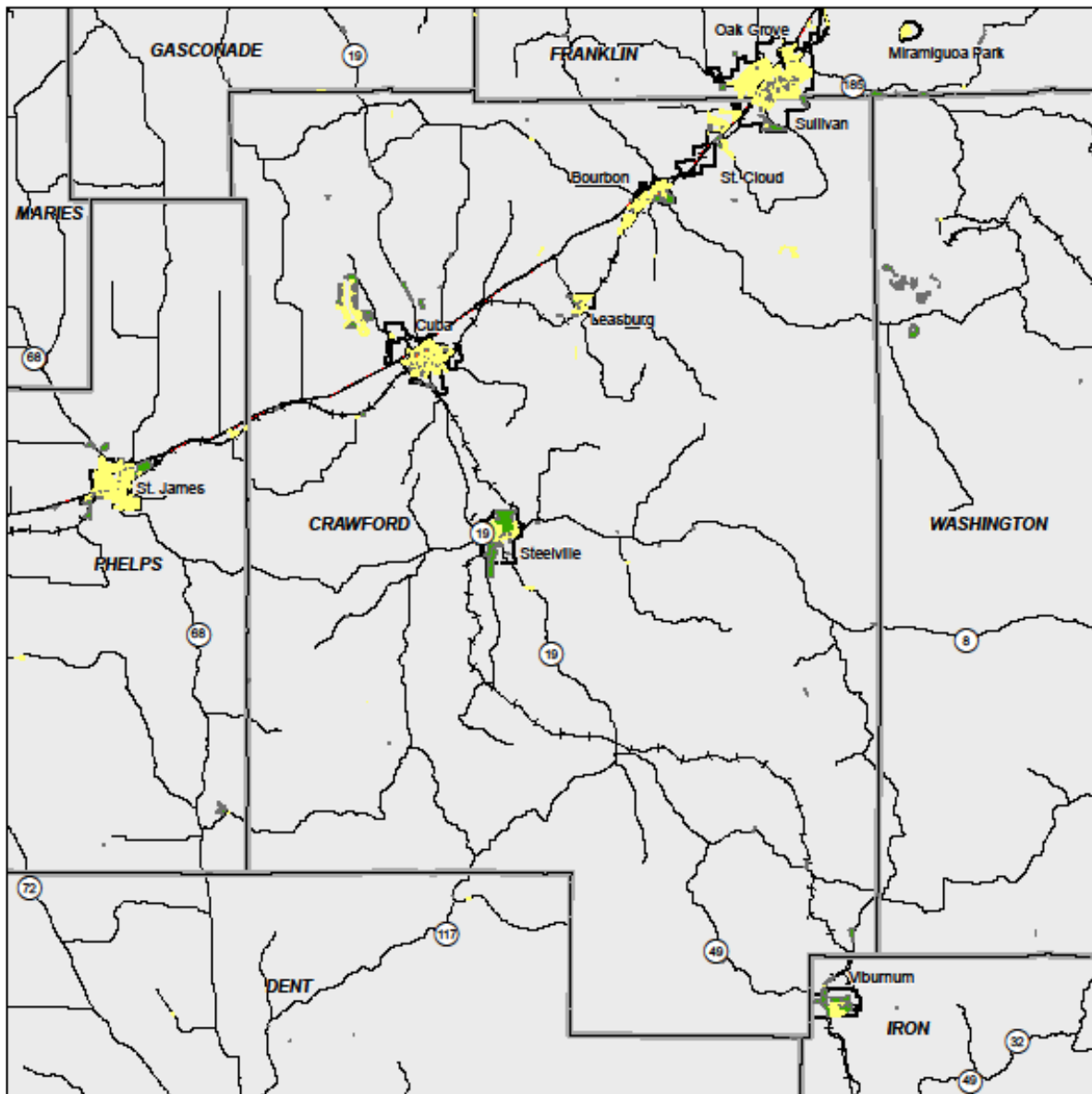
Highly Likely (4) – Event is probable within one year—a near 100 percent probability of occurring.

The probability of wildfire affecting the communities of Bourbon, Cuba, Leasburg, Steelville, Sullivan and West Sullivan, as well as the Steelville R-III school district is as follows:

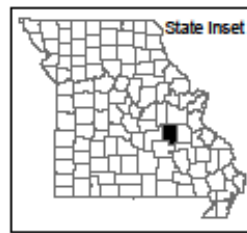
Likely (3) - An event is probable within the next three years—a 33 percent probability of occurring.

Figure 3-17

Crawford County Wildland Urban Interface



— Highways	Wildland Urban Interface
▭ Municipalities	2000
▭ Counties	■ High_Dens_NoVeg
▭ States	■ High_Dens_Interface
	■ High_Dens_Intermix
	■ Med_Dens_Interface
	■ Med_Dens_Intermix



0 3 6 Miles

N

For Planning Purposes Only
Data Source: silvis.forest.wisc.edu
Definitions: silvis.forest.wisc.edu/old/Library/WUIDefinitions.php

As most school facilities are located either in the city limits of communities or immediately adjacent to city limits, the risk of wildfire to school districts would be similar to that of communities. However, as school districts have far fewer buildings and assets that are at risk, their probably risk/likeliness for future occurrence would be less than that for communities in general. The one exception to this rule would be Steelville High School, which is located more than a mile outside of Steelville, in a rural area. The probability of wildfire affecting the Crawford County school districts of Crawford County R-I, Crawford County R-II and Sullivan C-2 is as follows:

Unlikely (1) – An event is possible within the next 10 years—a 10 percent probability of occurring.

Statement of Next Disaster’s Likely Adverse Impact on the Community

As long as drought conditions are not seriously inflamed, future wildfires in Crawford County should have a negligible adverse impact on the community, as it would affect a small percentage of the population.

Recommendation

Design and implement a comprehensive community awareness and educational campaign on the wildland fire danger, targeted at areas of highest risk. Develop capabilities, systems and procedures to pre-deploy fire-fighting resources during times of high wildland fire hazard. Through training and education, prepare local fire departments for wildfire scenarios. Encourage development and dissemination of maps relating to the fire hazard to help educate and assist builders and homeowners in being engaged in wildfire mitigation activities, and to help guide emergency services during response.

Hazard Summary – Wildfire – Crawford County

Calculated Priority Risk Index	Planning Priority
2.9	High

Hazard Summary – Wildfire – Bourbon, Cuba, Leasburg, St. Cloud, Steelville, Sullivan and West Sullivan and Steelville R-III School District

Calculated Priority Risk Index	Planning Priority
2.45	Moderate

Hazard Summary – Wildfire –Crawford County R-I, Crawford County R-II and Sullivan C-2 School Districts

Calculated Priority Risk Index	Planning Priority
1.55	Low

3.2.12 Hazard Profiles Summary

The following table (Table 3.16) provides a summary of the results of the hazard profiles and if there is any variation of hazards among the various jurisdictions.

Table 3.16 Hazard Profile Planning Priority Summary by Jurisdiction

Hazard	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan	Crawford Co. R-I School District	Crawford Co. R-II School District	Steelville R-III School District	Sullivan C-2 School District
Dam Failure	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Drought	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Earthquake	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Extreme Heat	High	High	High	High	High	High	High	High	High	High	High	High
Flood	High	High	High	High	High	High	High	High	High	High	High	High
Landslide	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Land Subsidence/Sinkhole	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Severe Storms Hail/Wind	High	High	High	High	High	High	High	High	High	High	High	High
Severe Winter Weather	High	High	High	High	High	High	High	High	High	High	High	High
Tornado	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Wildfire	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Moderate	Low

3.3 Vulnerability Assessment for Crawford County

Requirement 201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement 201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement 201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement 201.6(c)(2)(ii)©: [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Requirement 201.6(c)©(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.

3.3.1 Methodology

The vulnerability assessment further defines and quantifies populations, buildings, critical facilities and other community assets at risk from natural hazards. The vulnerability assessment for this plan followed the methodology described in the FEMA publication *Understanding Your Risks – Identifying Hazards and Estimating Losses (2002)*.

The vulnerability assessment was conducted based on the best available data and the significance of the hazard. Data to support the vulnerability assessment was gathered from the following sources:

- Missouri Spatial Data Information Service (MSDIS)
- Statewide GIS datasets compiled by state and federal agencies
- FEMA's HAZUS software
- Existing plans and reports
- Personal interviews with HMPC members and representatives of other jurisdictions and stakeholders

The vulnerability assessment includes a description of:

- The community assets that are at risk from hazards in the county;
- The vulnerability to each hazard identified in the plan, including an overview of all the hazards and for those hazards with high or moderate planning priority a more in-depth analysis based on existing data;
- An overview of projected development trends;
- A summary of key issues and conclusions drawn from the assessment.

Those hazards ranked as High or Moderate risks include an estimated damage count of buildings for each jurisdiction. This damage count is estimated based on the calculated priority risk index

(CPRI) that takes into account four elements of risk: probability, magnitude/severity, warning time and duration. As explained in Section 3.2.1 Methodology, each element is weighted and a numerical value developed using a pre-determined formula. Based on the score, each jurisdiction can rank a hazard as high, moderate or low risk. At the same time, this formula provides an estimated percentage for the magnitude of the damage should a hazard event occur. The magnitude of each profiled hazard is classified and quantified in the following manner:

- Catastrophic – More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths. (4)
- Critical – 25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses resulting in permanent disability. (3)
- Limited – 10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illness do not result in permanent disability. (2)
- Negligible – Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid. (1)

By applying these percentages to the building counts for each jurisdiction, the impact of that hazard occurring within that jurisdiction can be estimated. These building damage estimates are included with the overview for each hazard that would result in property damage.

3.3.2 Community Assets

This section of the plan assesses the population, number of structures and estimated values. This data is provided based on HAZUS-MH data and 2000 US Census data. Values reflected here are on improvements (structures) and do not include land values. As would be expected, exposure is concentrated in populated areas such as Cuba, Sullivan and Steelville. There are insufficiencies in the data. HAZUS data was provided by SEMA and in some cases the flood data runs done for Crawford County appear to include information from portions of surrounding counties. We have broken down data by census block for each city, but were not always able to break out data for the county, so some information on flood statistics may include data from portions of surrounding counties.

According to HAZUS-MH, there is a total building replacement value (excluding contents) of \$1,116,986,000 for Crawford County. Residential housing makes up 84 percent of the total building value for Crawford County, approximately \$939,565,000. Non-residential building stock is valued at \$177,421,000. Table 3.17 shows the breakout of type of buildings, exposure, and percentage of total building stock for all the jurisdictions in Crawford County. Tables 3.18 – 3.25 provide total building stock numbers for each of the jurisdictions in Crawford County. School district assets are described in Table 3.30 Specific Building Assets by Jurisdiction.

Table 3.17 Occupancy and Exposure of Crawford County Building Stock

Occupancy	Exposure	Percent of Total
Residential	\$939,565,000	84.0%
Commercial	\$117,431,000	10.6%
Industrial	\$22,662,000	2.1%
Agricultural	\$4,759,000	0.4%
Religion	\$16,004,000	1.5%
Government	\$2,709,000	0.2%
Education	\$13,856,000	1.2%
Total	\$1,116,986,000	100.0%

Source: HAZUS-MH

Table 3.18 Unincorporated Crawford County Building Stock

Occupancy	Building Count	Percent of Total
Residential	7018	94.7%
Commercial	192	2.6%
Industrial	104	1.4%
Agricultural	60	0.8%
Religion	28	0.4%
Government	8	0.08%
Education	2	0.02%
Total	7412	100%

Source: HAZUS-MH

Table 3.19 City of Bourbon Building Stock

Occupancy	Building Count	Percent of Total
Residential	889	92.2%
Commercial	35	3.7%
Industrial	24	2.5%
Agricultural	5	0.5%
Religion	7	0.7%
Government	1	0.1%
Education	3	0.3%
Total	964	100%

Source: HAZUS-MH

Table 3.20 City of Cuba Building Stock

Occupancy	Building Count	Percent of Total
Residential	2139	91.8%
Commercial	129	5.5%
Industrial	38	1.6%
Agricultural	8	0.3%
Religion	14	0.7%
Government	1	0.03%
Education	2	0.07%
Total	2331	100%

Source: HAZUS-MH

Table 3.21 Village of Leasburg Building Stock

Occupancy	Building Count	Percent of Total
Residential	364	96.4%
Commercial	4	1.0%
Industrial	4	1.0%
Agricultural	1	0.3%
Religion	4	1.0%
Government	1	0.3%
Education	0	0
Total	378	100%

Source: HAZUS-MH

Table 3.22 Village of St. Cloud Building Stock

Occupancy	Building Count	Percent of Total
Residential	141	93.4%
Commercial	4	2.6%
Industrial	5	3.3%
Agricultural	0	0
Religion	0	0
Government	1	0.7%
Education	0	0
Total	151	100%

Source: HAZUS-MH

Table 3.23 City of Steelville Building Stock

Occupancy	Building Count	Percent of Total
Residential	952	91.3%
Commercial	56	5.4%
Industrial	18	1.7%
Agricultural	3	0.3%
Religion	6	0.6%
Government	4	0.4%
Education	3	0.3%
Total	1042	100%

Source: HAZUS-MH

Table 3.24 City of Sullivan Building Stock

Occupancy	Building Count	Percent of Total
Residential	3879	91.6%
Commercial	250	5.8%
Industrial	58	1.4%
Agricultural	7	0.2%
Religion	25	0.6%
Government	10	0.2%
Education	7	0.2%
Total	4236	100%

Source: HAZUS-MH

Table 3.25 Village of West Sullivan Building Stock

Occupancy	Building Count	Percent of Total
Residential	43	97.7%
Commercial	1	2.3%
Industrial	0	0
Agricultural	0	0
Religion	0	0
Government	0	0
Education	0	0
Total	44	100%

Source: HAZUS-MH

For the purposes of this report, a critical facility is defined as one that provides essential public safety or mitigation functions during response or recovery operations or facilities that have the potential to suffer high losses during a disaster. Examples include fire department buildings, city halls, the courthouse, long-term care facilities, and hospitals. In addition, critical infrastructure facilities need to be considered such as highways, airports, water treatment facilities, pipelines and communications facilities. Table 3.26 has a more comprehensive list of potential critical facilities. Not all of these examples may exist in Crawford County.

Table 3.26 Critical Facilities Definitions and Examples

Essential Facilities	High Potential Loss Facilities	Transportation and Lifelines
Hospitals and other medical facilities	Power plants	Highways, bridges and tunnels
Police stations	Dams and levees	Railroads and rail facilities
Fire stations	Military installations	Airports
Sheriff department facilities	Schools	Water treatment facilities
Emergency operations centers	Shelters	Pipelines/pump stations
911 centers	Day care centers	Communications centers
	Nursing homes	
	Government buildings	

Source: FEMA HAZUS

Table 3.27 is an inventory of critical facilities and infrastructure in Crawford County, based on the data available. Data was collected from HAZUS-MH, directly from jurisdictions and in some cases from various sources that are listed in the endnotes.

Table 3.27 Critical Facilities and Infrastructure by Jurisdiction - Crawford County

Facility	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan	Total
Airports	0	0	1	0	0	0	1	0	2
Bridges	91	2	2	1	0	3	2	0	101
Communications Centers	1	1	1	0	0	2	1	0	5
Dams	73	0	3	0	0	0	1	0	77

Facility	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan	Total
Daycare Centers ^{lxxiii}	0	2	7	0	0	5	2	0	16
Elder Care/ Long Term Care Facilities ^{lxxivlxxv}	0	3	4	0	0	2	5	0	14
Health Care Facility	0	0	0	0	0	0	1	0	1
Fire Stations	0	1	1	1		1	1	0	5
EMS Stations	0	0	1	0	0	1	1	0	3
Emergency Operations Centers	1	0	1	0	0	1	1	0	4
Government Facilities	8	2	14	3	0	7	34	0	68
Law Enforcement Facilities	1	1	1	0	0	3	1	0	7
Major Interstate Highways	1	1	1	1	1	0	1	1	1
Military Installations	0	0	0	0	0	0	0	0	0
Railroads	1	1	1	0	0	0	1	0	1
Pipelines	3	0	0	0	0	0	0	0	3
Schools ^{lxxvi}	0	3	3	0	0	3	4	0	13
Emergency Shelters ^{lxxvii}	1	1	1	1	0	5	3	0	12
Wastewater Treatment Facilities	0	1	2	1	0	1	1	0	6
Public Wells	0	3	5	2	0	3	11	1	25

Source: Crawford County Hazard Mitigation Planning Committee

There are 14 long term care facilities for the elderly and disabled in Crawford County. They are located in Bourbon, Cuba, Steelville and Sullivan. Table 3.28 provides specific information on the long term care facilities in Crawford County.

Table 3.28 Long Term Elder Care and Elder Day Care Centers in Crawford County

Elder Care Facility Name	Location	Capacity	Level of Licensure
Al and Judy's Residential Care, LLC	Bourbon	8	RCF I
Cuba Manor Inc.	Cuba	90	SNF
Dunsford Court – Assisted Living by Americare	Sullivan	44	ALF II
Gibbs Care Center	Steelville	66	SNF
Gibbs Manor	Steelville	26	RCF II

Elder Care Facility Name	Location	Capacity	Level of Licensure
Happy Acres	Sullivan	26	RCF II
Meramec Nursing Center	Sullivan	60	SNF
Pilkenton residential Care Center	Cuba	24	RCF I
Redwood manor Care Center	Bourbon	46	RCF I
Ridgeway Residential Care	Sullivan	20	ALF I
Stubblefield Retirement Home	Cuba	34	RCF II'
Sunshine Acres Residential Care	Bourbon	20	RCF I
Victorian Manor of Cuba	Cuba	48	RCF I
Victorian Manor of Oak Grove/Sullivan	Sullivan	48	RCF I

Assisted Living Facility=ALF; Residential Care Facility=RCF; Skilled Nursing Facility=SNF
Source: Missouri Department of Health and Senior Services

There are 16 child daycare facilities in Crawford County. Smaller daycares that do not have enough children to require licensing are not included as data is not available on these facilities. Table 3.29 provides information on the licensed daycare facilities in Crawford County.

Table 3.29 Licensed Child Care Facilities in Crawford County

Facility Name	Location	Facility Type
All Aboard Learning Center	Cuba	Child Care Center
Beginning Steps Early Learning Center	Bourbon	Child Care Center
Carleen Ann Killeen	Cuba	Family Home
Children's Corner Preschool	Cuba	Child Care Center
Community Child Care Center	Steelville	Child Care Center
Crawford County Head Start	Cuba	Child Care Center
Crystal Dawn Gahr	Cuba	Family Home
Delilah Buckner	Steelville	Family Home
Diane Peterson	Bourbon	Group Home
Kountry Kids Daycare & Learning Center	Sullivan	Group Home
Kristi Hines	Sullivan	Family Home
Lola Christine Potter	Cuba	Group Home
St. Paul's Lutheran Early Childhood Center	Cuba	License Exempt Program
Steelville R-3 Pre-Kindergarten	Steelville	Child Care Center
Wee Care Day Care	Steelville	Group Home
Wee Care Too	Steelville	Group Home

Source: Missouri Department of Health and Senior Services

Other Assets

Vulnerability assessment involves more than just an inventory of critical infrastructure. It is also important to include assets of historic, cultural, natural and economic importance. Reasons for including these types of assets in the assessment are varied. The county may place priority on certain assets due to their uniqueness or irreplaceable nature. Having a list of these assets before a disaster can aid in their protection and restoration following an incident. In the case of historic structures, the rules for rebuilding or restoring them may be different or more restrictive than for ordinary buildings. Crawford County has many natural resource based assets that are important not only to recreation and tourism, but to the protection of threatened or endangered species. Natural resources such as wetland can help mitigate disasters such as floods. Damage to or the

complete loss of some economic assets can have long-term devastating effects on a community and its ability to recover from a disaster.

The following assets are located in Crawford County:

- Endangered, threatened, species of concern: hellbender, bald eagle, cerulean warbler, gray bat, Indiana bat, plains spotted skunk, scaleshell mollusk, and pink mucket mollusk.
- Historic and Cultural Resources: Big Bend Rural School in Steelville; Major General William S. Harney Summer Home in Sullivan; Scotia Iron Furnace Stack in Leasburg; Snelson-Brinker House in western Crawford County; Wagon Wheel Motel, Café and Station in Cuba.
- Museums: Crawford County Historic Museum, Cuba; Day Lark Jonas Museum, Steelville.
- Economic Resources: large employers in the county include the Paramount Hat in Bourbon; Crawford County School districts; Industrial Wire Products in Cuba; Mar-Bal, Inc. in Steelville and Meramec Electrical Products in Cuba.
- Natural Resources: there are 16 state public use areas and conservation areas in Crawford County; two federal public recreation areas; two state parks; 23 springs; two watersheds; portions of the Meramec Spring State Park, and Mark Twain National Forest lands.

Community Assets by Jurisdiction

The following table shows community assets by jurisdiction. Data has been collected from the various jurisdictions and from HAZUS-MH. (It has been determined that HAZUS-MH data is limited and may have errors.) Replacement values are, in some cases, estimates based on the available data. These assets have been identified for planning purposes as those structures and facilities that should receive priority consideration in hazard mitigation planning and projects in order to minimize risk for these assets.

Table 3.30 Specific Community Assets in Crawford County by Jurisdiction

Name of Asset	Replacement Value (\$)	Occupancy/Capacity
Unincorporated Area (Including County Government Assets)		
County buildings (including courthouse, jail and road sheds) (8)	\$5,438,702.00	N/A
Numerous highways & bridges	\$772,200,000	N/A
Railway	\$94,200,000	N/A
Dams (77)	Information not available	N/A
Museums (2)	Information not available	N/A
Public Access/Conservation Areas (20)	Information not available	N/A
Historic/Cultural Assets (5)	Information not available	N/A
Communications Centers (1)	Information not available	N/A
Pipelines (3)	Information not available	N/A
Bourbon		
Government Buildings including waste water and public well buildings (17)	\$255,752.00	N/A
Rural Fire Department	Information not available	N/A
Police (1)	\$194,572	N/A

Name of Asset	Replacement Value (\$)	Occupancy/Capacity
Waste Water Facility (1)	\$233,359.00	N/A
City Wells (3)	\$755,733.00	N/A
Cuba		
Government Buildings – includes city hall, park buildings, public works building, animal control, storage sheds (14)	\$3,803,100.00	N/A
Airport (1)	\$430,500.00	N/A
Rural Fire	Information not available	N/A
Museum (1)	\$262,500.00	N/A
Police (1)	288,750	N/A
Waste Water Facility (2)	\$115,500.00	N/A
City Well Buildings (5)	\$2,012,500.00	N/A
Leasburg		
Government Buildings -including city hall, storage sheds, and park buildings (3)	\$89,135.00	N/A
Police (part of city hall)	Included with Government buildings	N/A
Rural Fire	Information not available	N/A
Waste Water (1)	\$10,000.00	N/A
City Well (2)	\$200,000.00	N/A
St. Cloud		
No Assets		
Steelville		
Government Buildings (including city hall, recreation building, storage sheds, and park buildings) (7)	\$729,086.00	N/A
Rural Fire	Information not available	N/A
Police (part of city hall)	Included with Government buildings	N/A
Waste Water Plant and buildings (3)	\$124,924.00	N/A
City Wells and buildings (5)	\$793,704.00	N/A
Museum (2)	\$134,011.00	Info not available
Sullivan		
Government Buildings -including city hall, library, tourism center, storage sheds, and park buildings (34)	\$6,188,831.00	N/A
Fire Department	Information not available	N/A
Emergency Medical Services(1)	Information not available	N/A
Hospital (1)	Information not available	46 beds
Police (1)	\$1,283,217.00	N/A
Airport (5)	\$1,056,857.00	N/A
Waste Water Plant and buildings (5)	\$239,436.00	N/A
City Wells and buildings (8)	\$2,587,423.00	N/A
Health Care Facilities (1) Part of Hospital	Info not available	Info not available
Long Term Care Facilities (5)	Info not available	198 beds

Name of Asset	Replacement Value (\$)	Occupancy/Capacity
Day Care Facilities (2)	Info not available	Info not available
West Sullivan		
Well	Info not available	N/A
Crawford County R-I School District – Assessed Valuation \$57,369,790		
Bourbon Elementary School		429
Bourbon Middle School		302
Bourbon High School		307
Crawford County R-II School District – Assessed Valuation \$102,452,590		
Cuba Elementary		584
Cuba Middle School		411
Cuba High School		399
Steelville R-III School District – Assessed Valuation \$50,939,760		
Steelville Elementary		350
Steelville Middle School		315
Steelville High School		289
Sullivan School District – Assessed Valuation \$161,559,480		
Sullivan Primary School		408
Sullivan Elementary School		564
Sullivan Middle School		481
Sullivan Senior High School		791

3.3.3 Vulnerability by Hazard

This section describes the overall vulnerability of Crawford County to the hazards described earlier in this chapter. It also includes, where data is available, estimates of potential losses for buildings, infrastructure and critical facilities located in hazard prone areas. The hazards that will be discussed in this section are only those hazards that were classified through the CPRI process as being moderate or high priority. Hazards that were classified as low priority will not have detailed vulnerability assessments. A vulnerability overview will be provided for the following hazards that were ranked as low priority in the CPRI process:

- Dam Failure
- Drought
- Landslide
- Land Subsidence/Sinkhole

The vulnerability assessment for high and moderate hazards is limited by the data available and the analysis varies based on the data available and the type of hazard being assessed. Most weather related hazards affect the entire county and all of the jurisdictions and so cannot be mapped geographically. This is also the case for wildfire, which can occur anywhere, although the highest risk for property damage lies in the urban/wildfire interface zones. For weather

related hazards, which include extreme heat, severe storm/wind/hail, tornado and severe winter storm, vulnerability is discussed in qualitative terms because good data on potential losses to structures and infrastructure is not available. Good data on structures and infrastructure is also not available for dam failure. As this is ranked low as a hazard, the vulnerability assessment for dam failure is an overview. In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions, there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

Of the high and moderate ranked hazards, flood is the highest ranking hazard that's effects vary between jurisdictions and has clearly defined hazard areas based on NFIP and HAZUS data. Floods will be discussed first and the remaining moderate and high ranked hazards will be presented in alphabetical order.

Flood Vulnerability of Crawford County and Jurisdictions

Overview

Planning Significance: High. Overall vulnerability to flooding is highest in developed areas of the floodplains of the Meramec River and its tributaries. Based on the vulnerability analysis and the loss estimates provided in Table 3.23, the unincorporated areas of the county and portions of Steelville would be most severely impacted by a 100-year flood.

Methodology

FEMA's software program for estimating potential losses from disasters, HAZUS-MH MR3 was used to generate the flood data for Crawford County. Digital Flood Insurance Rate Map (DFIRM) is not yet available for Crawford County. HAZUS-MH was used to generate a 100-year floodplain for major rivers and creeks in the County that drain at least one square mile. The software produces a flood polygon and flood-depth grid that represents the base flood. While not as accurate as official flood maps, these floodplain boundaries are useful in GIS-based loss estimation. Once the floodplain was generated, the software's census-block level population and building inventory data was used to estimate numbers of residents potentially displaced by flooding as well as potential structural damages.

Flood Vulnerability: Estimated Potential Losses to Existing Development

HAZUS provides reports on the number of buildings impacted, cost of repairs and the loss of contents and business inventory. The loss of the use of a building, as well as the loss of income associated with the property can affect an entire community, whether the building be a business or rental property. Income loss data in HAZUS takes into account business interruption, rental income losses and the resources associated with repairing damages, and job and housing losses. These losses are calculated by HAZUS using a methodology based on the building damage estimates. Flood damage is directly related to the depth of the flood waters. For example, a two

foot flood generally results in approximately 20 percent damage to the structure or replacement value. HAZUS uses depth-damage curves to estimate building losses as the flood depth varies across the area that has been inundated by flood waters.

HAZUS data was the best available data, but may still have some inaccuracies. The damaged building counts produced by HAZUS may be rounded and sometimes have errors that can be associated with the use of census block data for analysis.

A 100-year flood scenario was run to determine damage estimates for Crawford County. HAZUS estimated that 65 residential structures would be affected by this size flood event. Thirty-four of those structures would sustain one to ten percent damage, 26 would sustain 11 to 20 percent damage, three would sustain 21 to 30 percent damage, two would sustain 31-40 percent damage, and none would sustain substantial damage. Figure 3-18 is a HAZUS generated map showing the 100 year flood boundary and the direct economic building losses for the county.

According to HAZUS data, of the 311 structures exposed to flood risk, 58 (19%) are commercial; 25 (8%) are government; and 228 (73%) are residential. The total financial exposure for structures in the county is an estimated \$1,116,986,000.

Based on the results of the HAZUS analysis for the 100-year flood event, the building inventory loss estimates, which are linked to census block geography, were sorted by jurisdiction to show how the potential for losses varies across the county. Table 3.31 shows the estimated building losses by jurisdiction, as well as contents damage, inventory damage, relocation loss, income related loss, rental income loss and wage loss. As mentioned earlier, there were some anomalies in the flood data provided. The information in Table 3.31 is based on the data provided and may have some insufficiencies. Based on the data available and analysis, the unincorporated portions of Crawford County are the most vulnerable to flood losses. The City of Steelville is the community most susceptible to flood losses. Critical facilities that are located in or adjacent to the flood plain include: Crawford County Courthouse, Steelville City Hall, Crawford County Sheriff's Department, Steelville Elementary and Middle schools, Steelville Ambulance District and Steelville Fire Protection District. It should be noted, however, that the HAZUS data indicated that in a 100 year flood, although 25 government buildings were listed as at risk, none would be damaged, nor would any schools.

Figure 3-18

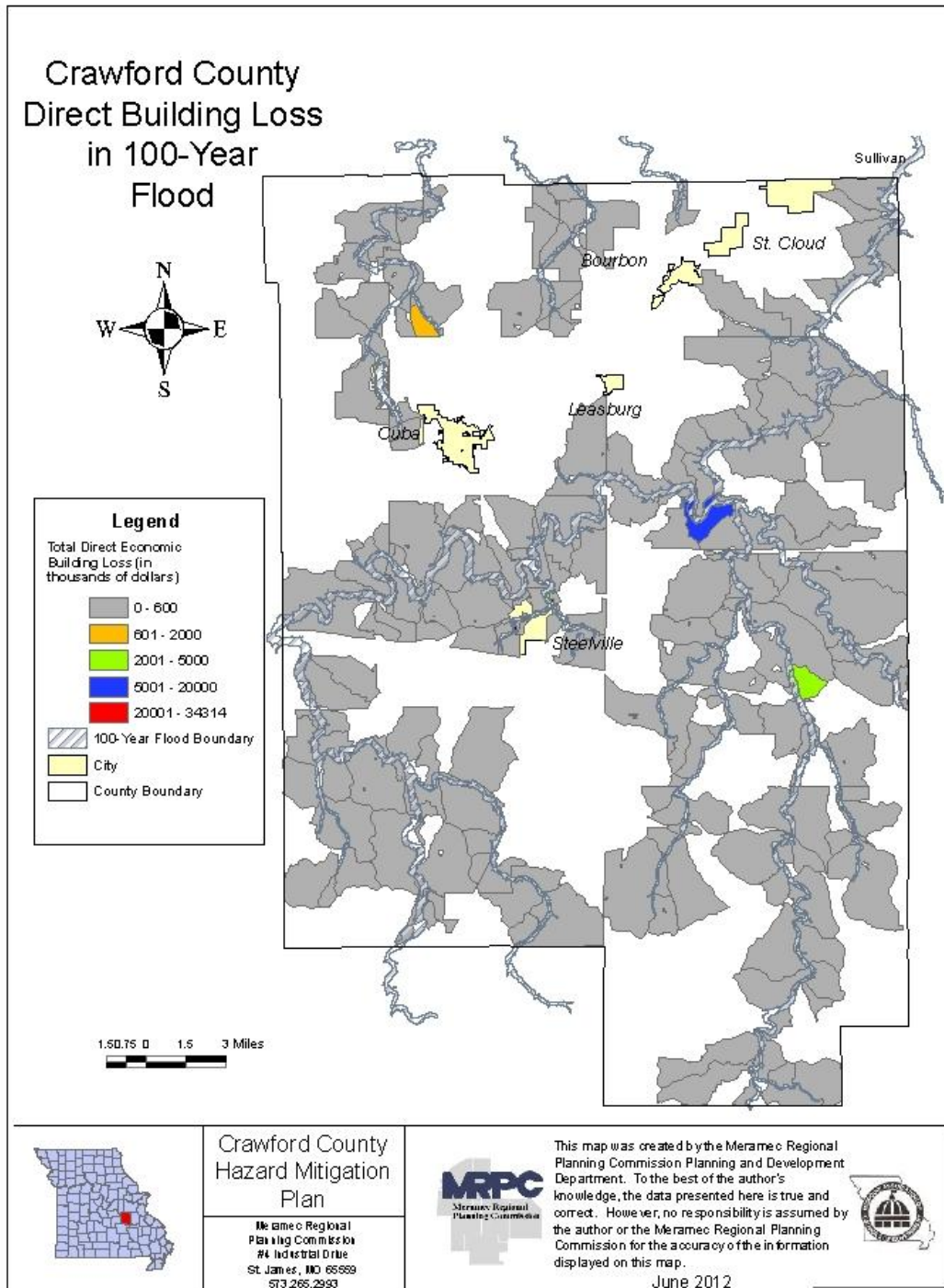


Table 3.31 Estimated Economic Losses in a 100-Year Flood by Jurisdiction

Jurisdiction	Building Damage	Contents Damage	Inventory Damage	Relocation Loss	Income Related Loss	Rental Income Loss	Wage Loss	Total	% of Total
Unincorporated Crawford County	13,640K	13,999K	473K	486K	5,319K	252K	16,442K	50,611K	50.6%
Bourbon	0	0	0	0	0	0	0	0	0
Cuba	0	0	0	0	0	0	0	0	0
Leasburg	0	0	0	0	0	0	0	0	0
St. Cloud	0	0	0	0	0	0	0	0	0
Steelville	4,010K	9,170K	263K	1,029K	4,753K	688K	29,370K	49,283K	49.3%
Sullivan	33K	15K	0	0	0	0	0	48K	.1%
West Sullivan	0	0	0	0	0	0	0	0	0
TOTAL	\$17.68M	\$23.184M	\$736K	\$1.515M	\$10.072M	\$940K	\$45.812M	\$99.942M	100%

Source: HAZUS-MH MR3

Total economic losses for Crawford County in the 100 year flood scenario are estimated at \$99.942 million. The total building related losses were \$42.543 million (building damage, contents damage, inventory damage and rental income loss) – 3.8 percent of the total replacement value of the county’s structures. Insufficiencies in the data prohibited running reports that would show damage to waste water treatment facilities in the floodplain.

Tables 3.32 – 3.39 show the estimated number of buildings that could be damaged should a flood occur in the each jurisdiction. As properties prone to flood damage do not include every building in the county, these damage counts were figured differently from the other hazard damage counts. As HAZUS cannot provide the estimated number of buildings damaged by jurisdiction, per the directions from the Missouri State Emergency Management Agency, planners overlaid floodplain and city boundaries with aerial photos and counted the number of structures found in the floodplain for each jurisdiction. The percentage of each type of occupancy was applied to the total number to get an estimate of the number of different types of structures. The maps showing the floodplain and critical facilities were also reviewed to determine if any critical facilities such as schools or government buildings were located in the floodplain. If not, those types of buildings were shown with zero damage. This method provided an estimate of the number and type of buildings that would be damaged in a 100-year flood. In the case of Steelville, it is known that religion, government and school buildings are located either in or immediately adjacent to the floodplain, and so have been included in the damaged building count, even though the percentage model would not warrant it.

Table 3.32 Estimated Damaged Building Count for Unincorporated Crawford County

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	205	94.7%
Commercial	6	2.6%
Industrial	3	1.4%
Agricultural	2	0.8%
Religion	1	0.4%
Government	0	0.08%
Education	0	0.02%
Total	217	100%

Source: HAZUS-MH

Table 3.33 Estimated Damaged Building Count for City of Bourbon - Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	0	92.2%
Commercial	0	3.7%
Industrial	0	2.5%
Agricultural	0	0.5%
Religion	0	0.7%
Government	0	0.1%
Education	0	0.3%
Total	0	100%

Source: HAZUS-MH

Table 3.34 Estimated Damaged Building Count for City of Cuba - Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	0	91.8%
Commercial	0	5.5%
Industrial	0	1.6%
Agricultural	0	0.3%
Religion	0	0.7%
Government	0	0.03%
Education	0	0.07%
Total	0	100%

Source: HAZUS-MH

Table 3.35 Estimated Damaged Building Count for Village of Leasburg - Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	0	96.4%
Commercial	0	1.0%
Industrial	0	1.0%
Agricultural	0	0.3%
Religion	0	1.0%

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Government	0	0.3%
Education	0	0
Total	0	100%

Source: HAZUS-MH

Table 3.36 Estimated Damaged Building Count for Village of St. Cloud - Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	0	93.4%
Commercial	0	2.6%
Industrial	0	3.3%
Agricultural	0	0
Religion	0	0
Government	0	0.7%
Education	0	0
Total	0	100%

Source: HAZUS-MH

Table 3.37 Estimated Damaged Building Count for City of Steelville - Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	96	91.3%
Commercial	6	5.4%
Industrial	2	1.7%
Agricultural	0	0.3%
Religion	*1	0.6%
Government	*1	0.4%
Education	*1	0.3%
Total	107	100%

Source: HAZUS-MH (*Known to be located in floodplain.)

Table 3.38 Estimated Damaged Building Count for City of Sullivan - Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	0	91.6%
Commercial	0	5.8%
Industrial	0	1.4%
Agricultural	0	0.2%
Religion	0	0.6%
Government	0	0.2%
Education	0	0.2%
Total	0	100%

Source: HAZUS-MH

Table 3.39 Estimated Damaged Building Count for Village of West Sullivan -Flood

Occupancy	Total Building Count	Estimated Number of Buildings Damaged in 100-Year Flood
Residential	0	97.7%
Commercial	0	2.3%
Industrial	0	0
Agricultural	0	0
Religion	0	0
Government	0	0
Education	0	0
Total	0	100%

Source: HAZUS-MH

Flood Vulnerability: Potential Population Displaced

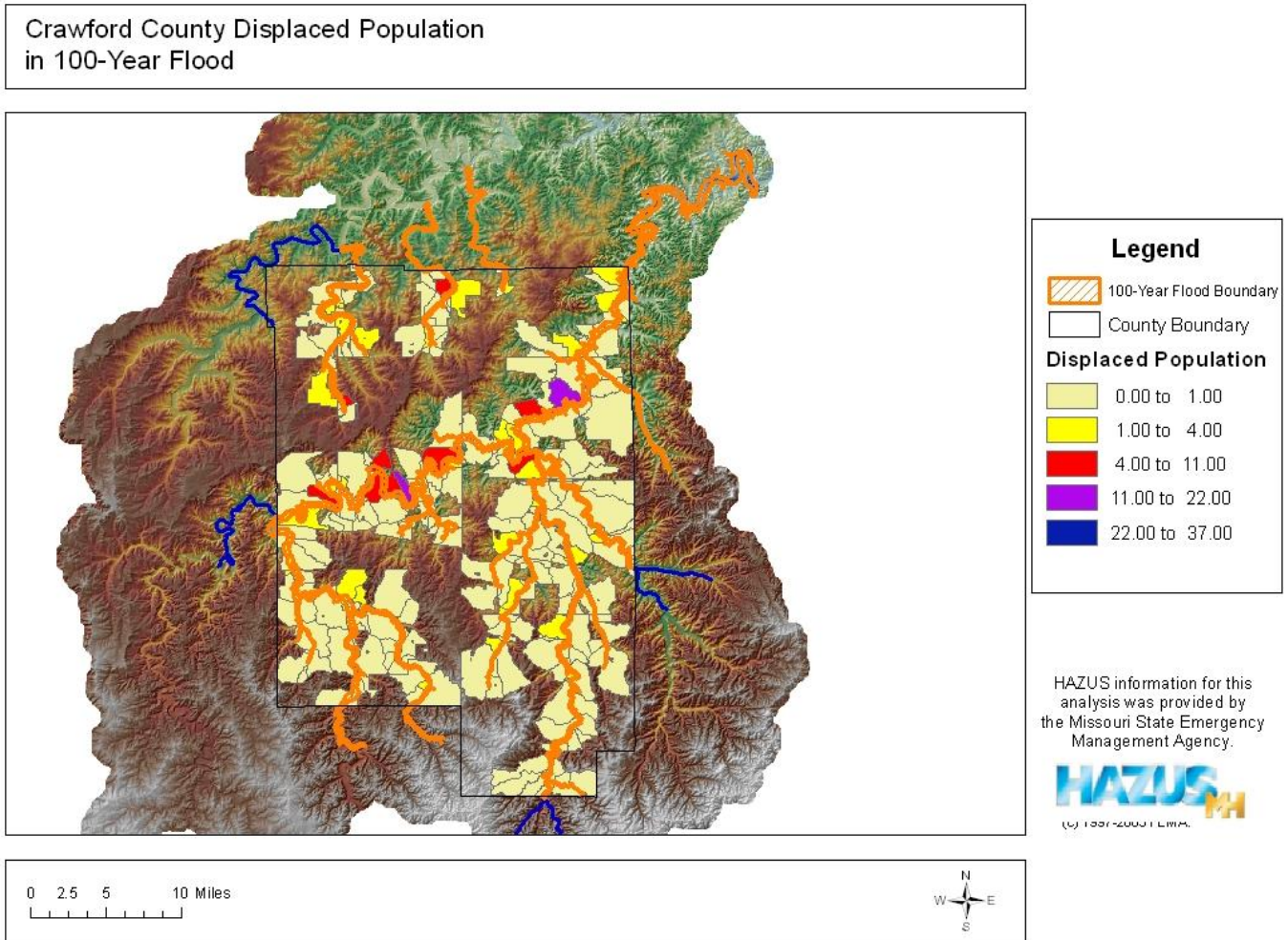
HAZUS-MH estimates for the population displaced during a 100-year flood event using U.S. Census data and flood depths. The software estimates that out of a total population of 22,804, approximately 441 people will be displaced due to the flood. Displacement includes households evacuated from within or very near the inundated area. Of this number, it is estimated that 102 will seek temporary shelter in public shelters.

Figure 3.19 classifies areas of Crawford County by the number of residents who could potentially be displaced by a flood with an estimated one percent chance of occurrence in any given year (100-year flood event). As shown by the darker shaded areas on the map, specific areas of risk include portions of the City of Steelville; concentrated areas along the Meramec River and its tributaries; and scattered throughout the unincorporated areas of the county along the Meramec River and the Bourbeuse River watershed. The areas of the unincorporated county that are most at risk can be seen all along the Meramec River and its tributaries. There is little risk to people or property for other incorporated cities in Crawford County.

Flood Vulnerability: Critical Facilities and Pipelines

Critical facilities data was pulled from the HAZUS-MH and was used along the floodplain generated by HAZUS-MH to identify any critical facilities in the floodplain. Figure 3-20 shows critical facilities in relation to the 100-year floodplain. Figure 3-21 shows transportation infrastructure in relation to the 100-year floodplain, including highways, bridges, bus stations, airports and railroads. Past history shows that Crawford County secondary roads, low water crossings and bridges have sustained damage in past flood incidents. Figure 3-22 shows the pipelines in the county in relation to the 100-year floodplain. Figures 3-23 through 3-26 show critical facilities for each of the jurisdictions.

Figure 3-19



Flood Vulnerability: Critical Facility Locations by City

Figures 3-23 through 3-26 map the locations of critical facilities in relation to the 100-year floodplain for the incorporated cities of Crawford County. Based on HAZUS-MH data, the only community with critical facilities located in or immediately adjacent to the 100-year floodplain is the city of Steelville. Highway 19, the main thoroughfare through the community, runs parallel to Yadkin Creek for several blocks. The county courthouse, sheriff's department, fire department, ambulance district, Steelville police department and city hall, as well as the elementary and middle schools, are all located within or adjacent to the 100-year floodplain for Yadkin and Whitenberg creeks. The only other critical facility impacted by the floodplain is the Onondaga State Park headquarters and facilities which are located on the Meramec River south of Leasburg.

National Flood Insurance Program and Repetitive Loss Properties

Of the eight local government jurisdictions participating in this plan, six are currently participating in the National Flood Insurance Program (NFIP): Crawford County, Bourbon, Cuba, Leasburg, Steelville, and Sullivan. According to repetitive loss data provided by SEMA, there are only five properties in Crawford County that have had repetitive losses. All are in unincorporated areas of the county. One is a single-family residence, the other four are classified as nonresidential. The single-family dwelling and one commercial property have been flooded three times. All the other properties have flooded twice. The most recent flood event occurred in April of 2008. None of the properties have been mitigated.

Figure 3-20

Crawford County Critical Facilities and the 100-Year Flood

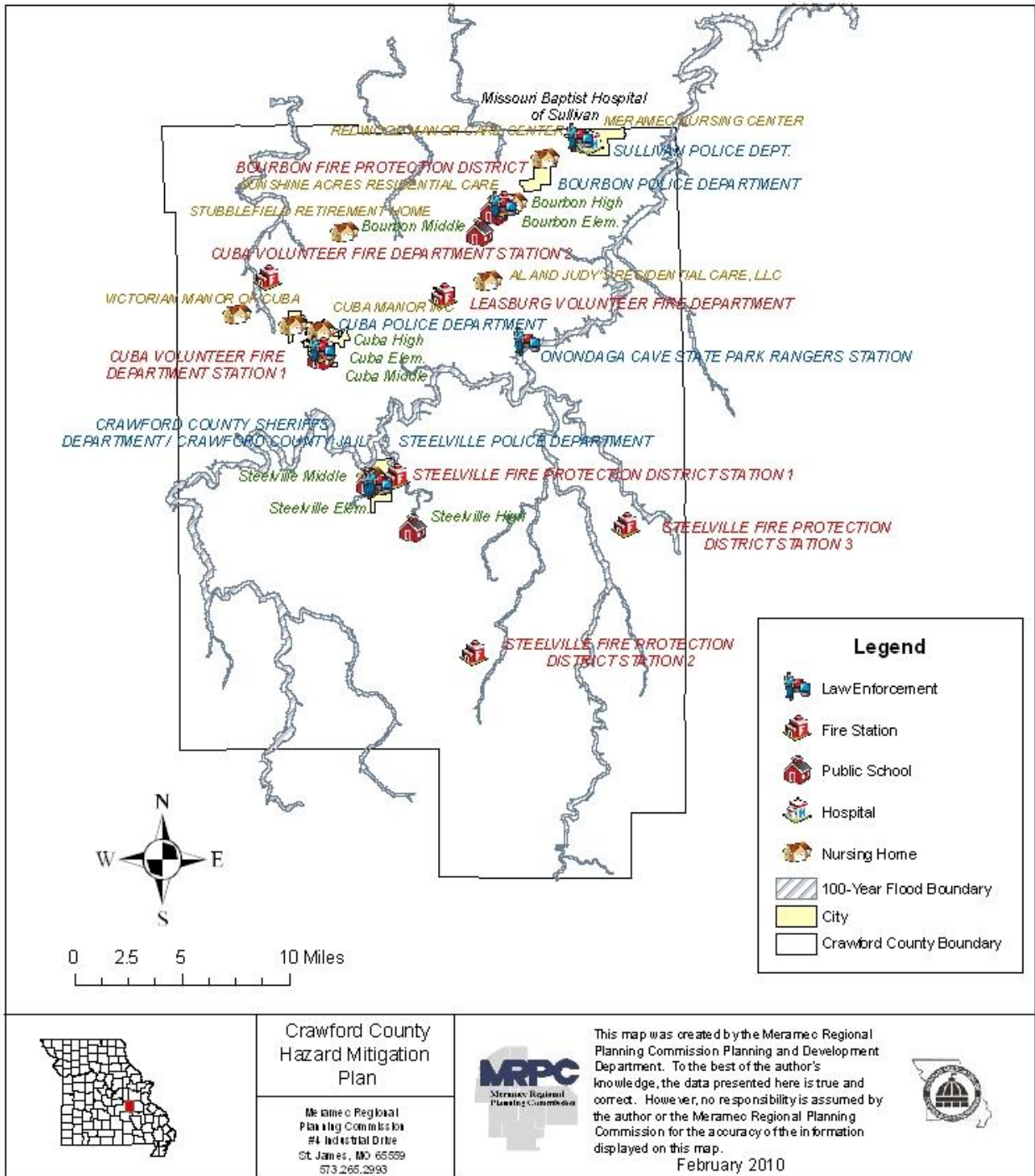


Figure 3-21

Crawford County Transportation Critical Facilities and the 100-Year Flood

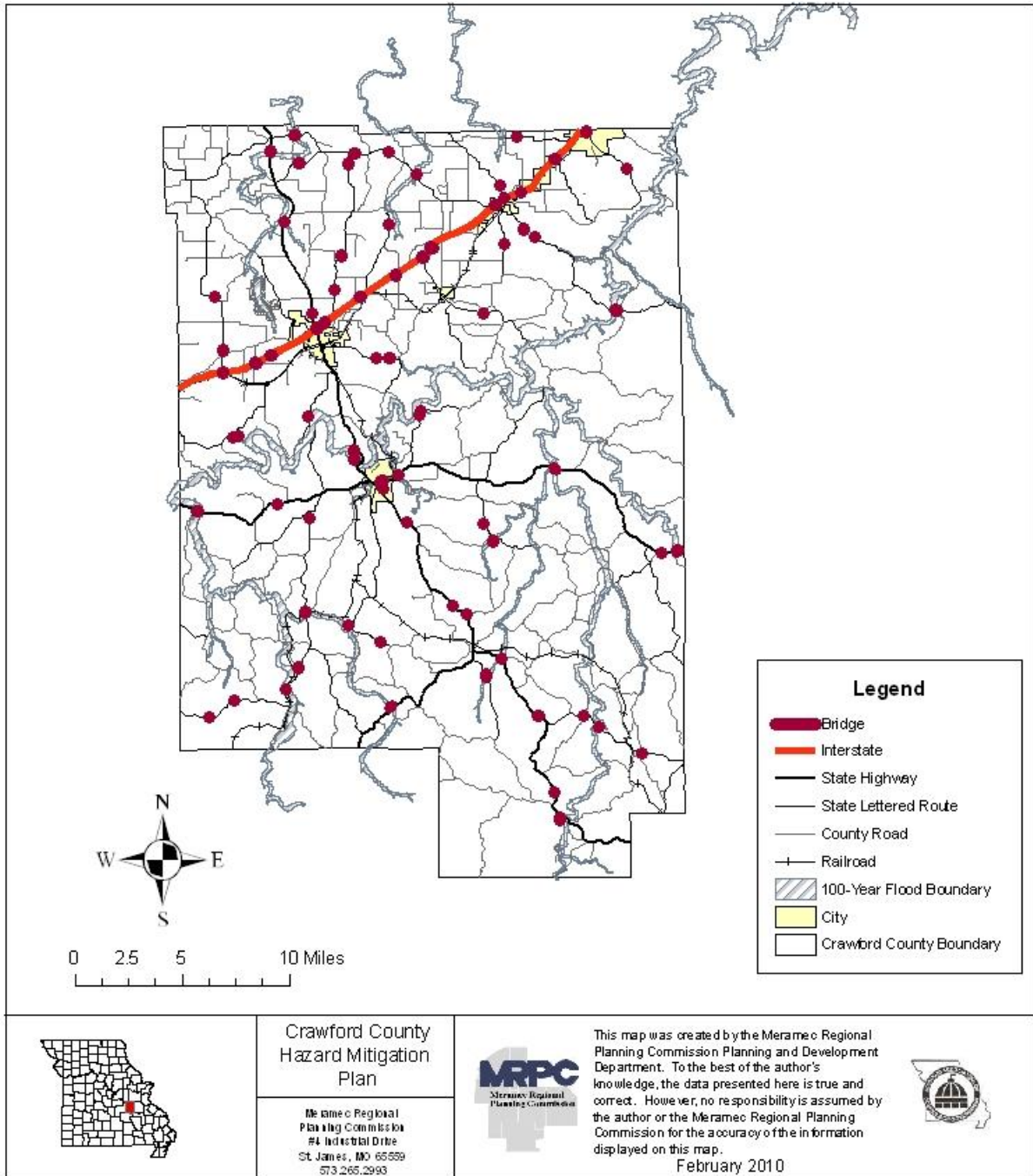


Figure 3-22

Crawford County Pipelines and the 100-Year Flood

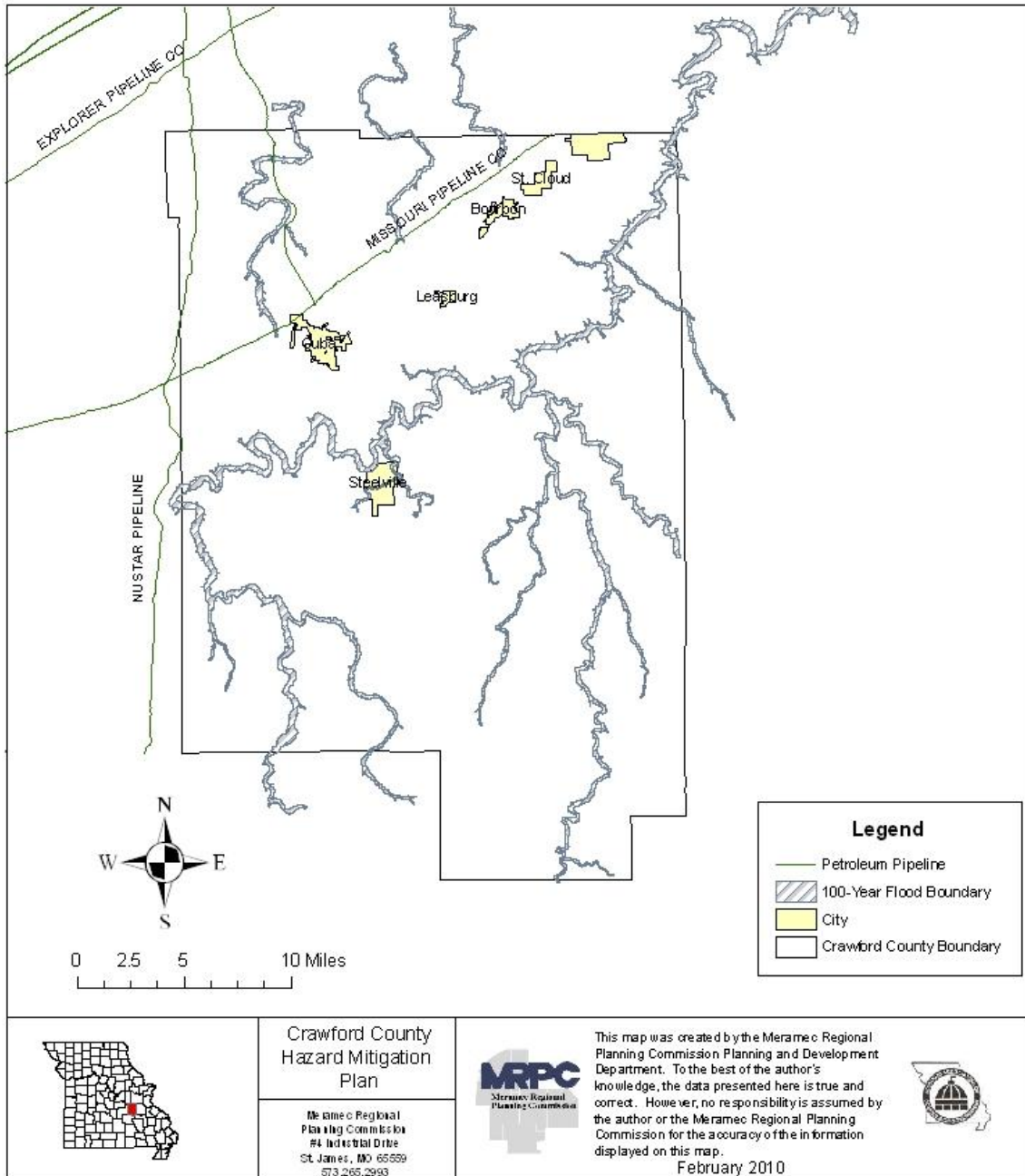


Figure 3-23

Cuba Critical Facilities and the 100-Year Flood

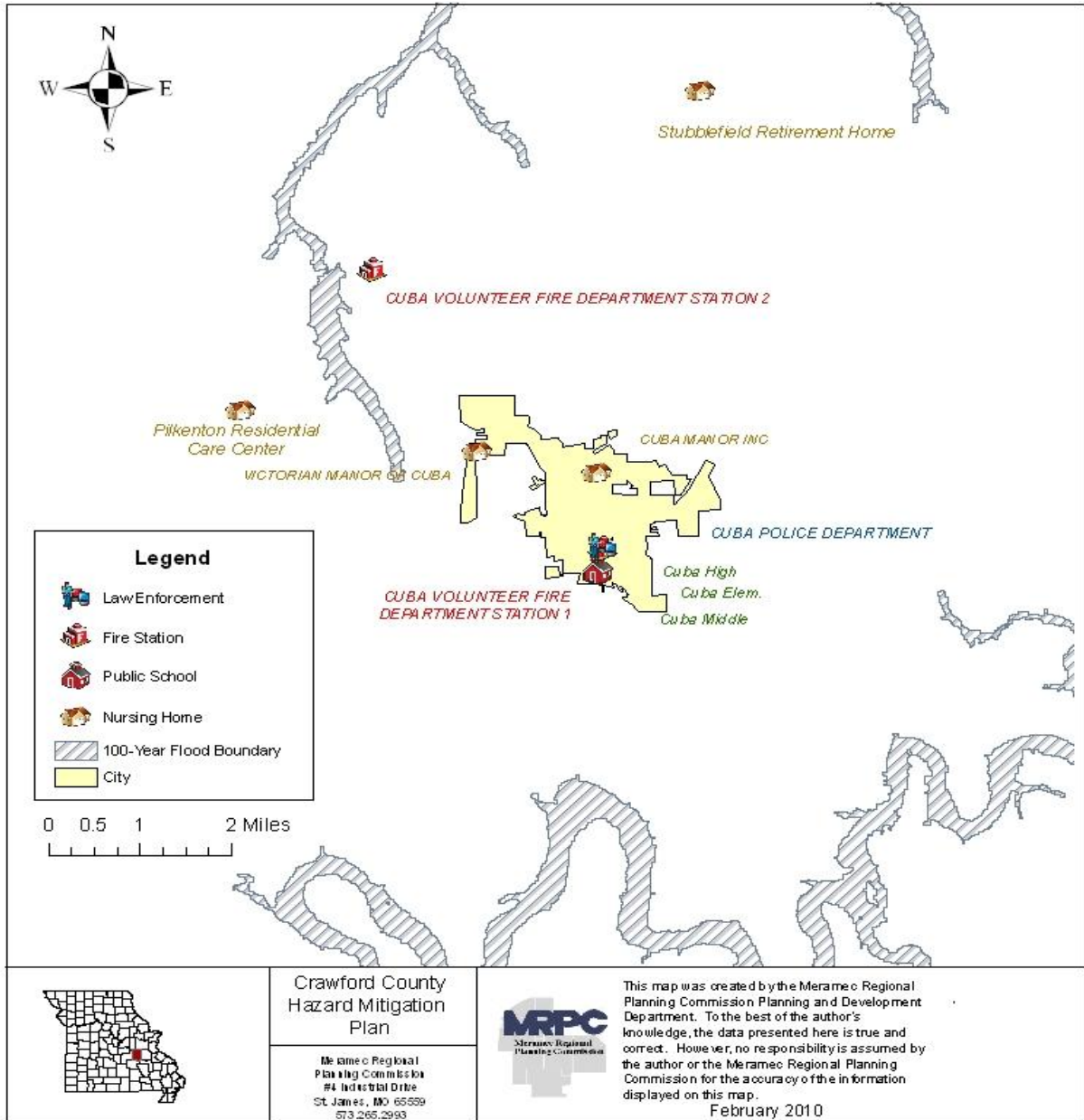


Figure 3-24

Sullivan/St. Cloud/Bourbon Critical Facilities and the 100-Year Flood

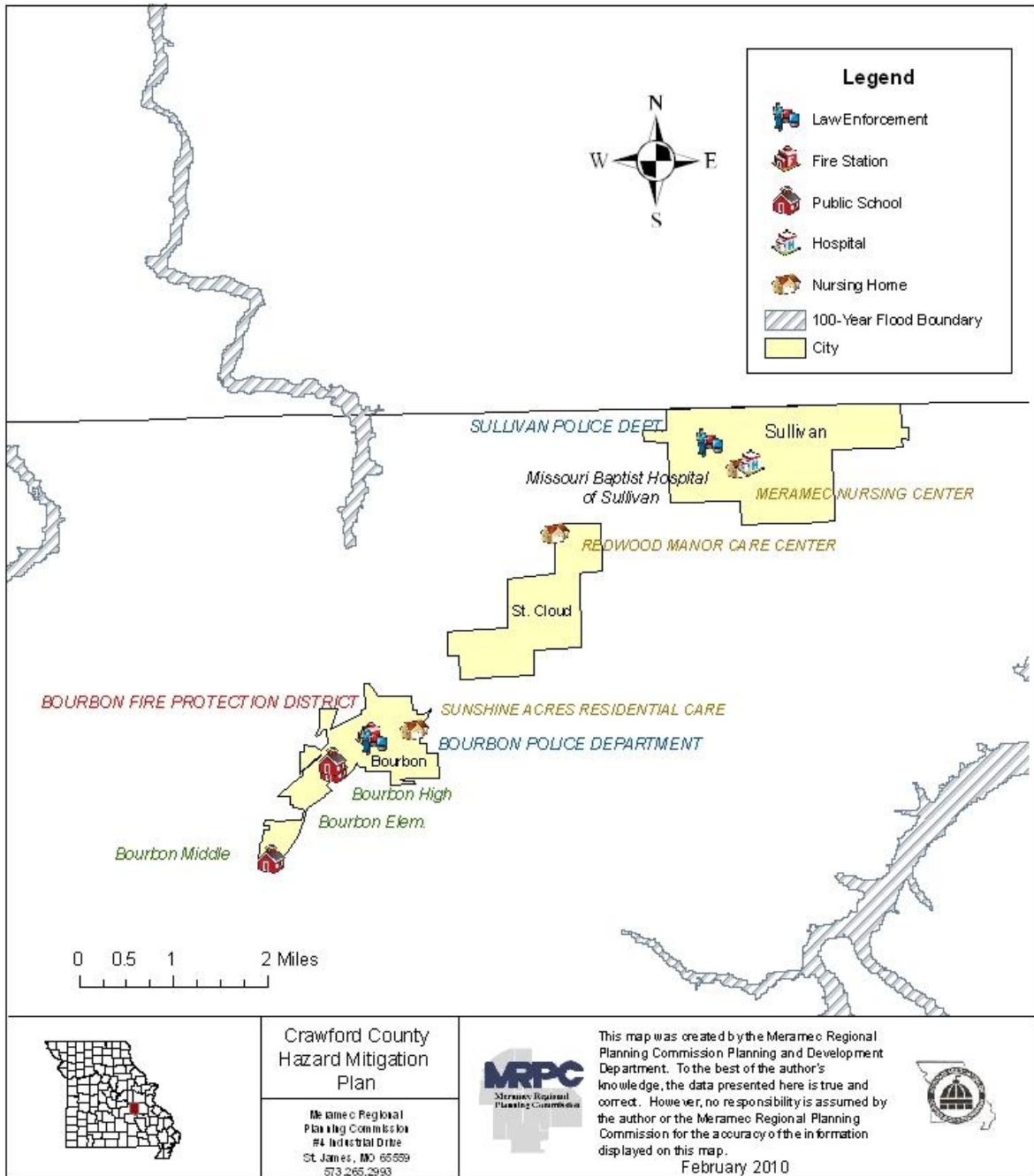


Figure 3-25



Leasburg Critical Facilities and the 100-Year Flood

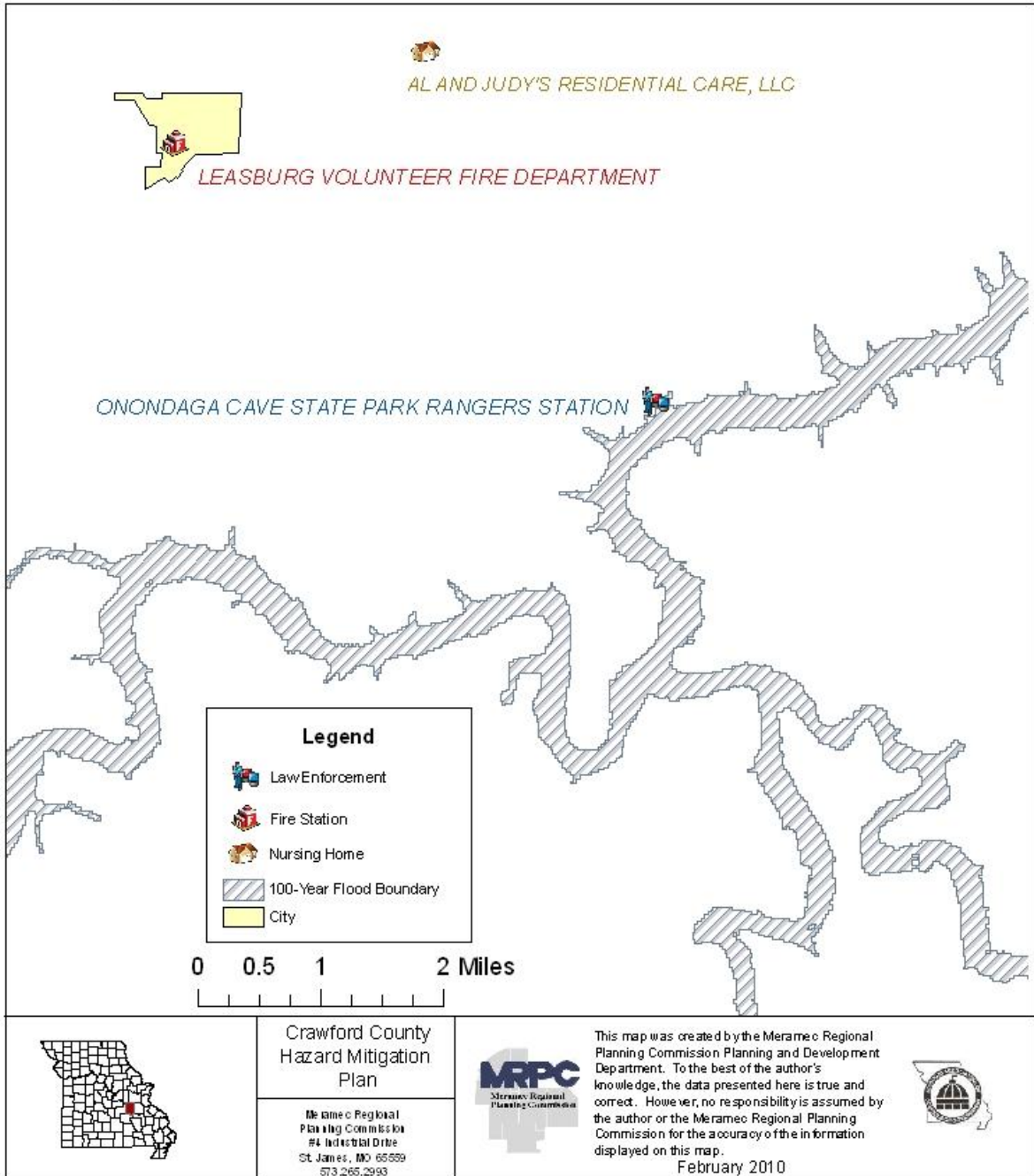
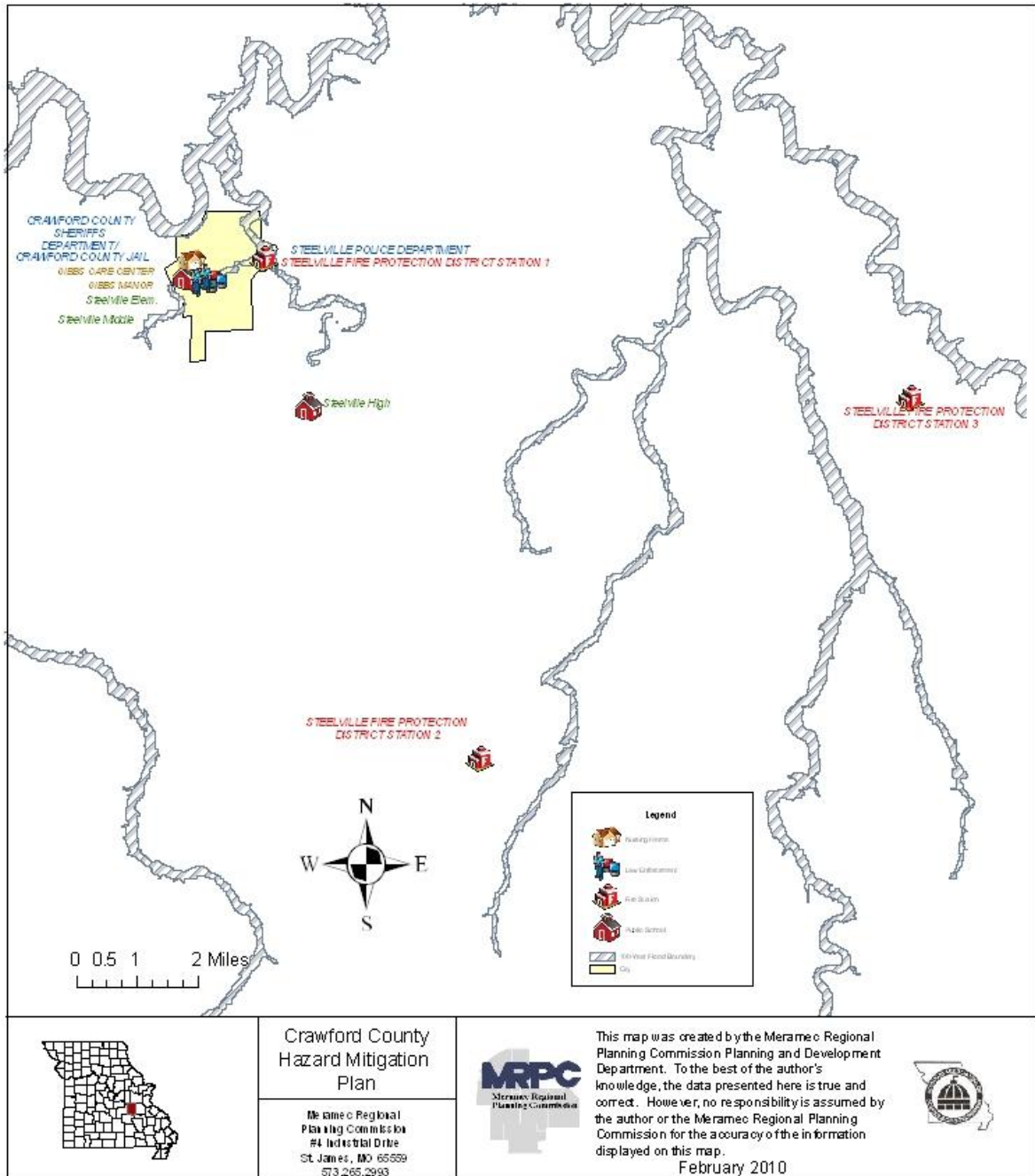


Figure 3-26

Steelville Critical Facilities and the 100-Year Flood



Dam Failure Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: Low. Due to insufficiencies in the available data, it is not possible to provide detailed information on the construction types and values of structures that might be affected by this hazard. As discussed under the probability and magnitude sections of the profile for this hazard (Section 3.2.2), this hazard was rated as Low for all of the jurisdiction – with Crawford County and the cities of Cuba and Sullivan having a numerical risk score slightly higher than the other jurisdictions. This rating was arrived at even though there are 26 dams in Crawford County that are rated as High hazard by the Missouri Department of Natural Resources. Due to the fact that there have been no incidents of dam failure in the county and because the majority of dams are located in undeveloped areas, overall this hazard was ranked as a low priority. During the vulnerability assessment it was determined that the cities of Cuba and Sullivan were more vulnerable to this hazard. There are two high hazard dams located in Cuba and one high hazard dam located in Sullivan. Failure of any of these dams could cause damage to streets, residences and/or businesses. But although the CPRI score was higher for these three jurisdictions, they still ranked as being at a low risk. There have been no incidents of dam failure in the county. The majority of all the dams are located in rural, undeveloped areas. For these reasons dam failure was given a low planning priority rating and it has been determined that Crawford County and its jurisdictions are not vulnerable to significant damage from dam failure.

In regards to future development, the county does not have a planning and zoning to regulate development, so the only recourse is to educate the public on the dangers of dam failure and discourage future development in hazard prone areas. The cities of Cuba and Sullivan have the potential for damage from a dam failure and should consider limiting additional development in those areas that might be affected by the failure of one of the dams located within those communities.

Drought Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: Low. As discussed under the probability and magnitude sections of the profile for this hazard (Section 3.2.3), historically, drought has not had a significant impact on Crawford County or the jurisdictions located in the county. Drought is not a hazard that would typically result in damage to structures or infrastructure. The probability for drought in the area is low due to geographic location and historic weather patterns and due to high quality groundwater resources drought is not considered a significant threat to the area. The threat of drought would have no effect on future development in Crawford County or its jurisdictions.

Earthquake Vulnerability

Overview

Planning significance: Moderate. As discussed under the probability and magnitude sections of the profile for this hazard (Section 3.2.4), there is a risk from earthquakes, but due to the distance to the nearest significant fault lines and the nature of the area's geology, it is expected that damage would be negligible. The greater significance will likely be the disruption of transportation and communications based on damage in southeast Missouri and the impact of evacuations from affected areas and staging of response and aid.

Potential Losses to Existing Development

It is highly unlikely that even a major earthquake in southeast Missouri would cause more than negligible damage in Crawford County. According to the Modified Mercalli Scale, the earthquake would likely be felt by most residents and they might experience the movement of some heavy furniture and fallen plaster. Damage to existing development would be slight. The HAZUS-MH software was used to run a worst-case earthquake scenario and the reports generated by the system showed no damage to any segment of Crawford County.

Future Development

It is anticipated that the threat of earthquake would have no effect on future development in Crawford County.

Extreme Heat Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: High. The entire planning area is susceptible to the hazards associated with extreme heat. The most vulnerable portions of the population are people age 65 and over and those who live in poverty. The elderly are often more prone to suffering from heat related illness. People living at or below the poverty line often cannot afford air conditioning. Based on information from the 2000 U.S. Census, Table 3.40 compares the percentage of persons over age 65 and the percentage of persons below the federal poverty line living in Crawford County and its jurisdictions to averages for Missouri and the United States.

Table 3.40 Crawford County Demographic and Economic Characteristics (2000)

Jurisdiction	2000 Population	Age 65 and Over (%)	Individuals Below the Poverty Level (%)
United States	281,421,906	12.4	12.4
Missouri	5,874,327	13.5	11.7
Crawford County	22,804	15.5	16.3
Bourbon	1,348	15.9	14.2

Jurisdiction	2000 Population	Age 65 and Over (%)	Individuals Below the Poverty Level (%)
Cuba	3,230	19.4	20.1
Leasburg	323	19.2	21
St. Cloud	56	16.1	48.1
Steelville	1,429	23.6	25.5
Sullivan	6,351	17.8	11
West Sullivan	82	No Data	No Data

Source: 2000 U. S. Census

The county and all of its incorporated areas have a higher than average percentage of people over the age of 65. All but Sullivan have a higher than average percentage of individuals living below the poverty level. Both of these populations are vulnerable to the affects of heat waves. The power grid in Crawford County is vulnerable to brown outs or outages during periods of high use associated with extreme heat when the use of air conditioning places additional stress on the power distribution system.

Potential Losses to Existing Development

Extreme heat does not generally have an impact on infrastructure or property and it is difficult to identify specific hazard areas. Stress on livestock and crops are also likely effects of severe heat, but are also difficult to quantify.

Long term care facilities for the elderly and disabled are especially vulnerable to extreme heat events. These facilities are listed in Table 3.20 in Section 3.3.2. The power distribution system is also known to be at risk during extreme heat events, however, there is little data to estimate potential financial losses as a result of power failure during these types of events. Extended power failures certainly have a negative impact on economic activities in the affected areas, but power outages associated with extreme heat are generally brown outs or short term power losses.

Future Development

A growing population increases the number of people vulnerable to extreme heat events. New development also increases the stress on the existing power distribution system. In the past ten years there has been growth in both development and population in areas in and around Cuba and Sullivan. It is anticipated that growth will continue at a slow but steady level into the future.

Landslide Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: Low. Due to insufficiencies in the available data, it is not possible to provide detailed information on the types and values of structures that might be affected by this hazard. As discussed under the magnitude section of the profile for this hazard (Section 3.2.7), historically, landslides have not had a significant impact on Crawford County or the jurisdictions

located within the county. The threat of a landslide causing damage in this area is very low due to the nature of the geology and soil types. As there have been no recorded landslides in the county or its communities, and the probability for damage from this hazard is very low, landslides are not considered a significant threat to the area. The threat of landslides would have no effect on future development in Crawford County.

Land Subsidence/Sinkhole Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: Low. As discussed under the past history and magnitude sections of the profile for this hazard (Section 3.2.8), although there are a large number of sinkholes in Crawford County, there are no recorded incidents of sinkhole collapse that caused injury or property damage. With the exception of a sinkhole located within the borders of Steelville and one located in Leasburg, sinkholes are located in undeveloped areas of the county. Although the two affected communities were rated separately, scores for both groups of jurisdictions still fell within the Low Hazard scoring criteria. The potential for this hazard certainly exists, but based on history and analysis, it is not considered a significant threat to the area. The threat of land subsidence/sinkholes would have no effect on future development in Crawford County.

Severe Storms Hail/Wind Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: High. The entire county and all of its jurisdictions are vulnerable to severe storms, including hail and wind storms. Assets that are likely to incur the most damage from either of these types of severe storms are built structures. Crops are also at risk but row cropping is not widespread in Crawford County and is mainly limited to bottomlands. Large hail and strong winds can damage crops and result in major crop losses. Structural damage that can occur with either wind or hail damage includes damage to roofs, siding and windows. But as all of this type of damage is generally covered under private insurance policies, data on the extent of these losses is not available.

Personal injury is also a potential threat during severe storms from lightening, windblown debris and large diameter hailstones.

Potential Losses to Existing Development

According to data from the National Climatic Data Center (NCDC), from 1950 through 2009, Crawford County reported a total of \$172,000 in property damage from severe storm winds. There was \$5,000 in damages reported attributed to hail. Most of the property damage caused from storms is covered by private insurance and data is not available. As stated earlier, most damage from these types of storms occurs to vehicles, roofs, siding and windows and cost data is not available for property damage covered by private insurance.

Based on CPRI scores and the rating system used to determine magnitude of impact, which includes percentages for damage, we can estimated the number of buildings that might be impacted by severe storms for each jurisdiction. Using HAZUS data, the census tracts were separated out to get the building counts for each jurisdiction.

Damage counts in the following Tables 3.41 -3.52 are based on the magnitude score given to each jurisdiction and applying the corresponding estimated percentage of damage to the total building count. As the percentage of damage is expressed in a range (i.e. 10 to 25 percent), a range is provided for the maximum damage estimate and the minimum damage estimate. Numbers have been rounded to the nearest whole number. All of the jurisdictions rated the magnitude for severe storms/wind/hail as limited – 10 to 25 percent of property severely damaged. All damage estimates have been figured using 10 percent and 25 percent. School district properties are included in the city and county tables, however, separate tables were developed for each school district based on nine percent and one percent damage to the total number of school buildings as provided by each school district. Due to the smaller number of buildings involved, a percentage of damage is show and numbers have not been rounded for school districts in order to provide a clearer picture of estimated damage.

Table 3.41 Estimated Damaged Building Count for Crawford County - Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	7,018	1,755	702
Commercial	192	48	19
Industrial	104	26	10
Agricultural	60	15	6
Religion	28	7	3
Government	8	2	1
Education	2	0	0
Total	7,412	1,853	741

Source: HAZUS-MH

Table 3.42 Estimated Damaged Building Count for Bourbon- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	889	222	89
Commercial	35	9	4
Industrial	24	6	2
Agricultural	5	1	1
Religion	7	2	1
Government	1	0	0
Education	3	1	0
Total	964	241	97

Source: HAZUS-MH

Table 3.43 Estimated Damaged Building Count for Cuba - Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	2,139	535	214
Commercial	129	32	13
Industrial	38	10	4
Agricultural	8	2	1
Religion	14	4	1
Government	1	0	0
Education	2	1	0
Total	2,331	584	233

Source: HAZUS-MH

Table 3.44 Estimated Damaged Building Count for Leasburg- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	364	91	36
Commercial	4	1	0
Industrial	4	1	0
Agricultural	1	0	0
Religion	4	1	0
Government	1	0	0
Education	0	0	0
Total	378	94	36

Source: HAZUS-MH

Table 3.45 Estimated Damaged Building Count for St. Cloud- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	141	35	14
Commercial	4	1	0
Industrial	5	1	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	151	37	14

Source: HAZUS-MH

Table 3.46 Estimated Damaged Building Count for Steelville- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	952	238	95
Commercial	56	14	6
Industrial	18	5	2
Agricultural	3	1	0
Religion	6	2	1
Government	4	1	0
Education	3	1	0
Total	1,042	262	104

Source: HAZUS-MH

Table 3.47 Estimated Damaged Building Count for Sullivan- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	834	209	83
Commercial	31	8	3
Industrial	7	2	1
Agricultural	0	0	0
Religion	4	1	0
Government	1	0	0
Education	0	0	0
Total	877	220	87

Source: HAZUS-MH

Table 3.48 Estimated Damaged Building Count for West Sullivan- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	43	11	4
Commercial	1	0	0
Industrial	0	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	0	0	0
Education	0	0	0
Total	44	11	4

Source: HAZUS-MH

Table 3.49 Estimated Damaged Building Count for Bourbon R-I - Storms

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.50 Estimated Damaged Building Count for Cuba R-II - Storms

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.51 Estimated Damaged Building Count for Steelville R-III - Storms

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.52 Estimated Damaged Building Count for Sullivan C-2 - Storms

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
4	1	.4

Source: www.dese.mo.gov/directory

Future Development

Development trends in Crawford County are not likely to increase vulnerability to this type of hazard.

Severe Winter Storm Vulnerability of Crawford County and Jurisdictions

Overview

Planning Significance: High. All of Crawford County is vulnerable to the effects of winter storms. During periods of heavy snow or ice transportation can be extremely hazardous. The most significant damage from winter storms is accumulating ice. Freezing rain and drizzle collects on utility lines and supporting poles and can cause the collapse of this infrastructure. This results in widespread power outages. As these storms occur during cold weather, the population that loses power also becomes vulnerable to the cold as heating systems are often dependent upon electricity. As with extreme heat events, the elderly are considered to be more vulnerable to injury or death during these types of disasters.

Potential Losses to Existing Development

Homes and businesses with trees are more vulnerable to damage from winter storms, not only to utility lines but to the structures themselves. Falling trees and limbs can cause considerable damage to property and injury or death to occupants. Power distribution infrastructure is the most vulnerable and the most critical during these types of storms. Downed power lines can

cause electrocution of unwary residents or even power company employees. Emergency responders can be hampered in their response by treacherous or impassable roads. Power outages can impact local economies if businesses are not able to stay open. Another hazard that frequently occurs during power outages is carbon monoxide related injuries or death due to the improper use of alternate heating or cooking sources.

Based on CPRI scores and the rating system used to determine magnitude of impact, which includes percentages for damage, we can estimate the number of buildings that might be impacted by severe winter storms for each jurisdiction. Using HAZUS data, the census tracts were separated out to get the building counts for each jurisdiction.

Damage counts in the following tables 3.53 – 3.64 are based on the magnitude score given to each jurisdiction and applying the corresponding estimated percentage of damage to the total building count. As the percentage of damage is expressed in a range (i.e. 10 to 25 percent), a range is provided for the maximum damage estimate and the minimum damage estimate. Number have been rounded to the nearest whole number. All of the jurisdictions rated the magnitude for severe winter storms as negligible – less than 10 percent of property severely damaged. All damage estimates have been figured using nine percent and one percent. School district properties are included in the city and county tables, however, separate tables were developed for each school district based on nine percent and one percent damage to the total number of school buildings as provided by each school district. Due to the smaller number of buildings involved, a percentage of damage is shown and numbers have not been rounded for school districts in order to provide a clearer picture of estimated damage.

Table 3.53 Estimated Damaged Building Count for Crawford County - Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	7,018	632	70
Commercial	192	17	2
Industrial	104	9	1
Agricultural	60	5	0
Religion	28	3	0
Government	8	1	0
Education	2	0	0
Total	7,412	667	73

Source: HAZUS-MH

Table 3.54 Estimated Damaged Building Count for Bourbon- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	889	80	9
Commercial	35	3	0
Industrial	24	2	0
Agricultural	5	0	0
Religion	7	1	0
Government	1	0	0
Education	3	0	0
Total	964	86	9

Source: HAZUS-MH

Table 3.55 Estimated Damaged Building Count for Cuba - Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	2,139	193	21
Commercial	129	12	1
Industrial	38	3	0
Agricultural	8	1	0
Religion	14	1	0
Government	1	0	0
Education	2	0	0
Total	2,331	210	22

Source: HAZUS-MH

Table 3.56 Estimated Damaged Building Count for Leasburg- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	364	33	4
Commercial	4	0	0
Industrial	4	0	0
Agricultural	1	0	0
Religion	4	0	0
Government	1	0	0
Education	0	0	0
Total	378	33	4

Source: HAZUS-MH

Table 3.57 Estimated Damaged Building Count for St. Cloud- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	141	13	1
Commercial	4	0	0
Industrial	5	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	151	13	1

Source: HAZUS-MH

Table 3.58 Estimated Damaged Building Count for Steelville- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	952	86	10
Commercial	56	5	1
Industrial	18	2	0
Agricultural	3	0	0
Religion	6	0	0
Government	4	0	0
Education	3	0	0
Total	1,042	93	11

Source: HAZUS-MH

Table 3.59 Estimated Damaged Building Count for Sullivan- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	834	75	8
Commercial	31	3	0
Industrial	7	1	0
Agricultural	0	0	0
Religion	4	0	0
Government	1	0	0
Education	0	0	0
Total	877	79	8

Source: HAZUS-MH

Table 3.60 Estimated Damaged Building Count for West Sullivan- Storms

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	43	4	0
Commercial	1	0	0
Industrial	0	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	0	0	0
Education	0	0	0
Total	44	4	0

Source: HAZUS-MH

Table 3.61 Estimated Damaged Building Count for Bourbon R-I - Storms

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.62 Estimated Damaged Building Count for Cuba R-II - Storms

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.63 Estimated Damaged Building Count for Steelville R-III - Storms

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.64 Estimated Damaged Building Count for Sullivan C-2 - Storms

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
4	1	.4

Source: www.dese.mo.gov/directory

Future Development

Future development could potentially increase risk through the addition of utility lines that would increase exposure of these systems.

Tornado Vulnerability of Crawford County and Jurisdictions

Overview

Planning Significance: Moderate. Based on the history of frequency and severity of tornados in Crawford County, this hazard was ranked as a moderate risk. As with all weather related hazards, the entire county and all of its jurisdictions are vulnerable to tornados. According to the NCDC, a total of 14 tornados have occurred in Crawford County between 1950 and 2009. Total damages were \$26.266 million during the 60 year period. Of that total, \$25 million was caused by one tornado event. A total of two people have been injured in tornados in the county but there have been no deaths attributed to tornados.

Warning time for tornados can be relatively short. Children, the elderly and the disabled are all more vulnerable to this type of hazard because of the speed of the onset. There is a need for additional storm shelters/safe rooms in Crawford County that can provide protection for residents and in particularly vulnerable populations. There are a number of residences in the area that do not have basements or cellars and several schools have identified the construction of tornado safe rooms as a high priority.

Potential Losses to Existing Development

Crawford County has never experienced a tornado larger than an F2. All but three of the 14 tornados that have occurred since 1950 have been F1 or smaller. Historical data does not preclude the possibility of a larger tornado and safe rooms/storm shelters should be constructed to provide protection during the most severe of tornados. Based on historical data available, tornados occur in Crawford County every four years. Of the 14 recorded events, all but five resulted in damages costing from \$1,000 to \$25 million. If the total losses are averaged over the 60 year period, the annual cost of tornados in Crawford County is \$437,766.

Based on CPRI scores and rating system used to determine magnitude of impact, which includes percentages for damage, we can estimate the number of buildings that might be impacted by tornados for each jurisdiction. Using HAZUS data, the census tracts were separated out to get the building counts for each jurisdiction.

Damage counts in the following Tables 3.64 – 3.75 are based on the magnitude score given to each jurisdiction and applying the corresponding estimated percentage of damage to the total building count. As the percentage of damage is expressed in a range (i.e. 10 to 25 percent), a range is provided for the maximum damage estimate and the minimum damage estimate. Numbers have been rounded to the nearest whole number. All of the jurisdictions rated the magnitude for tornadoes as limited – 10 to 25 percent of property severely damaged. All damage estimates have been figured using 10 percent and 25 percent. School districts properties are included in the city and county tables, however, separate tables were developed for each school district based on 10 percent and 25 percent damage to the total number of school buildings provided by each school district. Due to the smaller number of buildings involved, a percentage of damage is shown and numbers have not been rounded for school districts in order to provide a clearer picture of estimated damage.

Table 3.64 Estimated Damaged Building Count for Crawford County - Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	7,018	1,755	702
Commercial	192	48	19
Industrial	104	26	10
Agricultural	60	15	6
Religion	28	7	3
Government	8	2	1
Education	2	0	0
Total	7,412	1,853	741

Source: HAZUS-MH

Table 3.65 Estimated Damaged Building Count for Bourbon- Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	889	222	89
Commercial	35	9	4
Industrial	24	6	2
Agricultural	5	1	1
Religion	7	2	1
Government	1	0	0
Education	3	1	0
Total	964	241	97

Source: HAZUS-MH

Table 3.66 Estimated Damaged Building Count for Cuba - Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	2,139	535	214
Commercial	129	32	13
Industrial	38	10	4
Agricultural	8	2	1
Religion	14	4	1
Government	1	0	0
Education	2	1	0
Total	2,331	584	233

Source: HAZUS-MH

Table 3.67 Estimated Damaged Building Count for Leasburg - Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	364	91	36
Commercial	4	1	0
Industrial	4	1	0
Agricultural	1	0	0
Religion	4	1	0
Government	1	0	0
Education	0	0	0
Total	378	94	36

Source: HAZUS-MH

Table 3.68 Estimated Damaged Building Count for St. Cloud- Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	141	35	14
Commercial	4	1	0
Industrial	5	1	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	151	37	14

Source: HAZUS-MH

Table 3.69 Estimated Damaged Building Count for Steelville- Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	952	238	95
Commercial	56	14	6
Industrial	18	5	2
Agricultural	3	1	0
Religion	6	2	1
Government	4	1	0
Education	3	1	0
Total	1,042	262	104

Source: HAZUS-MH

Table 3.70 Estimated Damaged Building Count for Sullivan- Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	834	209	83
Commercial	31	8	3
Industrial	7	2	1
Agricultural	0	0	0
Religion	4	1	0
Government	1	0	0
Education	0	0	0
Total	877	220	87

Source: HAZUS-MH

Table 3.71 Estimated Damaged Building Count for West Sullivan- Tornadoes

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
Residential	43	11	4
Commercial	1	0	0
Industrial	0	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	0	0	0
Education	0	0	0
Total	44	11	4

Source: HAZUS-MH

Table 3.72 Estimated Damaged Building Count for Bourbon R-I - Tornadoes

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.73 Estimated Damaged Building Count for Cuba R-II - Tornadoes

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.74 Estimated Damaged Building Count for Steelville R-III - Tornadoes

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.75 Estimated Damaged Building Count for Sullivan C-2 - TORNADOS

Total Building County	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged with 10% Minimal Damage
4	1	.4

Source: www.dese.mo.gov/directory

Future Development

Future development projects, particularly those that serve vulnerable populations such as children and the elderly, should consider tornado hazards in the planning and construction phase of development. New construction of schools and nursing homes should make safe rooms a priority.

Wildfire Vulnerability of Crawford County and Jurisdictions

Overview

Planning significance: High. As discussed under the past history and magnitude sections of the profile for this hazard (Section 3.2.10), historically there have been 564 fires reported in Crawford County between January 2000 and November 2009. The total acreage burned from those incidents was 6,017 acres. Five residences and six outbuildings were damaged, and seven residences, 15 outbuildings and one commercial building were destroyed during the course of these fires. None of the fire caused deaths or injuries. Unfortunately, there is little data available on wildfires and few reported cases of damage to more than forest or pastureland. Due to the rural nature of the county and the sizeable expanse of public land (Mark Twain National Forest, Missouri Department of Conservation lands, Meramec Spring Park and Onondaga Cave State Park) this hazard should be considered a high priority. Wildfires are detected more quickly and response time by fire departments is typically faster in populated areas. The planning significance for cities was considered moderate.

Potential Losses to Existing Development

In a rural, wooded region like Crawford County, there is certainly potential for damage to existing development. The trend toward developing subdivisions outside of incorporated areas in isolated rural areas contributes to the potential for damage to property from wildfires. Historically, considering the large number of wildfires reported, Crawford County has not suffered a great deal of property damage from this hazard, but the potential exists.

Based on CPRI scores and the rating system used to determine magnitude of impact, which includes percentages for damage, we can estimate the number of buildings that might be impacted by wildfires for each jurisdiction. Using HAZUS data, the census tracts were separated out to get the building counts for each jurisdiction.

Damage counts in the following Tables 3.76 – 3.87 are based on the magnitude score given to each jurisdiction and applying the corresponding estimated percentage of damage to the total building count. As the percentage of damage is expressed in a range (i.e. 10 to 25 percent), a range is provided for the maximum damage estimate and the minimum damage estimate. Numbers have been rounded to the nearest whole number. All of the jurisdictions rated the magnitude for wildfire as negligible – less than 10 percent of property severely damaged. All damage estimates have been figured using nine percent and one percent. School district properties are included in the city and county tables, however, separate tables were developed for each school district based on nine percent and one percent damage to the total number of school buildings as provided by the school district. Due to the smaller number of buildings involved, a percentage of damage is shown and numbers have not been rounded for school districts in order to provide a clearer picture of estimated damage.

Table 3.76 Estimated Damaged Building Count for Crawford County - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	7,018	632	70
Commercial	192	17	2
Industrial	104	9	1
Agricultural	60	5	0
Religion	28	3	0
Government	8	1	0
Education	2	0	0
Total	7,412	667	73

Source: HAZUS-MH

Table 3.77 Estimated Damaged Building Count for Bourbon- Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	889	80	9
Commercial	35	3	0
Industrial	24	2	0
Agricultural	5	0	0
Religion	7	1	0
Government	1	0	0
Education	3	0	0
Total	964	86	9

Source: HAZUS-MH

Table 3.78 Estimated Damaged Building Count for Cuba - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	2,139	193	21
Commercial	129	12	1
Industrial	38	3	0
Agricultural	8	1	0
Religion	14	1	0
Government	1	0	0
Education	2	0	0
Total	2,331	210	22

Source: HAZUS-MH

Table 3.79 Estimated Damaged Building Count for Leasburg - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	364	33	4
Commercial	4	0	0
Industrial	4	0	0
Agricultural	1	0	0
Religion	4	0	0
Government	1	0	0
Education	0	0	0
Total	378	33	4

Source: HAZUS-MH

Table 3.80 Estimated Damaged Building Count for St. Cloud - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	141	13	1
Commercial	4	0	0
Industrial	5	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	151	13	1

Source: HAZUS-MH

Table 3.81 Estimated Damaged Building Count for Steelville - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	952	86	10
Commercial	56	5	1
Industrial	18	2	0
Agricultural	3	0	0
Religion	6	0	0
Government	4	0	0
Education	3	0	0
Total	1,042	93	11

Source: HAZUS-MH

Table 3.82 Estimated Damaged Building Count for Sullivan - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	834	75	8
Commercial	31	3	0
Industrial	7	1	0
Agricultural	0	0	0
Religion	4	0	0
Government	1	0	0
Education	0	0	0
Total	877	79	8

Source: HAZUS-MH

Table 3.83 Estimated Damaged Building Count for West Sullivan - Wildfire

Occupancy	Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
Residential	43	4	0
Commercial	1	0	0
Industrial	0	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	0	0	0
Education	0	0	0
Total	44	4	0

Source: HAZUS-MH

Table 3.84 Estimated Damaged Building Count for Bourbon R-I - Wildfire

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.85 Estimated Damaged Building Count for Cuba R-II - Wildfire

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.86 Estimated Damaged Building Count for Steelville R-III - Wildfire

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
3	.75	.3

Source: www.dese.mo.gov/directory

Table 3.87 Estimated Damaged Building Count for Sullivan C-2 - Wildfire

Total Building County	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged with 1% Minimal Damage
4	1	.4

Source: www.dese.mo.gov/directory

Future Development

New development, particularly residential or commercial buildings that are located outside of incorporated areas and farther from fire services, should consider fire suppressive landscaping and other measures to reduce vulnerability. Residents should be educated on the dangers of wildfire and provided information on how to make their property less vulnerable.

3.3.4 Future Land Use and Development

Table 3.41 shows the changes in population for Crawford County and its jurisdictions.

Table 3.41 Historic Population Trends for Crawford County and Jurisdictions

Jurisdiction	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan
2000 Population	22,804	1,348	3,320	323	56	1,429	6,351	82
% Change	18.9	13.5	27.3	11.8	5.1	-2.5	12.2	---
1990 Population	19,173	1,188	2,537	289	59	1,465	5,661	---
% Change	4.8	-5.6	19.7	-5.0	n/a	-0.3	3.7	---
1980 Population	18,300	1,259	2,120	304	n/a	1,470	5,461	---
% Change	23.4	31.8	2.4	39.4		5.6	7.1	

Jurisdiction	Crawford County	Bourbon	Cuba	Leasburg	St. Cloud	Steelville	Sullivan	West Sullivan
1970 Population	14,828	955	2,070	218	n/a	1,392	5,100	---
% Change	17.2	22.6	23.8	23.9		23.5	24.5	
1960 Population	12,647	779	1,672	176	n/a	1,127	4,098	---
% Change	8.9	43.5	28.5	-1.1		-2.6	32.8	
1950 Population	11,615	543	1,301	178	n/a	1,157	3,019	---
% Change	-9.3	50.8	25.9	2.9		14.2	19.9	

Source: U.S. Census Bureau

According to the Missouri Office of Administration, Division of Budget and Planning, the population for Crawford County is projected to grow slightly over the next 15 years. Much of the growth over the past two decades can be attributed to migration out of the urban St. Louis area. This migration is expected to slow due to the rising costs of transportation.

Between 1990 and 2000, Crawford County experienced the highest growth rate of all the counties in the Meramec region – 18.9 percent.^{lxxviii} Several communities in Crawford County also experienced striking growth during that time frame. Bourbon grew by 13.5 percent; Cuba by 27.3 percent; Leasburg by 11.8 percent and Sullivan by 12.2 percent. However, it is believed that population growth will stabilize and increase at a slower rate in the future.

Steelville has experienced decreases in population in recent years, falling by 2.5 percent in 2000 and 0.3 percent in 1990. This trend will likely continue.

3.3.5 Summary of Key Issues

Table 3.42 shows the results of the Hazard Ranking in order of High to Low Planning Significance based on the methodology described in section 3.1.

Table 3.42 Crawford County Hazard Ranking High to Low Planning Significance

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Flood – County, Steelville, Steelville R-III	4	1	4	3	3.0	High
Bourbon, Cuba, Leasburg, St. Cloud, Sullivan, West Sullivan, Bourbon R-I, Cuba R-II, Sullivan C-2	4	1	4	2	2.9	High
Severe Storm (Hail storm/Wind storm)	4	1	4	1	3.0	High
Wildfire – County	4	1	4	2	2.9	High
Cities & R-III	3	1	4	2	2.45	Moderate
Schools	1	1	4	2	1.55	Low

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Extreme Heat	4	1	1	3	2.55	High
Severe Winter Storm	4	1	1	3	2.55	High
Tornado	2	2	4	1	2.2	Moderate
Earthquake	2	1	4	4	2.05	Moderate
Land Subsidence/ Sinkholes – Bourbon, Cuba, St. Cloud, Sullivan, West Sullivan	1	2	4	3	1.95	Low
County, Leasburg, Steelville	1	1	4	3	1.45	Low
Dam Failure- Cuba, Sullivan, Crawford County	1	2	4	3	1.95	Low
Bourbon, Leasburg, St. Cloud, West Sullivan	1	1	4	3	1.65	Low
Landslide	1	1	4	1	1.45	Low
Drought	1	1	1	4	1.3	Low

Sources: Crawford County hazard mitigation planning committee, Missouri Hazard Mitigation Plan (2007), Missouri Hazard Analysis (2008)

The HMPC will focus efforts for hazard mitigation projects on those hazards that have a High or Moderate planning priority ranking. The following section highlights key issues brought out by the risk assessment.

Flood

- Homes and businesses throughout the county and in all of the communities have been impacted by riverine or flash flooding
- Several roads, bridges and low water crossings in the county are vulnerable to flooding.
- The City of Steelville is vulnerable to flooding along the Yadkin and Whitenburg creeks
- A number of homes and businesses that flooded in the past did not have flood insurance
- There are a number of low water bridges in the county that could be mitigated
- There are a number of vulnerable properties in the Meramec River watershed that could be considered for flood buyouts.

Severe Storm Hail Storm/ Wind Storm

- Severe storms can damage power lines through sheer force of wind or windblown debris such as tree limbs
- Mobile homes and other unsecured buildings such as carport awnings and sheds are vulnerable to windstorms
- Roofs are frequently damaged by wind and/or hail

Earthquake

- The New Madrid Fault has the potential to cause catastrophic damage to eastern and southeast Missouri
- Although Crawford County is not located in an area that will likely not see very much damage from an earthquake, the area will be impacted by loss of communications, transportation disruption of roads, rail and pipelines and the likely flow of refugees out of the impacted area and response going into the impacted region

Extreme Heat

- Stress on the power distribution system can lead to brown outs or power outages
- Need to identify and publicize cooling centers
- Elderly populations and those living below the poverty line are especially vulnerable. All of the communities in Crawford County have a higher than average percentage of people over the age of 65. All but Sullivan have a higher than average percentage of individuals living below the poverty level.

Severe Winter Storm

- Ice accumulation damages power lines and power infrastructure causing prolonged power outages for large portions of the region
- Roads become hazardous for motorists and emergency responders
- Schools and businesses close due to power outages and poor travel conditions

Tornado

- Mobile homes and unsecured structures such as carport awnings and sheds are particularly vulnerable
- Public may not be aware of the locations of shelters
- May need to increase the number of weather shelters and publicize their availability
- Not all schools, public buildings or other facilities serving vulnerable populations may have adequate safe rooms

Wildfire

- History shows that all areas of the county are at high risk for wildfire. Those areas of the county where population and vegetation densities are greater are at higher risk of property damage and potential for injuries should a wildfire occur.
- Crawford County has frequent wildfires and is considered high risk.
- Bourbon, Cuba, Leasburg, Steelville, Sullivan and West Sullivan were all considered to be at moderate risk for wildfire
- Homes and businesses located in unincorporated areas are at higher risk from wildfires due to proximity to woodland and distance from fire services
- Although the magnitude of a wildfire may be lessened in the incorporated areas due to the proximity to fire services, they are not exempt from the dangers of wildfires.

ⁱ United States Geological Survey. Damage Evaluation of the Taum Sauk Reservoir Failure using LiDAR. http://mcgsc.usgs.gov/publications/t_sauk_failure.pdf

ⁱⁱ The Alert. Spring 2006. After the Deluge...What's Ahead for Taum Sauk? By Dan Sherburne.

ⁱⁱⁱ Ibid.

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- ^{iv} United States Geological Survey Fact Sheet 131-02. October 2002
- ^v Missouri State Hazard Mitigation Plan, May 2007
- ^{vi} United States Geological Survey Fact Sheet 131-02. October 2002
- ^{vii} Missouri State Hazard Mitigation Plan, May 2007
- ^{viii} Ibid.
- ^{ix} Missouri Department of Natural Resources, Water Resources Center, website:
http://www.dnr.mo.gov/env/wrc/damsft/Crystal-Reports/crawford_dams.pdf
- ^x United States Geological Survey Fact Sheet 131-02. October 2002
- ^{xi} National Drought Mitigation Center. <http://www.drought.unl.edu/whatis/concept.htm>
- ^{xii} Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- ^{xiii} National Drought Mitigation Center. <http://www.drought.unl.edu/whatis/concept.htm>
- ^{xiv} Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- ^{xv} Ibid.
- ^{xvi} National Oceanic and Atmospheric Administration.
<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>
- ^{xvii} Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- ^{xviii} National Disaster Education Coalition. <http://www.disastercenter.com/missouri/heat.html>
- ^{xix} Missouri State Hazard Mitigation Plan May 2007
- ^{xx} United States Geological Survey. <http://neic.usgs.gov/neis/general/handouts/mercalli.html>
- ^{xxi} United States Geological Survey. http://neic.usgs.gov/neis/states/missouri/missouri_history.html
- ^{xxii} Missouri State Hazard Mitigation Plan May 2007
- ^{xxiii} United States Geological Survey Fact Sheet 131-02. October 2002
- ^{xxiv} Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- ^{xxv} Ibid.
- ^{xxvi} National Weather Service. <http://weather.noaa.gov/weather/hwave.html>
- ^{xxvii} Missouri State Hazard Mitigation Plan, May 2007
- ^{xxviii} Ibid.
- ^{xxix} Ibid.
- ^{xxx} Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- ^{xxxi} Ibid.
- ^{xxxii} United States Search and Rescue Task Force. <http://www.ussartf.org/landslides.htm>
- ^{xxxiii} Ibid.
- ^{xxxiv} Ibid.
- ^{xxxv} United States Geological Survey, Landslide Hazard Program, Landslides 101.
<http://landslides.usgs.gov/learning/l101.php>
- ^{xxxvi} Ibid.
- ^{xxxvii} Ibid.
- ^{xxxviii} United States Geological Survey.
<http://landslides.usgs.gov/learning/prepare/?PHPSESSID=vdngtb7fu9n7rjflnvkqocbh55>
- ^{xxxix} United States Geological Survey Fact Sheet 2005-3156
- ^{xl} United States Geological Survey, Landslide Hazard Program, Landslides 101.
<http://landslides.usgs.gov/learning/l101.php>
- ^{xli} United States Geological Survey Fact Sheet 2005-3156
- ^{xlii} United States Search and Rescue Task Force. <http://www.ussartf.org/landslides.htm>
- ^{xliii} Ibid.
- ^{xliv} Ibid.
- ^{xlv} United States Geological Survey.
<http://landslides.usgs.gov/learning/prepare/?PHPSESSID=vdngtb7fu9n7rjflnvkqocbh55>
- ^{xlvi} United States Geological Survey Fact Sheet 2005-3156
- ^{xlvii} Ibid.
- ^{xlviii} <http://ga.water.usgs.gov/edu/earthgwlandsubside.html>
- ^{xlix} Ibid.

¹ Missouri Department of Natural Resources, Missouri Resources Magazine, Spring/Summer 2003 – Volume 20, Number 1, *That Sinking Feeling – a Void, A Collapse*, by Jim Van Dyke

^{li} Ibid.

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- lii Ibid.
- liii Midwest Lakes Policy Center. <http://blog.midwestlakes.org>
- liv Missouri Department of Natural Resources, Missouri Resources Magazine, Spring/Summer 2003 – Volume 20, Number 1, *That Sinking Feeling – a Void, A Collapse*, by Jim Van Dyke
- lv Missouri Department of Natural Resources. <http://www.dnr.mo.gov/env/wrc/springsandcaves.htm>
- lvi Sinkhole.org. <http://www.sinkhole.org/CommonSigns.php>
- lvii Missouri Department of Natural Resources, Missouri Resources Magazine, Spring/Summer 2003 – Volume 20, Number 1, *That Sinking Feeling – a Void, A Collapse*, by Jim Van Dyke
- lviii Midwest Lakes Policy Center. <http://blog.midwestlakes.org>
- lix National Disaster Education Coalition. <http://www.disastercenter.com/missouri/tornado.html>
- lx Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- lxi National Disaster Education Coalition. <http://www.disastercenter.com/guide/thunder.html>
- lxii National Disaster Education Coalition. <http://www.disastercenter.com/guide/tornado.html>
- lxiii Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- lxiv National Oceanic and Atmospheric Administration.
<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>
- lxv Missouri State Hazard Mitigation Plan, May 2007
- lxvi Ibid.
- lxvii Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- lxviii Ibid.
- lxix Missouri Department of Conservation.
- lxx Ibid.
- lxxi Ibid.
- lxxii Missouri Hazard Analysis. State Emergency Management Agency. 1999.
- lxxiii Missouri Department of Health and Senior Services, Show Me Childcare,
<http://ccregu.dhss.mo.gov/smcc/pnpCCSearch>
- lxxiv Missouri Department of Health and Senior Services, <http://www.dhss.mo.gov/cgi-bin/nhomes2.pl?facid=15510>
- lxxv Missouri Department of Health and Senior Services, <http://www.dhss.mo.gov/NursingHomes/ADC-licensed.pdf>
- lxxvi Missouri Department of Elementary and Secondary Education, <http://dese.mo.gov/directory>
- lxxvii Region I Homeland Security Oversight Committee and American Red Cross lists of shelters
- lxxviii Meramec Region Comprehensive Economic Development Strategy, 2007 Revision

4 MITIGATION STRATEGY

44 CFR Requirement 201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section presents the mitigation strategy developed by the Crawford County Hazard Mitigation Planning Committee (HMPC) based on the risk assessment. The mitigation strategy was developed by the HMPC. The group first agreed on general goal statements that would guide the jurisdictions in their efforts to reduce the impact of disasters in Crawford County. Then the group looked at developing and prioritizing a list of specific mitigation actions that could be taken to further the overall goals and directly reduce the County's vulnerability to hazards.

Introduction to Mitigation

Definition of Mitigation

Mitigation is defined by FEMA as "...sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects." It describes the ongoing effort at the Federal, State, local, and individual levels to lessen the impact of disasters upon families, homes, communities and economy.

Mitigation includes not only avoiding the development of vulnerable sections of the community, but also making existing development in hazard-prone areas safer. For example, identifying areas in the community that are susceptible to damage from natural hazards and taking steps to make these areas less vulnerable, through flood buyouts for example.

Mitigation also includes steering growth to less risky areas, through nonstructural measures such as avoiding construction in the most flood-prone areas for example. Keeping buildings and people out of harm's way is the essence of mitigation. In fact, incorporating mitigation into decisions related to the community's growth can result in a safer, more resilient community, and one that is more attractive to new families and businesses.

Missouri is subject to many types of natural hazards: floods, tornadoes, winter storms, earthquakes, droughts, winter storms and occasionally, wildfires. Technological hazards such as chemical explosions, manmade explosions, hazardous material or HAZMAT spills, and terrorism, all of which can have significant economic and social impacts exist also. Some, such as floods and HAZMAT spills, can occur any time of the year and almost anywhere in the state. And as we all know, their occurrence in some places in our state is inevitable. However, due to time and funding limitations, this plan will focus on natural hazards only.

Categories of Mitigation

Mitigation measures may be grouped into six categories.

- Prevention
- Property protection
- Natural resource protection
- Emergency services
- Structural projects
- Public information

Prevention Measures

Prevention measures are intended to keep a hazard risk problem from getting worse. They ensure that future development does not increase hazard losses. Communities can achieve significant progress toward hazard resistance through prevention measures. This is particularly true in areas that have not been developed or where capital investment has not been substantial.

Using prevention measures, future development can be guided away from hazards, while maintaining other community goals such as economic development and quality of life.

Some examples of prevention measures are:

- Planning and zoning
- Open space preservation
- Land development regulations
- Storm water management

Property Protection Measures

Property protection measures are used to modify buildings subject to hazard risk, or their surroundings, rather than to prevent the hazard from occurring. A community may find these to be inexpensive measures because often they are implemented or cost-shared with property owners. These measures directly protect people and property at risk. (Protecting a building does not have to affect the building's appearance and is therefore a popular measure for historic and cultural sites.)

Some examples of property protection measures are:

- Acquisition – public procurement and management of lands that are vulnerable to damage from hazards
- Relocation – permanent evacuation of hazard-prone areas through movement of existing hazard-prone development and population to safer areas
- Rebuilding – modifying structures to reduce damage by future hazard events
- Flood-proofing – protecting a flood-prone building using one or more of several different methods

Natural Resource Protection Measures

Natural resource protection measures are intended to reduce the intensity of hazard effects as well as to improve the quality of the environment and wildlife habitats. Parks, recreation, or conservation agencies or organizations usually implement these activities.

Examples of natural resource protection include:

- Erosion and sediment control
- Wetlands protection

Emergency Services Measures

Emergency services measures protect people before and after a hazard event. Most counties and many cities have emergency management offices to coordinate warning, response and recovery during a disaster.

Emergency services include:

- Warning
- Capacity of Response (Not a Mitigation Measure)
- Critical facilities protection
- Health and safety maintenance

Structural Mitigation Measures

Structural measures directly protect people and property at risk. They are called “structural” because they involve construction of man-made structures to control hazards.

Structural projects for flood control may include:

- Reservoirs
- Levees and floodwalls
- Diversions
- Channel modifications
- Storm sewers
- A structural solution for landslides is the construction of a debris basin

Public Information Mitigation Measures

Public information activities inform and remind people about hazardous areas and the measures necessary to avoid potential damage and injury. Public information activities for mitigation are directed toward property owners, potential property owners, business owners and visitors.

A few examples of public information activities to achieve mitigation are:

- Providing hazard maps and other hazard information
- Outreach programs that provide hazard and mitigation information to people when they have not asked for it

- How might outreach programs accomplish this?
- Print media
- Radio/TV spots and interviews
- Videotape
- Mass mailings
- Notices to residents and property owners in a specific, hazard-prone area
- Displays in widely used facilities such as public buildings and malls
- Presentations at meetings of neighborhood groups
- Real estate disclosure
- Information in the public library or a library developed specifically for mitigation information
- Available technical assistance
- School age and adult education

How does mitigation differ from preparedness, response and recovery?

Mitigation includes long-term activities that reduce or eliminate a hazard and/or a hazard's damage. Building codes, floodplain management, tornado safe rooms/storm shelters, flood buyouts and planning are examples of mitigation. Preparedness activities are designed to develop individual and community capabilities to respond to and recover from disasters. Preparedness activities include training, exercises and stocking emergency supplies. Response actions include those immediate activities that save lives, protect property and stabilize the situation when disaster strikes. The activities that return the community to normal or pre-disaster conditions fall under the heading of recovery.

Mitigation Plan Benefits

Hazard Mitigation Planning offers many community benefits. Principally, it can:

- **Save lives and property** - Communities can save lives and reduce property damage from natural hazards through mitigation actions, such as keeping families and homes out of harm's way.
- **Meet the Needs of the Community** - Each community is different in terms of its economics, size, geography, governance, demography, land uses, and hazards. Therefore each community's mitigation plan will vary to some degree. Mitigation planning identifies problems and solutions that are specific to your community.
- **Achieve Multiple Objectives** - Developing a "multi-objective" plan that can help the community to better sustain itself:
 - Find the most appropriate solutions
 - Address multiple problems with a single solution
 - Maintain or improve local environmental and economic integrity
 - Demonstrate commitment to improving community health and safety

Multi-objective planning creates opportunities to develop a broader resource support base that no longer relies solely upon disaster programs to resolve disaster problems. The solutions may be imbedded in other projects such as transportation, economic development, recreation and environmental enhancements.

• **Reduce vulnerability to future hazards** - With a mitigation strategy in place, the community will be better prepared to take steps that will permanently reduce the risk of future losses for individuals and businesses.

- Preparing and following a Hazard Mitigation Plan can reduce business disruptions following a disaster. Usually it is assumed that business disruptions stem from direct building damages or from infrastructure damages such as a lengthy utility outage. Sometimes, these damages are the result of building a business in a hazardous location (the floodplain for example), and sometimes, the damages may be caused by poor construction, especially in the absence of building codes. However, even if a business is not directly damaged by a disaster and utilities are not adversely affected, the operations of a business may still be disrupted for some time should something like flooding or debris block customer and/or supplier access to the business. For this reason, hazard mitigation planning is important to every stakeholder in the community.
- Building a community without regard to natural hazards or rebuilding one after a disaster “just like it was before” eradicates the community’s power to reduce its vulnerability to natural hazards.
- While it is natural to want to return things to the way they were after a disaster, it is important to remember that, in many cases, the disaster damage will not be as severe if a mitigation plan is developed and implemented before a disaster occurs.

• **Guide & Speed Post-Disaster Recovery** - The planning process guides post-disaster recovery in many ways. By identifying and ranking projects before the next disaster, the community will be in a better position to obtain post-disaster funding because much of the background work necessary for applying for Federal funding will already be done. The plan:

- Prepares the community to deal with post-disaster situations by identifying actions that should be done immediately following the disaster.
- Helps the community to develop policies that promote a rapid and efficient recovery, and capitalize on post-disaster opportunities for safety improvements.
- Having a plan that includes post-disaster actions will ensure that opportunities for future mitigation are not overlooked in the urgency to rebuild.

• **Enhances Funding Opportunities** – The mitigation process works through the use of various possible sources of federal, state and local project funding. Successful completion of the Hazard Mitigation Plan can also fulfill the planning requirements for several federal programs such as the Hazard Mitigation Grant Program (only post-disaster mitigation grant program), the Pre-Disaster Mitigation (PDM) grant program, the Flood Mitigation Assistance (FMA) program and the Community Rating System (CRS) program. This plan also may qualify the community for recognition for other federal programs such as the National Weather Service’s StormReady program.

- **Promotes Public Participation** - The planning process promotes public participation by:
 - Helping generate ideas for solutions and ensuring recognition and local ownership of the plan.
 - Providing groups and individuals concerned about the potential effects of disasters many opportunities to participate in problem solving and in plan implementation.

Goal & Objective Development

The Crawford County Hazard Mitigation Planning Committee developed the goals and objectives by reviewing a list of needs compiled at previous meetings. Committee members created goals and objectives that would meet the needs of Crawford County and reduce hazards by the greatest amount. During the 2009 update, the advisory committee reviewed all the goals and objectives and provided input on what had been accomplished in the last five years.

4.1 Goals

44 CFR Requirement 201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long term vulnerabilities to the identified hazards.

The HMPC developed goals to provide direction for reducing hazard-related losses in Crawford County. These were based upon the results of the risk assessment and a review of mitigation goals from other state and local plans. These included the Missouri State Hazard Mitigation Plan, and local hazard mitigation plans from adjoining counties as well as the Crawford County Local Emergency Operations Plan.

The following overall goals and mitigation objectives were reviewed and accepted by the HMPC as best reflecting the needs of Crawford County, and were reconfirmed at the five-year review.

Goal 1: Reduce risks and vulnerabilities of people in hazard-prone areas through current technology, better planning and hazard mitigation activities.

Goal 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.

Goal 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.

Goal 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.

Goal 5: Establish priorities for reducing risks to the people and their property with emphasis on long-term and maximum benefits to the public rather than short-term benefit of special interests.

Goal 6: Secure resources for investment in hazard mitigation.

4.2 Identification and Analysis of Mitigation Measures

44 CFR Requirement 201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

At the first HMPC meeting information was distributed defining mitigation and the differences between mitigation and response activities to help the committee better define needs and action items. The following mitigation needs were developed by the Crawford County hazard mitigation planning committee during the first committee meeting. Each mitigation need was posted on the wall and committee members then discussed possible action items that could be included in the plan to address each of the identified needs.

1. Need road and bridge upgrades to improve drainage and reduce flooding.
2. Need trees trimmed near lines.
3. Need trees trimmed and dead ones removed along streets/roads.
4. Need all house addresses posted, especially in rural areas.
5. Need alternative/temporary housing/designated shelters for a variety of disasters.
6. Need to improve emergency services/response in rural/National Forest areas.
7. Need to expand/upgrade early warning systems, especially in rural areas.
8. Need local agreements between public agencies and private contractors to work together.
9. Need to encourage growth of existing CERT program.
10. Need to encourage earthquake-proof equipment in hospital, 9-1-1 center, nursing homes and emergency operations center.
11. Need to encourage citizens to have weather radio, emergency medical kit, water, flashlights, blankets, medicine, etc. to have if evacuated or have to endure without utilities.
12. Need countywide drill for disaster.
13. Need more training (fire drills, evacuation drills, participation in statewide drills, incident command, etc.)
14. Need to encourage business/government to have a disaster plan and implement it.
15. Need to address flood-prone areas.
16. Need storm water management plans in all cities.
17. Need stronger floodplain permit enforcement.
18. Need to develop evacuation plans and procedures (consider school buses).
19. Need water conservation plans.
20. Need early warning system for homes below dams.
21. Need monitoring systems for dams.
22. Need to make residents aware of fire hazards (fire prevention).

23. Need to educate residents on how to shut down utilities, use fire extinguishers.
24. Need to secure propane tanks in flood prone areas.
25. Need to improve communication between agencies (more meetings, etc.)
26. Need to improve public media communications for warnings, updates (radio, cable stations, local channels).
27. Need emergency backup generators for water systems and emergency services.
28. Need warning signs at low-water bridges.
29. Need to be sure that all schools and facilities with high population densities have adequate storm shelters and/or tornado safe rooms.

4.2.1 STAPLEE Scoring

When developing the mitigation strategy, the planning committee followed several guidelines for selection of action items. According to the STAPLEE criteria, the committee looked for action items that were socially acceptable, technically feasible, executable by local communities, politically acceptable, legal, and economically feasible and environmentally sound. Each action item was rated, as illustrated in Table 4.1.

To assist with the prioritization of mitigation actions, the STAPLEE prioritization, criteria recommended by FEMA, was used. STAPLEE is a tool used to assess the costs and benefits and overall feasibility of mitigation actions. STAPLEE stands for the following:

- **Social:** Will the action be acceptable to the community? Could it have an unfair effect on a particular segment of the population?
- **Technical:** is the action technically feasible? Are there secondary impacts? Does it offer a long-term solution?
- **Aministrative:** Are there adequate staffing, funding and maintenance capabilities to implement the project?
- **Political:** Will there be adequate political and public support for the project?
- **Legal:** Does your jurisdiction have the legal authority to implement the action?
- **Economic:** is the action cost-beneficial? Is there funding available: Will the action contribute to the local economy?
- **Environmental:** Will there be negative environmental consequences from the action? Does it comply with environmental regulations? Is it consistent with community environmental goals?

The HMPC was asked to review the STAPLEE score sheet and list of mitigation actions and assign a High, Medium or Low score to each item to help determine the item's priority. Each action item was discussed and a consensus reached by the group on the importance of each item.

Table 4.1 STAPLEE Evaluation	Socially Acceptable	Technically Feasible	Administrative	Politically Acceptable	Legal	Economically Feasible	Environmentally Sound
Action 1: Need road and bridge upgrades to improve drainage and reduce flooding	•	•	•	•	•		•
Action 2: Need trees trimmed near power lines	•	•	•	•	•	•	•
Action 3: Need trees trimmed & dead ones removed along streets/roads	•	•	•	•	•	•	•
Action 4: Need all house addresses posted, especially in rural areas.	•	•	•	•	•	•	•
Action 5: Need alternative/temporary housing/designated shelters for a variety of disasters.	•			•	•		•
Action 6: Improve emergency services/response in rural/National Forest areas	•			•	•		•
Action 7: Need to expand/upgrade early warning systems, especially in rural areas.	•	•		•	•		•
Action 8: Need local agreements between public agencies and private contractors to work together.	•	•		•	•	•	•
Action 9: Need to encourage growth of existing CERT program.	•	•	•	•	•	•	•
Action 10: Need to encourage earthquake-proof equipment in hospital, 9-1-1 center, nursing homes, EOC.	•	•	•	•	•		•
Action 11: Need to encourage citizens to have weather radio, emergency medical kit, water, flashlights, blankets, medicine, etc. to have if evacuated or have to endure without utilities.	•	•	•	•	•	•	•
Action 12: Need countywide drill for disaster.	•	•		•	•		•
Action 13: Need more training (fire drills, evacuation drills, participation in statewide drills, incident command, etc.)	•	•	•	•	•		•
Action 14: Need to encourage business/government to have a disaster plan and implement it	•	•		•	•		•
Action 15: Need to address flood-prone areas.	•	•	•	•	•		•
Action 16: Need storm water management plans in all cities.	•	•	•	•	•	•	•
Action 17: Need stronger floodplain permit enforcement.				•	•		•

Table 4.1 STAPLEE Evaluation	Socially Acceptable	Technically Feasible	Administrative	Politically Acceptable	Legal	Economically Feasible	Environmentally Sound
Action 18: Need to develop evacuation plans and procedures (consider school buses)	•	•		•	•	•	•
Action 19: Need stronger water conservation plans.	•	•	•	•	•		•
Action 20: Need early warning system for homes below dams.	•			•	•		•
Action 21: Need to monitoring systems for dams.	•			•	•		•
Action 22: Need to make residents aware of fire hazards (fire prevention).	•	•	•	•	•	•	•
Action 23: Need to educate residents on how to shut down utilities, use fire extinguishers.	•	•	•	•	•	•	•
Action 24: Need to secure propane tanks in flood prone areas.	•	•		•	•		•
Action 25: Need to improve communication between agencies (more meetings).	•	•		•	•	•	•
Action 26: Need to improve public media communications for warnings, updates (radio, cable stations, local channels).	•	•	•	•	•	•	•
Action 27: Emergency backup generators for water systems and emergency services	•	•	•	•			•
Action 28: Need warning signs at low-water crossings.	•	•	•	•	•	•	•
Action 29: Need to be sure that all schools and facilities with high population densities have adequate storm shelters/tornado safe rooms.	•	•	•	•	•		•

Following the STAPLEE scoring, the action items were reviewed again to determine if any could be combined or if any were not mitigation actions. The results of that review were:

- Action items 4, 6, 8 and 18 were discarded because they were designated as response or preparedness instead of mitigation.
- Action item 20, “Need early warning system for homes below dams” though important, was not addressed due to the costliness of implementing such a program. This item will be further examined in the five-year review. [At the five-year review this action item was still deemed to not be feasible.]
- Action item 21, “Need monitoring system for dams” was brought up after the announcement that MDNR would no longer monitor private dams throughout Missouri.

Self-inspection through the hiring of a private entity seemed the only alternative at the time and too costly for most landowners. This action will be examined during the five-year review, at which time a solution may be arranged with MDNR for dam inspection. [Per state guidelines, MDNR only regulates dams that are 35 feet or more in height.]

- All other needs created during the needs assessment were converted to hazard mitigation action items and integrated into the mitigation strategy that follows.

After the planning committee decided on which needs to address in the mitigation strategy, the committee prioritized the needs and discussed action items that could address those needs. HMPC members reviewed and discussed each need and assigned either High, Medium or Low priority to each item. In addition the committee discussed who the responsible party or parties should be for each mitigation measure. The results of that prioritization process are described below in Table 4.2.

Table 4.2 Crawford County Mitigation Action Item Prioritization

Mitigation Measure	Possible Action Items	Actions Taken Since 2005	Priority	Responsible Party
Improve low water crossings and upgrade bridges on county roads that are prone to flooding.	Seek funding and/or budget for improving low water crossings.	Improvements and/or replacements made to: Swyers Bridge, Beers Bridge, Brickey Slab, Fourth Street Bridge in Steelville, Jakes prairie road, Eastman Dunn Road & Highway PP	High	County Commission and city govt. where applicable
Improve floodplain management through better monitoring, education/awareness and additional buyouts.	Adopt more aggressive methods for monitoring. Develop & disseminate outreach programs to educate key groups.		High	Local Government flood plain managers
Early warning systems	Promotional campaign by all local governments to encourage citizens to purchase weather radios. Local governments should check into USDA grants for sirens and siren upgrades.	Steelville added to siren system. Indian Hills Subdivision installed sirens.	High	Local Government Local EMDs

Mitigation Measure	Possible Action Items	Actions Taken Since 2005	Priority	Responsible Party
More cooperation and collaboration between agencies, local governments and businesses.	Hold annual meeting of responders/local govt/businesses/utilities, etc. to discuss issues, network, explore ways of working together and planning for disasters.		High	Local Government EMDs
Shelters	Pre-designate shelters with adequate facilities. Increase public awareness of where shelters are located.		High	Public Health Red Cross Schools
Maintain tree trimming programs.		Following ice storms of recent years, utilities have adopted much more aggressive tree trimming programs and most communities have followed suit.	Medium	Utilities Local Government
Insure that all schools and facilities with high population densities have certified safe rooms or adequate storm shelter areas.	Have a professional safety assessment done of all schools to determine what areas of the schools are "safe" for sheltering. Seek methods of funding the construction of safe rooms where needed.		High	Local Schools
Provide training/information for residents on emergency basics, such as how to use fire extinguishers, shut off utilities, what should be in a home emergency kit,	Develop and train CERT team. Provide classes on specific subjects for the public. Provide press releases, brochures	CERT training has been provided in the County. "Ready in 3" info distributed to the public thru the Health Dept., radio programs and local media. Brochures for "Ready in 3" are	Medium	EMD Local Emergency Response Agencies Public Health

Mitigation Measure	Possible Action Items	Actions Taken Since 2005	Priority	Responsible Party
		available at local public offices. Press releases are regularly printed in local newspapers.		

Source: Crawford County Hazard Mitigation Planning Committee

All other needs created during the needs assessment were converted to hazard mitigation action items and integrated into the mitigation strategy that follows. More details on actions taken since 2005 are also included in the following strategy.

4.2.2 Mitigation Goals and Objectives

The Crawford County hazard mitigation planning committee asked MRPC staff to further develop the goals by adding objectives and recommendations based on the committee’s discussions. The following goals and objectives were reviewed and approved by the Crawford County hazard mitigation planning committee as best reflecting and addressing the needs of Crawford County and were reconfirmed at the five-year review.

Goal 1: Reduce risks and vulnerabilities of people in hazard-prone areas through current technology, better planning and hazard mitigation activities.

Objectives

- 1.1 Advise the public about health and safety precautions to guard against injury and loss of life from natural hazards.

Action item: Education program on personal emergency preparedness (turning off utilities, preparing emergency survival kits that include water, blankets, flashlights, etc).

Action item: Promote development of emergency plans by businesses.

- 1.2 Use the latest technology to provide adequate warning, communication, and mitigation of hazard events.

Action item: Encourage cities to obtain early warning systems and improved communications systems.

Action item: Promote use of weather radios by local residents and schools to ensure advanced warning about threatening weather.

Action item: Partner with local radio stations to ensure that appropriate warning is provided to county residents of impending disasters.

- 1.3 Reduce the danger to, and enhance protection of, dangerous areas during hazard events.

Action item: Enact tree trimming programs, dead tree removal programs.

Action item: Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.

Action item: Promote the development of tornado safe rooms/storm shelters in areas with high population densities, such as schools and large employers.

Goal 2: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy.

Objectives

- 2.1 Implement cost-effective activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to natural hazards.

Action item: Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.

Action item: Encourage businesses to develop and implement emergency plans.

- 2.2 Discourage new development and encourage preventive measures for existing development in areas vulnerable to natural hazards, thereby reducing repetitive losses to the National Flood Insurance Program.

Action item: Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program

- 2.3 Use regulations to ensure that development will not put people in harm's way or increase threats to existing properties.

Action item: Encourage minimum standards for building codes in all cities.

Action item: Encourage local governments to develop and implement regulations for the securing of hazardous materials tanks and mobile homes to reduce hazards during flooding and high winds.

Goal 3: Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards, and hazard mitigation alternatives that can reduce their vulnerabilities.

Objectives

- 3.1 Heighten public awareness of the full range of natural hazards by developing education and outreach programs.

Action item: Distribute SEMA brochures at public facilities and events.

Action item: Regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.

- 3.2 Provide information on tools, partnership opportunities, and funding resources to assist in

implementing mitigation activities.

Action item: Encourage local residents to purchase weather radios through press releases and brochures.

Action item: Ask SEMA mitigation specialists to present information to city councils, county commission, Meramec Regional Planning Commission, Meramec Regional Emergency Planning Committee.

3.3 Publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments.

Action item: Cities/county should continually re-evaluate hazard mitigation plan and merge with other community planning.

Action item: Press releases by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.

3.4 Educate the public on actions they can take to prevent or reduce the loss of life or property from all natural hazards.

Action item: Encourage county health department and local American Red Cross chapter to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought, heat wave)

Action item: Publicize county or citywide drills.

Goal 4: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business, and industry to create a widespread interest in mitigation.

Objectives

4.1 Build and support local partnerships to continuously become less vulnerable to hazards.

Action item: Encourage joint meetings of different organizations/agencies for mitigation planning.

Action item: Joint training (and drills) between agencies, public & private entities (including schools/businesses).

Action item: Pool different agency resources to achieve widespread mitigation planning results.

4.2 Encourage active participation and responsibility of chief elected officials in mitigation planning and activities.

Action item: Encourage meetings between EMD, city/county, and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.

Goal 5: Establish priorities for reducing risks to the people and their property with

emphasis on long-term and maximum benefits to the public rather than short-term benefit of special interests.

Objectives

5.1 Incorporate hazard mitigation into the long-range planning and development activities of the county and each jurisdiction.

Action item: Encourage communities to budget for enhanced warning systems.

Action item: Encourage all communities to develop stormwater management plans.

Action item: Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

Action item: Encourage cities to require contractor stormwater management plans in all new development—both residential and commercial properties.

5.2 Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

Action item: Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.

Action item: Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.

Goal 6: Secure resources for investment in hazard mitigation

Objectives

6.1 Research the use of local and outside sources of funding

Action item: Work with SEMA Region I coordinator to learn about new mitigation funding opportunities.

Action item: Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.

Action item: Work with state/local/federal agencies to include mitigation in all economic and community development projects.

Action item: Encourage local governments to budget for mitigation projects.

6.2 Encourage participation of property owners in investing in hazard mitigation projects on their own property.

Action item: Encourage cities and counties to implement cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.

Action item: Implement public awareness program about the benefits of hazard mitigation projects, both public and private.

6.3 In the event of a disaster declaration, be prepared to apply for hazard mitigation grants for

prioritized projects.

Action item: Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

4.3 Implementation of Mitigation Actions

44 CFR Requirement 201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.

After determining which action items to include in the mitigation strategy, the committee asked MRPC staff to complete the following tasks:

- Develop an outline for programs to address each planning goal;
- Assign the action items to the appropriate goals and objectives;
- Identify other local plans that would need to be coordinated with the specific action items;
- Organize action items into each of these overarching programs
- Outline a strategy for each program;
- Develop a timeline to accomplish each action item;
- Identify potential partners;
- Assign responsibility for the identified actions
- Estimate costs for implementing programs
- Identify possible funding sources

The following section outlines the six over arching programs that were developed to implement the mitigation strategy developed for Crawford County. Those programs include:

1. Reducing Vulnerability of the People;
2. Property and Infrastructure Protection;
3. Outreach and Education;
4. Communication Enhancement;
5. Long-Term Planning; and
6. Finding Funding for Mitigation Projects

For each program the following information is provided:

- Ties the program to one of the adopted mitigation goals and related objectives;
- Lists the community programs or plans that should be cross-coordinated with the program;
- Lists the actions/measures to be taken;
- Provides a short narrative on the strategy;

- Provides a timeline, divided by phases, of milestones and target dates to reach those milestones;
- The acceptance or approval that needs to be accomplished in order for the program to be successful
- A list of potential partners
- Assignment of general responsibility for the program and action items contained within it;
- A list of each action within the program including the responsible party for that action and the estimated cost of completing the action; and
- Potential sources for funding the program.

A summary of the hazard mitigation programs developed for Crawford County can be found at the end of this section in Figure 4.4. Summary of Mitigation Programs and Action Items Developed for Crawford County and All Jurisdictions. This table shows each program and action item and to which jurisdictions each action item applies. It also lists the action item's priority ranking, the goal it applies to and what hazards it addresses.

In addition, at the end of this section is Table 4.3 which summarizes the mitigation strategy and includes which programs and action items are applicable to which jurisdictions, goals, hazards and their priority. In addition Tables 4.4 through 4.8 summarizes each program and action item and the estimated costs, responsible parties for each and potential sources of funding. And lastly, Figure 4.9 illustrates which action items address and support the National Flood Insurance Program.

Those areas where progress has been made are noted in the following narrative as Achievements 2004-2009. Those action items with no achievements listed have been deferred due to lack of funding or administrative support. The HMPC has reviewed the action items and renewed their commitment to move forward with those action items that have been deferred to this point and the participating jurisdictions, by adopting the plan, are making the commitment to continue to work toward accomplishing the goals and actions as outlined in this plan.

Program Title: Reducing Vulnerability of the People

Goal: Reduce risks and vulnerabilities of people in hazard-prone areas through current technology, better planning and hazard mitigation activities through the following objectives:

1. Advise the public about health and safety precautions to guard against injury and loss of life from natural hazards.
2. Use the latest technology to provide adequate warning, communication and mitigation of hazard events.
3. Reduce the danger to, and enhance protection of, dangerous areas during hazard events.

Necessary Community Program/Plan Cross-Coordination

Local Emergency Operations Plans
Comprehensive Economic Development Strategy for the Meramec Region
Cuba Comprehensive Plan
Sullivan Comprehensive Plan
Specifications for building roads, subdivisions, culverts and stormwater

Actions/Measures to be Taken and Progress Made 2004-2009

Action 1: Implement an education program on personal emergency preparedness that teaches residents how to prepare emergency medical kits that include water, blankets, flashlights, etc. and how to shut off their home utilities in times of emergency.

Achievements 2004-2009: Press releases on disaster related information are regularly disseminated by SEMA and printed in local newspapers. The City of Cuba's emergency management office has distributed information on pet owner preparedness and pandemic flu. The Crawford County 9-1-1 does back to school programs for school aged children. The fire departments and ambulance services in the county do programs at local schools on fire safety.

Action 2: Promote the development of emergency plans by businesses.

Achievements 2004-2009: Larger employers in the county have plans in place for fire evacuation and storm safety per liability insurance requirements.

Action 3: Encourage cities to obtain early warning systems and improved communications systems to minimize loss of life.

Achievements 2004-2009: The City of Cuba has improved their early warning siren system by placing the responsibility for activating it at the Police Department. This has improved response time. The Indian Hills subdivision has installed early warning sirens. The City of Steelville has added sirens.

In regards to enhanced communications, the Region I Homeland Security Oversight Committee (HSOC) has made interoperable communications a priority for its grant program. The HSOC conducted a needs assessment of all the emergency response agencies in the six-county region to determine their interoperable communications capabilities and then used grant funds to purchase handheld radios for those agencies that demonstrated the greatest need. Recipients in Crawford County include Bourbon Emergency Management, Crawford County Emergency Management, Cuba Police Department, Crawford County Emergency 9-1-1 Commission, Steelville Police Department, Missouri Baptist Emergency Medical Services (Sullivan), Leasburg Fire Department and Bourbon Fire Department. In addition, HSOC purchased satellite telephone systems for each of the six counties, including Crawford County.

Action 4: Promote the use of weather radios by local residents and schools to ensure advanced warning about threatening weather.

Achievements 2004-2009: The schools in Crawford County now have weather radios.

Action 5: Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.

Achievements 2004-2009: Contacts have been made with the local radio stations in Cuba and Sullivan, as well as with Charter Cable to work with local emergency management personnel during severe weather and disasters to provide assistance in warning the public and providing preparedness information.

Action 6: Encourage the county's tree trimming programs that reduce damages during high winds and severe winter storms while also encouraging the dead tree removal program implemented by Mark Twain National Forest.

Achievements 2004-2009: Although local jurisdictions, electric co-ops and utility companies did have tree trimming programs in place, those activities were stepped up and intensified following the ice storm of 2006. These programs are now more comprehensive and aggressive than they were prior to that event. Trimming distances have been increased from six feet to 10 feet. The Mark Twain National Forest has also increased their programs for dead tree removal due to higher tree mortality rates in the last few years.

Action 7: Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.

Achievements 2004-2009: Crawford County continues to review roads and bridges and work to make this infrastructure less vulnerable to disasters. The County has made improvements to Swyers Bridge and Beers Bridge. Jakes Prairie Road bed was raised along Brush Creek. Eastman Dunn Road was also raised and improved. Improvements were also made to Brickey Slab and Blunt Road. In the City of Cuba, improvements were made to melody Lane. A double pipe was installed on Highway PP to improve drainage under that stretch of road. In the City of Steelville, improvements were made to the Fourth Street Bridge over Yadkin Creek that improved debris damming that caused flooding of adjacent homes and businesses.

Action 8: Encourage the construction of storm shelters, especially tornado safe rooms, near schools & large employment centers.

Strategy: Establish a mitigation planning committee comprised of emergency response agencies, health department officials, Red Cross employees, CERT teams, local businesses, schools and citizens, who will plan for and implement the activities and projects necessary to accomplish the stated mitigation goal. A second partnership comprised of all EMD directors from the various jurisdictions in the county should be established to meet once each year to discuss emergency planning and mitigation issues and share ideas.

Achievements 2004-2009: Although a separate mitigation planning committee has not been formed, the emergency management directors in the county do meet periodically. In addition, the Region I HSOC, of which Crawford County is a member, has provided a regional forum for disaster planning and preparedness. The HSOC is also providing training for CERT teams in each of the region's six counties. There is also a program to establish enough shelters to house 10 percent of the region's population and to train shelter volunteers. The HSOC has funded mass care shelter trailers for each county as well as a mass casualty trailer (located in Sullivan) and an agricultural emergency response trailer. The HSOC grant program has also funded a generator

and oxygen transfill system for the Steelville Ambulance District that provides oxygen refill services for county residents during power outages.

Phase 1: Within six months, with the committee's assistance:

1. Form a committee of emergency response agencies, health department officials, Red Cross employees, CERT team members, local businesses, schools, chamber of commerce members and citizens who will review current education programs—if any—and design and implement a comprehensive program.
2. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
3. Meet with local radio station personnel to determine and implement the best means of providing up to date information and warnings to the public.
4. Begin working with local utilities to make sure that power lines are regularly inspected and tree limbs and dead trees are removed.

Phase 2: Within one year, with the committee's assistance:

1. Send press releases to local media discussing self-readiness and promoting the importance of preparing emergency medical kits.
2. Partner with local businesses to display sample kits or items that would be useful in such kits.
3. Work with local businesses to educate on the importance of development and implementing emergency plans.
4. Invite SEMA representatives to attend and speak at local meetings of businesspersons (chamber of commerce, Rotary, Kiwanis, etc.)
5. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
6. Research new techniques in early warning and communication technology.
7. Establish a schedule to regularly upgrade warning and communications equipment.
8. Work with NOAA to develop a promotional campaign to encourage the purchase of weather radios.
9. Work with weather radio manufacturers and/or retailers to arrange bulk purchasing to lower costs for county/city residents.
10. Encourage schools, daycares, nursing homes and other vulnerable facilities to purchase weather radios to improve their warning capabilities.
11. Establish and practice procedures for communication between the EMD and emergency operations center during incidents.
12. Promote to the public what stations to tune into for weather advisories and information during emergencies.
13. Continue working with local utilities to make sure that power lines are regularly inspected and tree limbs and dead trees are removed.
14. Maintain a list of road and bridge-related mitigation projects that can be implemented as funds become available.

Phase 3: Within three years, with the committee’s assistance:

1. Continue sending press releases to local media discussing self-readiness and promoting the importance of preparing emergency medical kits.
2. Work with city utilities and rural electric cooperatives to develop and implement an education and awareness program on shutting off utilities (water, electric, gas) through mailings, articles in industry publications or newsletters.
3. Provide technical assistance through local and state resources to businesses.
4. Invite local businesses to participate in drills and exercises.
5. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
6. Continue researching new techniques in early warning and communication technology.
7. Review the schedule of regularly upgrading warning and communications equipment and implement appropriately.
8. Incorporate hazard mitigation considerations into infrastructure upgrades.
9. Continue working with local utilities to make sure that power lines are regularly inspected and tree limbs and dead trees are removed.
10. Review list of road and bridge-related mitigation projects that can be implemented as funds become available.
11. Promote to the public what stations to tune into for weather advisories and information during emergencies.

Phase 4: Within five years, with the committee’s assistance:

1. Continue sending press releases to local media discussing self-readiness and promoting the importance of preparing emergency medical kits.
2. Continue working with city utilities and rural electric cooperatives to develop and implement an education and awareness program on shutting off utilities (water, electric, gas) through mailings, articles in industry publications or newsletters.
3. Continue providing technical assistance through local and state resources to businesses.
4. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
5. Continue researching new techniques in early warning and communication technology.
6. Review the schedule of regularly upgrading warning and communications equipment and implement appropriately.
7. Promote to the public what stations to tune into for weather advisories and information during emergencies.
8. Continue working with local utilities to make sure that power lines are regularly inspected and tree limbs and dead trees are removed.
9. Incorporate hazard mitigation considerations into infrastructure upgrades.
10. Review list of road and bridge-related mitigation projects that can be implemented as funds become available.

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Potential Partners:

- City Government
- County Government
- Emergency Management Directors
- Hazard Mitigation Planning Committee
- Region I Homeland Security Oversight Committee
- Area churches
- Crawford County Health Department
- Local Emergency Response Agencies (Fire, Emergency Medical, Law Enforcement)
- Local Chapter of the American Red Cross
- Missouri State Emergency Management Agency
- National Weather Service/NOAA
- Local radio stations, newspapers and public access television
- Crawford County School Districts

General Responsibility: It is recommended that the county and city emergency management directors and the Mitigation Planning Committee accept general responsibility to steer the development and execution of the activities and projects required to accomplish the goals, objectives and strategies identified in this program document. With the exception of normal responsibility of local governmental agents, this is a voluntary participation that in no way states nor implies the acceptance of any liability for the success or failure of the program, activities, events or projects undertaken to complete the program or any portions thereof.

Potential Lead Responsibility by Action	Estimated Cost
Action 1: All EMDs, Co. Health Dept.	\$1,500
Action 2: County EMD, Co. Health Dept.	\$2,500
Action 3: All EMDs and city/county government	\$1,500
Action 4: All EMDs, Local Government, Emergency Responders, School Districts	\$500
Action 5: All EMDs	\$500
Action 6: Local government, utilities, MTNF	Unknown
Action 7: Local Government	\$5,000
Action 8: School Districts, all EMDs, Local Government, Local Business	Unknown
Total Estimated Cost:	\$11,500

Sources of Funding: Grants, local general revenue funds, private financial donations and private donations of goods and services.

Summary of Actions/Measures Achieved 2004-2009:

In the five year interim since the hazard mitigation plan was adopted, Crawford County and the communities within the county have made good progress in making the county's population less vulnerable to disasters. Activities have included improving early warning systems in Steelville and installing sirens at Indian Hills Subdivision; providing education/awareness materials to the public on preparedness; providing training on CERT and encouraging CERT members to become more involved in emergency preparedness and their local emergency response agencies; working with local radio stations to improve communication leading up to and during disaster events; initiated more aggressive tree trimming programs; established an oxygen transfill station with generator backup to refill oxygen bottles during a power outage; acquired a trailer with shelter supplies that can be moved around the county and region to support shelters during disasters; established a mass care response trailer; improving a number of bridges, low water crossings and improving water drainage on roads; raising two road beds; and improving communications with the distribution of 25 interoperable handheld radios to nine agencies in Crawford County as well as a satellite phone system. All of these activities have lessened the vulnerability of the County's residents and businesses in disasters.

Program Title: Property and Infrastructure Protection

Goal: Reduce the potential impact of natural disasters on new and existing properties and infrastructure and the local economy through the following objectives:

1. Implement cost-effective activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities and other property more resistant to natural hazards.
2. Discourage new development and encourage preventive measures for existing development in areas vulnerable to natural hazards, thereby reducing repetitive losses to the National Flood Insurance Program.
3. Use regulation to ensure that development will not put people in harm's way or increase threats to existing properties.

Necessary Community Program/Plan Cross-Coordination

Local Emergency Operations Plans

Comprehensive Economic Development Strategy for the Meramec Region

Cuba Comprehensive Plan

Sullivan Comprehensive Plan

Specifications for building roads, subdivisions, culverts and stormwater systems

Actions/Measures to be Taken

Action 1: Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.

Action 2: Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program

Achievements 2004-2009: Press releases on the NFIP and the dangers of floodplain development are released to area news media on a regular basis to raise awareness of the general public on floodplain issues.

Action 3: Encourage minimum standards for building codes in all cities.

Achievements 2004-2009: The communities of Cuba, Sullivan and Steelville all have building inspectors on staff.

Action 4: Encourage local governments to develop and implement regulations for the securing of hazardous material tanks and mobile homes to reduce hazards during flooding and high winds.

Strategy: Establish a mitigation planning committee comprised of emergency response agencies, health department officials, Red Cross employees, CERT teams, local businesses, schools and citizens, who will plan for and implement the activities and projects necessary to accomplish the stated mitigation goal. A second partnership comprised of all EMD directors from the various jurisdictions in the county should be established to meet once each year to discuss emergency planning and mitigation issues and share ideas.

Achievements 2004-2009: Although a separate mitigation planning committee has not been formed, the emergency managers in Crawford County meet periodically to discuss preparedness and response issues.

In addition, the Region I HSOC, of which Crawford County is a member, has provided a regional forum for disaster planning and preparedness. The HSOC is also providing training for CERT teams in each of the region's six counties. There is also a program to establish enough shelters to house 10 percent of the region's population and to train shelter volunteers. The HSOC has funded mass care shelter trailers for each county as well as a mass casualty trailer located in Sullivan and an agricultural emergency response trailer. The HSOC grant program has also funded a generator and oxygen transfill system for the Steelville Ambulance District that provides oxygen refill services for county residents during power outages.

Phase 1: Within six months, with the committee's assistance:

1. Distribute floodplain development brochures at public buildings, real estate offices and banks.
2. Develop and send press releases to local media regarding the dangers of developing in the floodplain, current county floodplain regulations and information about the National Flood Insurance Program.

Phase 2: Within one year, with the committee's assistance:

1. City engineer/building inspector and EMD develop guidelines for what should be included when examining critical facilities.

2. Floodplain administrators make presentations at chamber of commerce meetings on floodplain issues.
3. Provide sample minimum standard building codes to all communities.
4. Provide sample ordinances regarding the securing of hazardous material tanks and trailers to all communities.
5. Research new methods of securing hazardous material tanks and mobile homes.
6. Continue distributing floodplain development brochures at public buildings, real estate offices and banks.
7. Continue to develop and send press releases to local media regarding the dangers of developing in the floodplain, current county floodplain regulations and information about the National Flood Insurance Program.

Phase 3: Within three years, with the committee's assistance:

1. Invite SEMA representative to attend city council meeting to promote benefits of adopting and enforcing citywide building codes.
2. Launch promotional campaign on the hazards of not securing propane tanks and the solutions to this dilemma.
3. Mitigation planning committee should develop and implement a program to work with local businesses and critical facility operators to encourage annual self-inspections.
4. Local governments develop a certification/awards program to recognize businesses/facilities that participate in an annual self-inspection program that ensures their building/infrastructure is earthquake and tornado resistant.
5. City engineer/building inspector and EMD meet to re-examine guidelines for what should be included when examining critical facilities.
6. Continue distributing floodplain development brochures at public buildings, real estate offices and banks.
7. Floodplain administrators make presentations at chamber of commerce meetings on floodplain issues.
8. Continue to develop and send press releases to local media regarding the dangers of developing in the floodplain, current county floodplain regulations and information about the National Flood Insurance Program.
9. Continue researching new methods of securing hazardous material tanks and mobile homes.

Phase 4: Within five years, with the committee's assistance:

1. Work with propane companies and mobile home sales/installers to encourage them to adopt minimum standards for securing their products.
2. Continue with promotional campaign on the hazards of not securing propane tanks and the solutions to this dilemma.
3. Mitigation planning committee continues working with local businesses and critical facility operators to encourage annual self-inspections of buildings.

4. Local governments should continue to give certification/awards that recognize businesses/facilities that participate in an annual self-inspection program that ensures their building/infrastructure is earthquake and tornado resistant.
5. City engineer/building inspector and EMD should meet to re-examine guidelines for what should be included when examining critical facilities.
6. Continue distributing floodplain development brochures at public buildings, real estate offices and banks.
7. Floodplain administrators continue making annual presentations at chamber of commerce meetings on floodplain issues.
8. Continue to develop and send press releases to local media regarding the dangers of developing in the floodplain, current county floodplain regulations and information about the National Flood Insurance Program.
9. Continue researching new methods of securing hazardous material tanks and mobile homes.

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Potential Partners:

- City Engineers
- Emergency Management Directors
- Mitigation Planning Committee
- Floodplain Administrator
- Missouri State Emergency Management Agency
- Corps of Engineers
- Propane trade association
- Mobile home trade association
- Local radio stations, newspapers and public access television

General Responsibility: It is recommended that the county and city emergency management directors and the Mitigation Planning committee accept general responsibility to steer the development and execution of the activities and projects required to accomplish the goals, objectives and strategies identified in this program document. With the exception of normal responsibility of local governmental agents, this is a voluntary participation that in no way states nor implies the acceptance of any liability for the success or failure of the program, activities, events or projects undertaken to complete the program or any portions thereof.

Potential Lead Responsibility by Action		Estimated Cost
Action 1:	All EMDs	\$1,500
Action 2:	Floodplain Administrator, City Engineers, County EMD	\$1,500
Action 3:	County EMD and Local Government	\$1,500

Action 4: County EMD, Trade Associations and Local Government \$3,000

Total Estimated Cost: \$7,500

Sources of Funding: Grants, local general revenue funds, private financial donations and private donations of goods and services.

Summary of Actions/Measures Achieved 2004-2009:

In the five year interim since the hazard mitigation plan was adopted, Crawford County and the communities within the county have made progress in making the county’s infrastructure and property less vulnerable to disasters. Activities have included regularly distributing press releases on floodplain issues and guidelines as well as having building inspectors in Cuba, Steelville and Sullivan.

Program Title: Outreach and Education

Goal: Promote education, outreach, research and development programs to improve the knowledge and awareness among the citizens and industry about hazards they may face, their vulnerability to identified hazards and hazard mitigation alternatives that can reduce their vulnerabilities through the following objectives:

1. Heighten public awareness of the full range of natural hazards by developing education and outreach programs.
2. Provide information on tools, partnership opportunities and funding resources to assist in implementing mitigation activities.
3. Publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments.
4. Educate the public on actions they can take to prevent or reduce the loss of life or property from all natural hazards.

Necessary Community Program/Plan Cross-Coordination

Local Emergency Operations Plans
Comprehensive Economic Development Strategy for the Meramec Region
Cuba Comprehensive Plan
Sullivan Comprehensive Plan
Specifications for building roads, subdivisions, culverts and stormwater systems
9-1-1 Ordinance for addressing

Actions/Measures to be Taken

Action 1: Distribute SEMA brochures at public facilities and events.

Achievements 2004-2009: “Ready in 3”, pandemic flu and pet owner preparedness brochures are available at several local public facilities including Cuba City Hall and the Crawford County

Courthouse. These materials are also routinely distributed by fire departments and the health department at community events. Crawford County 9-1-1 also distributes and promotes safety related information. The cities who have natural gas (Bourbon, Cuba and Sullivan) provide information to residents on natural gas safety.

Action 2: Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.

Achievements 2004-2009: Press releases on disaster preparedness provided by SEMA are regularly distributed to area media. The Cuba Fire Department holds an open house each year to teach people how to use fire extinguishers and other household preparedness practices.

Action 3: Encourage local residents to purchase weather radios through press releases and brochures.

Action 4: Ask SEMA mitigation specialists to present information to city councils, county commission, and local planning organizations.

Achievements 2004-2009: SEMA representatives have participated in meetings following local disasters such as the ice storm and flooding. In addition, the Region I area coordinator holds quarterly meetings in the region to share information and encourage networking between agencies.

Action 5: Re-evaluate the hazard mitigation plan and merge with other community planning.

Achievements 2004-2009: Planning organizations such as the MRPC work to integrate mitigation objectives into planning documents that are developed or updated on a regular basis such as the Community Economic Development Strategy.

Action 6: Distribute press releases by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.

Achievements 2004-2009: The City of Cuba distributed information when new snow routes were developed for the community.

Action 7: Encourage county health department and local American Red Cross chapter to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).

Achievements 2004-2009: The Crawford County Health Department and local not-for-profit organizations such as the Red Cross provide information on preparedness to the community. SEMA's Faith Based Initiative also encourages local churches to help their members be more informed and prepared for disasters. Public announcements of where to seek shelter during heat waves or power outages are done through local media.

Action 8: Publicize county or citywide drills.

Achievements 2004-2009: Local jurisdictions regularly participate in statewide tornado and severe weather drills. Local media, especially radio stations, publicize upcoming drills. The City of Cuba emergency responders have conducted drills with the Cuba High School.

Strategy: Establish a mitigation planning committee comprised of emergency response agencies, health department officials, Red Cross employees, CERT teams, local businesses, schools and citizens, who will plan for and implement the activities and projects necessary to accomplish the stated mitigation goal. A second partnership comprised of all EMD directors from the various jurisdictions in the county should be established to meet once each year to discuss emergency planning and mitigation issues and share ideas.

Achievements 2004-2009: Local organizations, such as fire departments, Red Cross and the Crawford County Health Department all provide programs to raise awareness and educate the public on disaster preparedness and hazard mitigation. Red Cross and several local fire departments regularly provide programs on safety and disaster preparedness for local schools and civic organizations. The Crawford County Health Department and many local fire departments provide brochures such as “Ready in 3” at local events. Local media regularly include information on preparedness and related activities in the county. The Region I HSOC does regular press releases on its activities and promotes CERT and shelter related training.

Phase 1: Within six months, with the committee’s assistance:

1. Distribute SEMA brochures related to hazard mitigation at government buildings, fairs, festivals and other public events or facilities.
2. Write and distribute regular press releases to local media regarding hazards and hazard preparation.
3. Write and distribute press releases that encourage local residents to purchase weather radios.
4. Request city council/county commission to meet once each year with SEMA representative(s) to discuss emergency management and mitigation.
5. Write and distribute press releases when changing mitigation plan to encourage public support and inform the public about new regulations or regulation changes related to mitigation.
6. Make brochures about heat and cold related illnesses available in public facilities (e.g. city hall, county courthouse, health department office).
7. Write and distribute press releases prior to and during seasonal events (e.g. summer heat season, winter storms/cold).
8. Distribute press releases from EMDs regarding upcoming drills/exercises that emergency responders will be participating in to encourage public interest and participation in drills.

Phase 2: Within one year, with the committee’s assistance:

1. Distribute SEMA brochures related to hazard mitigation at government buildings, fairs, festivals and other public events or facilities.
2. Write and distribute regular press releases to local media regarding hazards and hazard preparation.
3. Work with NOAA to develop a promotional campaign to encourage the purchase of weather radios. Look for grants and ways to purchase weather radios in bulk and distribute to agencies that need them; schools, nursing homes, shelters, etc.

4. Work with weather radio manufacturers and/or retailers to arrange bulk purchasing to lower costs for county/city residents.
5. Write and distribute press releases that encourage local residents to purchase weather radios.
6. Request city council/county commission to meet once each year with SEMA representative(s) to discuss emergency management and mitigation.
7. Inform planning organizations and planners of the existence of the hazard mitigation plan and the need to incorporate it into future planning processes.
8. Provide copies of hazard mitigation plan to planning groups.
9. Write and distribute press releases when changing mitigation plan to encourage public support and inform the public about new regulations or regulation changes related to mitigation.
10. Make brochures about heat and cold related illnesses available in public facilities (e.g. city hall, county courthouse, health department office).
11. Write and distribute press releases prior to and during seasonal events (e.g. summer heat season, winter storms/cold).
12. Distribute press releases from EMDs regarding upcoming drills/exercises that emergency responders will be participating in to encourage public interest and participation in drills.

Phase 3: Within three years, with the committee's assistance:

1. Distribute SEMA brochures related to hazard mitigation at government buildings, fairs, festivals and other public events or facilities.
2. Write and distribute regular press releases to local media regarding hazards and hazard preparation.
3. Write and distribute press releases that encourage local residents to purchase weather radios.
4. Request city council/county commission to meet once each year with SEMA representative(s) to discuss emergency management and mitigation.
5. Inform planning organizations and planners of the existence of hazard mitigation plan and the need to incorporate it into future planning processes.
6. Write and distribute press releases when changing mitigation plan to encourage public support and inform the public about new regulations or regulation changes related to mitigation.
7. Make brochures about heat and cold related illnesses available in public facilities (e.g. city hall, county courthouse, health department office).
8. Write and distribute press releases prior to and during seasonal events (e.g. summer heat season, winter storms/cold).
9. Distribute press releases from EMDs regarding upcoming drills/exercises that emergency responders will be participating in to encourage public interest and participation in drills.
10. Discuss the inclusion of public participation into emergency drills during annual EMD meeting.

Phase 4: Within five years, with the committee's assistance:

1. Distribute SEMA brochures related to hazard mitigation at government buildings, fairs, festivals and other public events or facilities.
2. Write and distribute regular press releases to local media regarding hazards and hazard preparation.
3. Write and distribute press releases that encourage local residents to purchase weather radios.
4. Request city council/county commission to meet once each year with SEMA representative(s) to discuss emergency management and mitigation.
5. Inform planning organizations and planners of the existence of hazard mitigation plan and the need to incorporate it into future planning processes.
6. Write and distribute press releases when changing mitigation plan to encourage public support and inform the public about new regulations or regulation changes related to mitigation.
7. Make brochures about heat and cold related illnesses available in public facilities (e.g. city hall, county courthouse, health department office).
8. Write and distribute press releases prior to and during seasonal events (e.g. summer heat season, winter storms/cold).
9. Press releases from EMDs regarding upcoming drills/exercises that emergency responders will be participating in to encourage public interest and participation in drills.
10. Discuss inclusion of public participation into emergency drills during annual EMD meeting.

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Potential Partners:

Emergency Management Directors
 Mitigation Planning Committee
 Missouri State Emergency Management Agency
 Federal Emergency Management Agency
 Local Utilities
 Region I Homeland Security Oversight Committee
 Local emergency response agencies
 Crawford County Health Department
 Red Cross
 Local churches
 Local radio stations, newspapers and public access television

General Responsibility: It is recommended that the county and city emergency management directors and the Mitigation Planning committee accept general responsibility to steer the

development and execution of the activities and projects required to accomplish the goals, objectives and strategies identified in this program document. With the exception of normal responsibility of local governmental agents, this is a voluntary participation that in no way states nor implies the acceptance of any liability for the success or failure of the program, activities, events or projects undertaken to complete the program or any portions thereof.

Potential Lead Responsibility by Action	Estimated Cost
Action 1: County and city EMDs	\$500
Action 2: County and city EMDs, SEMA	\$500
Action 3: County and City EMDs	\$500
Action 4: County and city EMDs, Local Governments	-0-
Action 5: County and city EMDs and Administrators, Local Planners, HMPC	\$3,500
Action 6: County and city EMDs, Local Governments	\$700
Action 7: County EMD, County Health Department, American Red Cross	\$1,000
Action 8: County and city EMDs	\$250
Total Estimated Cost:	\$6,950

Sources of Funding: Grants, local general revenue funds, private financial donations and private donations of goods and services.

Summary of Actions/Measures Achieved 2004-2009:

In the five year interim since the hazard mitigation plan was adopted, Crawford County and the communities within the county have made progress in public outreach and education in the area of disaster preparedness and hazard mitigation. Information is disseminated through local newspapers, radio, websites and newsletters. Multiple local agencies participate in outreach programs by providing educational materials and presentations to the public. Faith based initiatives have encouraged the participation of local churches in public outreach on disaster preparedness.

Program Title: Communication Enhancement

Goal: Strengthen communication and coordinate participation between public agencies, citizens, non-profit organizations, business and industry to create a widespread interest in mitigation through the following objectives:

1. Build and support local partnerships to continuously become less vulnerable to hazards.
2. Encourage active participation and responsibility of chief elected officials in mitigation planning and activities.

Necessary Community Program/Plan Cross-Coordination

Local Emergency Operations Plans
Comprehensive Economic Development Strategy for the Meramec Region
Cuba Comprehensive Plan
Sullivan Comprehensive Plan
Region I Interoperable Communications Plan

Actions/Measures to be Taken

Action 1: Encourage joint meetings of different organizations/agencies for mitigation planning.
Achievements 2004-2009: The Crawford County Fire Chiefs Association meets regularly in the County. There are occasional “debriefing” meetings of all the emergency response agencies in Crawford County to discuss specific incidents or situations. In addition, emergency response agencies in the county regularly do joint trainings. The SEMA Region I area coordinator holds quarterly meetings in the region to share information with local response agencies and elected officials. In addition, the Maries/Phelps County Health Department has worked with the MRPC in 2007 and 2008 for the past two years to develop and initiate a Region I tabletop exercise on pandemic flu which included participants from Crawford County. Participants include representatives from a broad spectrum of groups including school districts, businesses, public health, nursing homes emergency responders and elected officials. These exercises have proven to be an excellent forum for these diverse groups to communicate, network and conduct planning activities in preparation of a disaster. The Region I HSOC also meets quarterly in the region. This organization also provides an excellent forum for representatives from various disciplines to work together on homeland security issues and preparedness. Representatives on the HSOC include police chief, sheriff, fire chief, 9-1-1, school, hospital, emergency medical, volunteer, county commission, mayor, public utility, county health, public works, HSRT and emergency management director.

Action 2: Joint training (or drills) between agencies, public and private entities (including schools and businesses).

Achievements 2004-2009: A number of opportunities for joint exercises/drills occur in Crawford County and the Meramec region each year. The Maries/Phelps County Health Department, with assistance from MRPC, has hosted a tabletop exercise on pandemic flu in 2007 and 2008. Participants included representatives from schools, businesses, hospitals, emergency responders, local elected officials, SEMA and public health. Region I hospitals have held exercises for mass casualty incidents in the last two years and invited other agencies and organizations to participate. A statewide drill of emergency response agencies was held two years ago in Region I. The emergency response agencies in Cuba hold joint drills with the Cuba High School.

Action 3: Pool different agency resources to achieve widespread mitigation results.

Achievements 2004-2009: The most significant result in this action item is the development of the regionalization of homeland security planning and funding. Region I Homeland Security Oversight Committee (HSOC) includes six counties – Crawford, Dent, Maries, Crawford, Pulaski and Laclede. In 2007 and 2008, the Region I HSOC granted out more than \$800,000 in

homeland security grants. The assets purchased with these grant funds are considered regional assets. Some examples of purchases made so far include: trailers stocked with sheltering supplies for each county; generators and oxygen transfill systems for each county; triage tag and tracking systems for each county; interoperable communications equipment, including satellite phones for each county; an agricultural emergency response trailer for the region; trucks to move assets around the region; CERT training in each county and a mass casualty trailer for the region. The purchase and deployment of each of these resources strengthens the resources of everyone in the region.

A mutual aid coordinator has been appointed by the state for each region to facilitate mutual aid agreements between fire departments throughout the region and the state to improve the pooling of resources during a disaster.

The Faith Based Initiative sponsored by SEMA provides an opportunity for local churches to work and train with emergency planners to develop and host additional shelters in the region.

Action 4: Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.
Achievements 2004-2009: The Crawford County EMD regularly attends SEMA area coordinator meetings for Region I.

Strategy: Establish a mitigation planning committee comprised of emergency response agencies, health department officials, Red Cross employees, CERT teams, local businesses, schools and citizens, who will plan for and implement the activities and projects necessary to accomplish the stated mitigation goal. A second partnership comprised of all EMD directors from the various jurisdictions in the county should be established to meet once each year to discuss emergency planning and mitigation issues and share ideas.

Achievements 2004-2009: Local organizations and State organizations such as the Region I HSOC, Crawford County Health Department and SEMA all coordinate efforts to enhance communications at the local, regional and state level. A number of forums now exist within the county that facilitate better communication and networking between individuals and agencies at all levels.

Phase 1: Within six months, with the committee's assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
2. Form a committee of emergency response agencies, health department officials, Red Cross employees, CERT team members, local businesses, schools, chamber of commerce members and citizens who will encourage community partnerships among businesses, schools, organizations, churches, other government agencies, etc.
3. Request city council/county commission to meet once each year with SEMA representative(s) to discuss and mitigation project implementation and budgeting.

Phase 2: Within one year, with the committee's assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
2. Schedule an annual meeting of the committee of emergency response agencies, health department officials, Red Cross employees, CERT team members, local businesses, schools, chamber of commerce members and citizens who will encourage community partnerships among businesses, schools, organizations, churches, other government agencies, etc.
3. Work with local emergency responders to develop and implement an annual drill program for the county and pursue joint training opportunities.
4. Work with Crawford County amateur radio operators organization to encourage participation in countywide drills.
5. Partnership committee of businesses, agencies, organizations, churches, schools visits other businesses, agencies, organizations, churches and presents information about mitigation planning, forming partnerships/alliances and pooling resources.
6. Request city council/county commission to meet once each year with SEMA representative(s) to discuss and mitigation project implementation and budgeting.

Phase 3: Within three years, with the committee's assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
2. Schedule an annual meeting of the committee of emergency response agencies, health department officials, Red Cross employees, CERT team members, local businesses, schools, chamber of commerce members and citizens who will encourage community partnerships among businesses, schools, organizations, churches, other government agencies, etc.
3. Work with local emergency responders to develop and implement an annual drill program for the county and pursue joint training opportunities.
4. Work with Crawford County amateur radio operators organization to encourage participation in countywide drills.
5. Partnership committee of businesses, agencies, organizations, churches, schools visits other businesses, agencies, organizations, churches and presents information about mitigation planning, forming partnerships/alliances and pooling resources.
6. Request city council/county commission to meet once each year with SEMA representative(s) to discuss and mitigation project implementation and budgeting.
7. Partnership committee raises funds for community mitigation projects and/or education programs.

Phase 4: Within five years, with the committee's assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and arrange for possible joint purchases of equipment or the sale of older equipment to smaller cities.
2. Schedule an annual meeting of the committee of emergency response agencies, health department officials, Red Cross employees, CERT team members, local businesses, schools, chamber of commerce members and citizens who will encourage community partnerships among businesses, schools, organizations, churches, other government agencies, etc.
3. Work with local emergency responders to develop and implement an annual drill program for the county and pursue joint training opportunities.
4. Work with Crawford County amateur radio operators organization to encourage participation in countywide drills.
5. Community Partnership committee of businesses, agencies, organizations, churches, schools visits other businesses, agencies, organizations, churches and presents information about mitigation planning, forming partnerships/alliances and pooling resources.
6. Request city council/county commission to meet once each year with SEMA representative(s) to discuss and mitigation project implementation and budgeting.
7. Community Partnership committee raises funds for community mitigation projects and/or education programs.
8. Community Partnership committee becomes involved in drills, trainings and review of the hazard mitigation plan.

Acceptance and Approval: Local government acceptance and approval through local government resolution of the details of this mitigation program document in no way obligates the local government to actually carry out its provisions. Each individual action contained in this document that incurs a cost and/or liability must still be approved by separate governmental actions commensurate with the normal governmental proceedings for approving such actions, in accordance with local ordinance, laws and regulations.

Potential Partners:

City Government

County Government

Emergency Management Directors

Mitigation Planning Committee

Crawford Chapter of the American Red Cross

Missouri State Emergency Management Agency

Region I Homeland Security Oversight Committee

Region I Homeland Security Response Team

Crawford County Health Department

Local ham radio clubs

USDA Rural Development

Local schools, churches, non-profit organizations, government agencies and businesses

Local radio stations, newspapers and public access television

General Responsibility: It is recommended that the county and city emergency management directors and the Mitigation Planning committee accept general responsibility to steer the development and execution of the activities and projects required to accomplish the goals, objectives and strategies identified in this program document. With the exception of normal responsibility of local governmental agents, this is a voluntary participation that in no way states nor implies the acceptance of any liability for the success or failure of the program, activities, events or projects undertaken to complete the program or any portions thereof.

Potential Lead Responsibility by Action		Estimated Cost
Action 1:	County and city EMDs	\$500
Action 2:	County and city EMDs and Emergency Response Agencies	\$10,000
Action 3:	County and city EMDs, Local Government	\$1,000
Action 4:	County and city EMDs and Local Government	\$500
Total Estimated Cost:		\$12,000

Sources of Funding: Grants, local general revenue funds, private financial donations and private donations of goods and services.

Summary of Actions/Measures Achieved 2004-2009:

In the five year interim since the hazard mitigation plan was adopted, Crawford County and the communities within the county have made good progress in enhancing communications in the county and throughout the region. There are now several opportunities for agencies to network and work together on planning, training, exercises and sharing assets. Region I HSOC, public health planning, Region I HSRT and SEMA all hold meetings and/or training events where a broad spectrum of agencies and organizations can share information and improve communication.

Program Title: Long-Term Planning

Goal: Establish priorities for reducing risks to the people and their property with emphasis on long-term and maximum benefits to the public rather than short-term benefit of special interests through the following objectives:

1. Incorporate hazard mitigation into the long-range planning and development activities of the county and each jurisdiction.
2. Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

Necessary Community Program/Plan Cross-Coordination

Local Emergency Operations Plans
 Comprehensive Economic Development Strategy for the Meramec Region

Actions/Measures to be Taken

Action 1: Encourage communities to budget for enhanced warning systems.

Achievements 2004-2009: Indian Hills Subdivision installed a warning siren. The City of Steelville made improvements to their warning sirens.

Action 2: Encourage all communities to develop stormwater management plans.

Action 3: Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

Action 4: Encourage cities to require contractor stormwater management plans in all new development—both residential and commercial properties.

Action 5: Encourage local government to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.

Action 6: Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.

Strategy: Establish a mitigation planning committee comprised of emergency response agencies, health department officials, Red Cross employees, CERT teams, local businesses, schools and citizens, who will plan for and implement the activities and projects necessary to accomplish the stated mitigation goal. A second partnership comprised of all EMD directors from the various jurisdictions in the county should be established to meet once each year to discuss emergency planning and mitigation issues and share ideas.

Achievements 2004-2009: Local organizations, as well as city and county governments, have taken steps to do long-term planning on hazard mitigation. Warning sirens have been installed in the Indian Hills subdivision, north of Cuba. The City of Steelville has improved its warning system. A number of road and bridge improvements have been made within the county to address flooding issues. All of these activities are evidence that the county and its jurisdictions are planning for and making improvements in the area of hazard mitigation.

Phase 1: Within six months, with the committee's assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and discuss potential funding sources for advanced warning systems. EMDs would then take back this information to their respective communities.

2. Convene annual EMD meeting, where discussion of county’s LEOP should be a major topic. This discussion should include integrating hazard mitigation activities into the county LEOP and municipal LEOPs.
3. EMDs from smaller cities work with EMDs from larger cities to examine the possibility of purchasing used warning equipment from larger cities.
4. Add “Inclusion of Mitigation” to checklist for updating local economic development or comprehensive plans to ensure that hazard mitigation will be included in future planning.
5. EMDs meet with building associations and encourage them to include stormwater planning in all new development.
6. County Commission and EMD develop and maintain a list of potential flood-prone properties, based on past disaster declarations and flash flooding events.

Phase 2: Within one year, with the committee’s assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and discuss potential funding sources for advanced warning systems. EMDs would then take back this information to their respective communities.
2. Convene annual EMD meeting, where discussion of county’s LEOP should be a major topic. This discussion should include integrating hazard mitigation activities into the county LEOP and municipal LEOPs.
3. Investigate cooperative purchasing of advanced warning systems between all jurisdictions to reduce the cost of the system for each municipality.
4. Public Works Department officials and city engineer meet to discuss ideas for stormwater management, then make presentation to city council that outlines the need for a stormwater management plan.
5. The LEOP review committee comprised of local emergency responders, businesses, residents, government officials and schools should examine the hazard mitigation plan when updating the LEOP.
6. Add “Inclusion of Mitigation” to checklist for updating local economic development or comprehensive plans to ensure that hazard mitigation will be included in future planning.
7. Work with contractors and building associations to design an ordinance requiring stormwater management plans for all new development.
8. Recommend county/city officials earmark budget funds for purchasing floodplain property.
9. Meet with planning and zoning board to discuss rezoning floodplain as open space.
10. Larger communities that are purchasing new warning systems could make their old warning systems available to smaller communities in the county or region.

Phase 3: Within three years, with the committee’s assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and discuss potential funding sources for advanced warning

- systems. EMDs would then take back this information to their respective communities.
2. Convene annual EMD meeting, where discussion of county's LEOP should be a major topic. This discussion should include integrating hazard mitigation activities into the county LEOP and municipal LEOPs.
 3. Add "Inclusion of Mitigation" to checklist for updating local economic development or comprehensive plans to ensure that hazard mitigation will be included in future planning.
 4. Recommend county/city officials earmark budget funds for purchasing floodplain property.
 5. Pursue funding for stormwater management planning process.
 6. Make recommendation to city council, after working with building associations to draft ordinance, to pass ordinance requiring stormwater management plans for all new development.
 7. Examine option of passing a sales tax that can be used to purchase flood-prone areas and convert to public space.
 8. Use funding (from city budget or federal grants) to buy flood prone property.
 9. Recommend, after meeting with planning and zoning board, that repetitive loss properties in the floodplain be rezoned as open space.

Phase 4: Within five years, with the committee's assistance:

1. Schedule an annual meeting of EMDs from Crawford County jurisdictions to exchange information and discuss potential funding sources for advanced warning systems. EMDs would then take back this information to their respective communities.
2. Convene EMD meeting, where discussion of county's LEOP should be a major topic. This discussion should include integrating hazard mitigation activities into the county LEOP and municipal LEOPs.
3. Add "Inclusion of Mitigation" to checklist for updating local economic development or comprehensive plans to ensure that hazard mitigation will be included in future planning.
4. Recommend county/city officials earmark budget funds for purchasing floodplain property.
5. Budget for purchase of new warning system or apply for grants to support the same cause.
6. Examine option of passing a sales tax that can be used to purchase flood-prone areas and convert to public space.
7. Use funding (from city budget or federal grants) to buy flood prone property and convert to public space.

Acceptance and Approval: Local government acceptance and approval through local government resolution of the details of this mitigation program document in no way obligates the local government to actually carry out its provisions. Each individual action contained in this document that incurs a cost and/or liability must still be approved by separate governmental

actions commensurate with the normal governmental proceedings for approving such actions, in accordance with local ordinance, laws and regulations.

Potential Partners:

- City Government
- County Government
- Emergency Management Directors
- Mitigation Planning Committee
- Missouri State Emergency Management Agency
- Corps of Engineers
- Region I Homeland Security Oversight Committee
- Local schools, churches, non-profit organizations, government agencies and businesses

General Responsibility: It is recommended that the county and city emergency management directors and the Mitigation Planning committee accept general responsibility to steer the development and execution of the activities and projects required to accomplish the goals, objectives and strategies identified in this program document. With the exception of normal responsibility of local governmental agents, this is a voluntary participation that in no way states nor implies the acceptance of any liability for the success or failure of the program, activities, events or projects undertaken to complete the program or any portions thereof.

Potential Lead Responsibility by Action		Estimated Cost
Action 1:	County and city EMDs and Local Government	Unknown
Action 2:	Local Planners, Local Government	\$800
Action 3:	County and city EMDs	\$500
Action 4:	County and city EMDs and Building Associations	\$1,500
Action 5:	Local Government, All EMDs, Floodplain Managers	Unknown
Action 6:	City EMDs and City Councils, Local Planners, Floodplain Managers	\$1,500
Total Estimated Cost:		\$4,300

Sources of Funding: Grants, local general revenue funds, private financial donations and private donations of goods and services.

Summary of Actions/Measures Achieved 2004-2009:

In the five year interim since the hazard mitigation plan was adopted, Crawford County and the communities within the county have made progress in long-term planning for hazard mitigation. Community warning systems have been improved. New planning efforts are including mitigation issues and projects.

Program Title: Finding Funding

Goal: Secure resources for investment in hazard mitigation through the following objectives:

1. Research the use of local and outside sources of funding.
2. Encourage participation of property owners in investing in hazard mitigation projects on their own property.
3. In the event of a disaster declaration, be prepared to apply for hazard mitigation grants for prioritized projects.

Necessary Community Program/Plan Cross-Coordination

Local Emergency Operations Plans
Comprehensive Economic Development Strategy for the Meramec Region
Cuba Comprehensive Plan
Sullivan Comprehensive Plan

Actions/Measures to be Taken

Action 1: Work with SEMA Region I coordinator to learn about new mitigation funding opportunities.

Achievements 2004-2009: Quarterly meetings are hosted by SEMA's area coordinator in Region I.

Action 2: Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.

Action 3: Work with state/local/federal agencies to include mitigation in all economic and community development projects.

Action 4: Encourage local governments to budget for mitigation projects.

Achievements 2004-2009: Several road and bridge improvements have been made in Crawford County, Steelville and Cuba that have resulted in improvements in flood problem areas. These include upgrades to Swyers Bridge, Beers Bridge, Brickey Slab, crossings over Shoal Creek, Highway PP, replacement of Fourth Street Bridge in Steelville, and improvements to Blunt Road, Jakes Prairie Road, Eastman Dunn Road and Melody Lane in Cuba.

Action 5: Encourage cities and counties to implement cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.

Action 6: Implement public awareness program about the benefits of hazard mitigation projects, both public and private.

Action 7: Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Strategy: Establish a mitigation planning committee comprised of emergency response agencies, health department officials, Red Cross employees, CERT teams, local businesses, schools and citizens, who will plan for and implement the activities and projects necessary to accomplish the stated mitigation goal. A second partnership comprised of all EMD directors from the various jurisdictions in the county should be established to meet once each year to discuss emergency planning and mitigation issues and share ideas.

Achievements 2004-2009:

Local governments and organizations have taken steps to do long-term planning on funding for hazard mitigation projects. Whether including projects in their own budgets or actively seeking grant funds to complete mitigation projects, actions are being taken by several entities in the region to address this goal.

Phase 1: Within six months, with the committee's assistance:

1. Invite Region I coordinator to annual meeting of EMDs to discuss recent mitigation projects funded by SEMA and new grant monies available. The Invite SEMA mitigation specialist or mitigation officer to meet with EMDs at their annual meeting and/or local officials of county and cities.
2. Add an action item to the Comprehensive Economic Development Strategy (CEDS) plan for the Meramec Regional Planning Commission to work with one or more community each year to assess mitigation needs and seek funding to meet those needs.
3. Discuss and explore possibility of cost-share programs between residents and city/county. The committee should explore what types of programs would achieve the greatest response and benefit and look at funding possibilities.
4. Develop and maintain a list of potential flood-prone properties, based on past disaster declarations and flash flooding events.

Phase 2: Within one year, with the committee's assistance:

1. Invite SEMA Region I coordinator to meet with city/county officials on a yearly basis.
2. Invite SEMA Region I coordinator to annual meeting of EMDs to discuss recent mitigation projects funded by SEMA and new grant monies available.
3. Make bridges that would mitigate flooding problems a top priority when applying for grants.
4. Complete a survey of bridge/road upgrades that would mitigate flooding, to be prepared for when funding becomes available.
5. Research and distribute press releases encouraging residents to secure propane tanks, trailers, small buildings, have power lines run underground using personal finances.
6. Discuss and explore possibility of cost-share programs between residents and city/county. The committee should explore what types of programs would achieve the greatest response and benefit and look at funding possibilities.
7. Present cost-share funding program ideas to local officials to incorporate into annual budgets.

Phase 3: Within three years, with the committee's assistance:

1. Invite SEMA Region I coordinator to meet with city/county officials on a yearly basis.
2. Invite SEMA Region I coordinator to annual meeting of EMDs to discuss recent mitigation projects funded by SEMA and new grant monies available.
3. During annual comment period on use of Community Development Block Grant funds, suggest that Missouri Department of Economic Development set aside funds for community mitigation projects each year.
4. Publicize availability of cost-share programs in each jurisdiction.

Phase 4: Within five years, with the committee's assistance:

1. Invite SEMA Region I coordinator to meet with city/county officials on a yearly basis.
2. Invite SEMA Region I coordinator to annual meeting of EMDs to discuss recent mitigation projects funded by SEMA and new grant monies available.
3. During annual comment period on use of Community Development Block Grant funds, suggest that Missouri Department of Economic Development set aside funds for community mitigation projects each year.
4. Publicize availability of cost-share programs in each jurisdiction.
5. Apply for any mitigation grants that become available through FEMA.

Acceptance and Approval: Local government acceptance and approval through local government resolution of the details of this mitigation program document in no way obligates the local government to actually carry out its provisions. Each individual action contained in this document that incurs a cost and/or liability must still be approved by separate governmental actions commensurate with the normal governmental proceedings for approving such actions, in accordance with local ordinance, laws and regulations.

Potential Partners:

City Government
County Government
Emergency Management Directors
Mitigation Planning Committee
Missouri State Emergency Management Agency
Meramec Regional Planning Commission
Region I Homeland Security Oversight Committee

General Responsibility: It is recommended that the county and city emergency management directors and the Mitigation Planning committee accept general responsibility to steer the development and execution of the activities and projects required to accomplish the goals, objectives and strategies identified in this program document. With the exception of normal responsibility of local governmental agents, this is a voluntary participation that in no way states nor implies the acceptance of any liability for the success or failure of the program, activities, events or projects undertaken to complete the program or any portions thereof.

Potential Lead Responsibility by Action		Estimated Cost
Action 1:	County and city EMDs, Local Government	\$0
Action 2:	County/City engineers, Local Government, Grant Writers	\$3,500
Action 3:	Local Planners, Local Government, County and City EMDs	\$2,500
Action 4:	County and City EMDs, Local Government	\$500
Action 5:	County and City EMDs, Local Government, HMPC	\$1,500
Action 6:	City and County EMDs, Local Government	\$750
Action 7:	City and County EMDs, Local Government, Local Planners, City/County Engineers, HMPC	\$1,500
Total Estimated Cost:		\$10,250

Sources of Funding: Grants, local general revenue funds, private financial donations and private donations of goods and services.

Summary of Actions/Measures Achieved 2004-2009:

In the five year interim since the hazard mitigation plan was adopted, Crawford County and the communities within the county have made progress in finding funding for hazard mitigation projects. Funding for hazard mitigation projects have been included in local government budgets. Indian Hills subdivision sought out grant funds from USDA Rural Development for a siren warning system.

Table 4.3 Summary of Mitigation Programs and Action items Developed for Crawford County and All Jurisdictions

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Implement an education program on personal emergency preparedness.	Reducing Vulnerability of the People	1	High	All Hazards
Crawford County Bourbon Cuba Leasburg	2. Promote the development of emergency plans by businesses.			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
St. Cloud Steelville Sullivan West Sullivan		Reducing Vulnerability of the People	1		
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Encourage cities to obtain early warning systems and improved communications systems to minimize loss of life.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Promote the use of weather radios by local residents and schools to ensure advanced warning about threatening weather.			High	Severe Storms Tornados
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	6. Encourage and continue tree trimming programs as well as dead tree removal program.			High	Severe Storms Tornados
Crawford County Bourbon Cuba	7. Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural			High	Flood Earthquake

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Leasburg St. Cloud Steelville Sullivan West Sullivan	disasters.	Reducing Vulnerability of the People	1		
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan School Districts	8. Encourage the construction of storm shelters, especially tornado safe rooms, near schools & large employment centers			High	Severe Storms Tornados
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.	Property and Infrastructure Protection	2	High	Earthquake Tornado
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Educate residents about the dangers of floodplain development and the benefits the National Flood Insurance Program.			High	Flood
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Encourage minimum standards for building codes in all cities.			Medium	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Encourage local governments to develop and implement regulations for securing hazardous materials tanks and mobile homes.	Property and Infrastructure Protection	2	Medium	Flood Severe Storms Tornado
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Distribute SEMA brochures at public facilities and events.	Outreach and Education	3	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparedness.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Encourage local residents to purchase weather radios.			High	Severe Storms Tornados
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan	4. Ask SEMA mitigation specialists to present information to city councils, county commission and local planning organizations.			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
West Sullivan					
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Re-evaluate the hazard mitigation plan and merge with other community planning	Outreach and Education	3	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	6. Distribute press releases by cities/county regarding adopted mitigation measures.			Medium	All Hazards
Crawford County	7. Encourage county health department and Red Cross to implement education/awareness campaigns on individual preparedness.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	8. Publicize city and/or county drills.			Medium	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Encourage joint meetings of different organizations/ agencies for mitigation planning	Communication Enhancement	4	Medium	All Hazards
Crawford County	2. Joint training or drills between agencies, public and private			Medium	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	entities including schools and businesses.	Communication Enhancement	4		
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	3. Pool different agency resources to achieve widespread mitigation results.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Encourage meetings between EMD, city/county officials and SEMA to familiarize local officials with mitigation planning and implementation and budgeting for mitigation projects.			High	All Hazards
Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Encourage communities to budget for enhanced warning systems.	Long-Term Planning	5	High	All Hazards
Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Encourage all communities to develop stormwater management plans.			Low	Flood Severe Storms
Crawford County Bourbon Cuba Leasburg	3. Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.			Medium	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
St. Cloud Steelville Sullivan West Sullivan		Long-Term Planning	5		
Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	4. Encourage cities to require contractor stormwater management plans in all new development.			Low	Flood Severe Storms
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Encourage local governments to purchase properties in the floodplain as funds become available and convert land into public space/recreation area.			Medium	Flood
Crawford County	6. Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.			High	Flood
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	1. Work with SEMA Region I coordinator to learn about new mitigation funding opportunities.	Finding Funding	6	High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	2. Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.			Medium	Flood Earthquake
Crawford	3. Work with state/local/federal				

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	agencies to include mitigation in all economic and community development projects.	Finding Funding	6	Medium	All Hazards
Crawford County Bourbon Cuba Leasburg Steelville Sullivan West Sullivan	4. Encourage local governments to budget for mitigation projects.			Medium	All Hazard
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	5. Encourage cities and county to implement cost-share programs with private landowners for hazard mitigation projects that benefit the community as a whole.			Medium	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	6. Implement public awareness program about the benefits of hazard mitigation projects, both public and private.			High	All Hazards
Crawford County Bourbon Cuba Leasburg St. Cloud Steelville Sullivan West Sullivan	7. Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.			High	All Hazards

Table 4.4 Summary of Estimated Costs and Responsible Parties and Potential Funding Sources For Reducing Vulnerability of People

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Implement education program on personal emergency preparedness	County EMD City EMDs County Health Dept.	\$1,500	Grants Local general revenue funds Private donations of cash, goods or services
Promote the development of emergency plans by businesses	County EMD County Health Dept.	\$2,500	Grants Local general revenue funds Private donations of cash, goods or services
Encourage cities to obtain early warning systems and improved communications systems and update existing warning systems	Local Government County EMD City EMDs	\$1,500	Grants Local general revenue funds Private donations of cash, goods or services
Promote the use of weather radios by local residents and schools to ensure advanced warning of threatening weather.	County EMD City EMDs Local Government Emergency Response Agencies School Districts	\$500	Grants Local general revenue funds Private donations of cash, goods or services
Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.	County EMD City EMDs	\$500	Grants (USDA, Homeland Security) Local general revenue funds Private donations of cash, goods or services
Continue tree trimming and dead tree removal programs.	Local Government County EMD City EMDs Public Utilities Private Utilities	Unknown	Local general revenue funds Private donations
Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.	County Government City Government	\$5,000	Grants Local general revenue funds Private donations of cash, goods or services
Encourage the construction of storm shelters, especially tornado safe rooms, near schools & large employment centers	Local governments Local school districts	Unknown	Grants Local general revenue funds Private donations of cash, goods or services

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Total Estimated Cost of Program:		\$11,500	

Table 4.5 Summary of Estimated Costs, Responsible Parties and Potential Funding Sources For Property and Infrastructure Protection

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Encourage self-inspection program at critical facilities for earthquake and tornado resistance	All EMDs	\$1,500	Grants Local general revenue funds
Educate residents & contractors about the dangers of floodplain development, floodplain building requirements & benefits of NFIP	County EMD/ Floodplain Manager	\$1,500	Grants Local general revenue funds Private donations of cash, goods or services
Encourage minimum standards for building codes in all cities.	County EMD Local Government	\$1,500	Grants Local general revenue funds Private donations of cash, goods or services
Encourage local governments to develop & implement regulations for securing hazardous materials tanks and Mobile homes to reduce risk during flooding & severe weather	County EMD City EMDs Local government	\$3,000	Grants Local general revenue funds Private donations of cash, goods or services
Total Estimated Cost of Program		\$7,500	

Table 4.6 Summary of Estimated Costs, Responsible Parties and Potential Funding Sources for Hazard Mitigation Outreach and Education Program

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Distribute SEMA brochures at public facilities & events	County EMD City EMDs	\$500	Local general revenue funds Private donations of cash, goods or services
Distribute regular press releases from county & city EMD offices on hazards	County EMD City EMDs	\$500	Local general revenue funds
Encourage residents to purchase weather radios thru press releases and brochures	County EMD City EMDs	\$500	Grants Local general revenue funds Private donations of cash, goods or services

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Ask SEMA mitigation specialists to present information to city councils, county commission & local planning organizations	County EMD City EMDs Local governments	\$ 0	N/A
Re-evaluate the hazard mitigation plan & merge with other community planning	County EMD City EMDs Local planners City administrators HMPC	\$3,500	Grants Local general revenue funds Private donations of cash, goods or services
Distribute press releases by cities/county regarding adopted mitigation measures	County EMD City EMDs Local governments	\$700	Local general revenue funds
Encourage county health department & local American Red Cross Chapter to use publicity campaigns to make residents aware of proper measures to take during threatening conditions (ex. Heat wave)	County EMD County Health Department Local Red Cross Chapter	\$1,000	Grants Local general revenue funds Private donations of cash, goods or services
Publicize county or city-wide drills	County EMD City EMDs	\$250	Grants Local general revenue funds Private donations of cash, goods or services
Total Estimated Cost of Program:		\$6,950	

Table 4.7 Summary of Estimated Costs, Responsible Parties and Potential Funding Sources for Communication Enhancement Program

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Encourage joint meetings of different organizations/agencies for mitigation planning	County EMD City EMDs	\$500	Grants Local general revenue funds Private donations of cash, goods or services
Joint training (or drills) between agencies, public & private entities (including schools & businesses)	County EMD City EMDs Emergency response agencies	\$10,000	Grants Local general revenue funds Private donations of cash, goods or services
Pool different agency resources to achieve widespread mitigation results	County & City EMDs Local government	\$1,000	Grants Local general revenue funds

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
			Private donations of cash, goods or services
Encourage meetings between EMD, city/county officials & SEMA to familiarize officials with mitigation planning & implementation & budgeting for mitigation projects.	County EMD City EMD Local governments	-0-	
Encourage elected officials to distribute public relations information about mitigation projects	County EMD City EMDs Local Governments	\$500	Grants Local general revenue funds
Total Estimated Cost of Program:		\$12,000	

Table 4.8 Summary of Estimated Costs, Responsible Parties and Potential Funding Sources for Long-Term Planning Program

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Encourage communities to budget for enhanced warning systems.	County EMD City EMD Local governments	Unknown	Grants Local general revenue funds Private donations of cash, goods or services
Encourage all communities to develop storm water management plans	Local planners Local governments	\$800	Grants Local general revenue funds Private donations of cash, goods or services
Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans & procedures	County EMD City EMDs	\$500	Local general revenue funds
Encourage cities to require contractor storm water management plans in all new development – both residential & commercial	Local planners Local governments	\$1,500	Local general revenue funds Private donations of cash, goods or services
Encourage local government to purchase properties in the floodplain as funds become available & convert land to public space/recreation areas	Local government County & city EMDs Floodplain managers	Unknown	Grants Local general revenue funds Private donations of cash, goods or services
Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space	City government Local planners City EMDs	\$1,500	Local general revenue funds

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
	Floodplain managers		
Total Estimated Cost of Program:		\$4,300	

Table 4.9 Summary of Estimated Costs, Responsible Parties and Potential Funding Sources for Finding Funding Program

Action Item	Responsible Party	Estimated Cost	Potential Sources of Funding
Work with SEMA Region I coordinator to learn about new mitigation funding opportunities	County EMD City EMD Local governments	\$-0-	
Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met	City/County engineers Local government Local grant writers	\$3,500	Grants Local general revenue funds Private donations of cash, goods or services
Work with local/state/federal agencies to include mitigation in all economic & community development projects	Local planners Local government County & city EMDs	\$2,500	Grants Local general revenue funds Private donations of cash, goods or services
Encourage local governments to budget for mitigation projects	County & City EMDs Local governments	\$500	Local general revenue funds
Encourage cities and counties to implement cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole	Local governments, County & city EMDs	\$1,500	Grants Local general revenue funds Private donations of cash, goods or services
Implement public awareness program about the benefits of hazard mitigation projects, both public & private	County & city EMDs Local government	\$750	Grants Local general revenue funds Private donations of cash, goods or services
Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health & property	County & city EMDs Local governments Local planners City/County engineers HMPC	\$1,500	Grants Local general revenue funds Private donations of cash, goods or services
Total Estimated Cost of Program:		\$10,250	

4.4 Mitigation Actions in Support of the National Flood Insurance Program

Crawford County and the cities of Bourbon, Cuba, Leasburg, Steelville and Sullivan are committed to continuing participation in the National Flood Insurance Program (NFIP). Table 4.9 summarizes specific hazard mitigation action items that directly or indirectly support the NFIP.

Table 4.10 Specific Mitigation Actions Supporting NFIP in Crawford County and the Cities of Bourbon, Cuba, Leasburg, Steelville and Sullivan

Hazard Mitigation Program	Action Item	Jurisdiction
Reducing Vulnerability	1. Implement an education program on personal emergency preparedness.	Crawford County, Bourbon, Cuba, Leasburg, Steelville and Sullivan
Property and Infrastructure Protection	4. Educate residents, realtors & contractors on the dangers of floodplain development & the benefits of the NFIP.	Crawford County, Bourbon, Cuba, Leasburg, Steelville and Sullivan
	1. Encourage local government to develop and implement regulations for securing hazardous materials tanks and mobile homes to reduce hazards during storms/flooding.	
Outreach and Education	2. Distribute regular press releases on hazards, vulnerable areas, frequency and preparedness	Crawford County, Bourbon, Cuba, Leasburg, Steelville and Sullivan
Long-Term Planning	2. Encourage all communities to develop storm water management plans	Crawford County, Bourbon, Cuba, Leasburg, Steelville and Sullivan
	4. Encourage cities to require contractor storm water management plans in all new development--both residential and commercial properties	
	5. Encourage local government to purchase properties in the flood plain as funds become available and convert that land into public space/recreation areas	
	6. Encourage communities to discuss zoning repetitive loss properties in the flood plain as open space.	
Finding Funding	5. Encourage cities and county to implement cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole	Crawford County, Bourbon, Cuba, Leasburg, Steelville and Sullivan

5 PLAN MAINTENANCE PROCESS

The plan maintenance section of this document details the formal process that will ensure that the Crawford County Hazard Mitigation Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing a plan revision every five years. This section describes how the county will integrate public participation throughout the plan maintenance process. Finally, this section includes an explanation of how Crawford County government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the County Local Emergency Operations Plan, CEDS and floodplain management.

5.1 Monitoring, Evaluating and Updating the Plan

44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle.

Periodic revisions and updates of the Plan are required by Missouri SEMA to ensure that the goals and objectives for Crawford County are kept current. More importantly, revisions may be necessary to ensure the plan is in full compliance with Federal regulations and state statutes. This portion of the plan outlines the procedures for completing such revisions and updates.

A key component of the ongoing plan monitoring, evaluating and updating will be the Crawford County Hazard Mitigation Planning Committee (HMPC). In order to carry out the activities necessary for maintaining the plan, the HMPC will need to remain in place and meet periodically. The coordination of this group, as indicated in the mitigation strategy, should be a responsibility of the county EMD. On-going activities of the HMPC are:

- Meet on an annual basis, at a minimum, to monitor and evaluate the implementation of the hazard mitigation plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Actively pursue the implementation of mitigation actions, focusing first on high priority measures that are no or low in cost;
- Actively search for methods of funding mitigation measures through grants and/or cost share programs;
- Monitor and assist with the implementation and updating of the plan;
- Promote mitigation activities through the identification of plan recommendations that overlap or influence other community goals, plans and activities or when those actions affect the community's vulnerability to hazards;
- Keep the governing bodies of jurisdictions, county commission and city councils, aware of HMPC activities, plan progress and modifications;
- Keep the public informed of hazard mitigation activities and encourage public input and participation in mitigation planning and implementation.

The primary responsibilities of the HMPC will be to see that the hazard mitigation plan is successfully implemented and that the governing jurisdictions and general public are kept informed of that progress. The HMPC will also be responsible for encouraging public participation and input into the on-going planning and implementation process.

5.2 Plan Maintenance

Periodic revisions and updates of the Plan are required by Missouri SEMA to ensure that the goals and objectives for Crawford County are kept current. More importantly, revisions may be necessary to ensure the plan is in full compliance with Federal regulations and state statutes. This portion of the plan outlines the procedures for completing such revisions and updates.

The three background studies (Hazard Identification and Analysis, Capabilities Assessment, and Community Vulnerability Assessment) and the goals and objectives should be reviewed at a minimum of every five years to determine if there have been any significant changes in Crawford County that would affect the hazard mitigation plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and changes to federal or state legislation are examples of changes that may affect the plan.

Further, following a disaster declaration, the plan will need to be revised to reflect any lessons learned or to address specific circumstances arising out of the disaster.

The results of this five-year review should become summarized in a report prepared for this mitigation plan under the direction of the Crawford County Emergency Management Director and the HMPC. The report will include an evaluation of the effectiveness and appropriateness of the plan, and will recommend, as appropriate, any required changes or amendments to the plan.

The HMPC should continue to recruit members and should include all those individuals identified in the plan as having responsibilities in hazard mitigation as well as representatives from various government agencies, county officials, city employees, utility service employees, emergency responders and planners, regional planners and any concerned residents. Upon meeting, the committee members will also report on the status of their projects and will include which implementation processes worked well, any difficulties encountered, how coordination efforts were proceeding, and which strategies should be revised.

The emergency management office, with the help of the HMPC will update and make changes to the plan before submitting it to the jurisdictions for review and input. Following local review, the revised plan will be submitted to the state hazard mitigation officer at the Missouri State Emergency Management Agency (SEMA) and the FEMA Region VII office per requirements of the Disaster Mitigation Act of 2000. The revised plan will also need to be formally adopted by participating jurisdictions following State and Federal approval. If no changes are necessary to the plan, the state hazard mitigation officer will be given a justification for this determination. A disaster or other circumstance, such as changing regulations, may require that this five-year revision schedule be changed.

5.3 Incorporation of Hazard Mitigation into Existing Planning

44 CFR Requirement 201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Wherever possible, participating jurisdictions will use existing plans and programs to implement the hazard mitigation measures. Each jurisdiction will pursue mitigation actions based upon their capabilities and funding availability. Planning for reducing loss of life and property to natural hazards will be on-going. This planning document has been written to build upon the foundation of existing plans and programs and recommends implementing mitigation action items, whenever possible, through the following avenues:

- Comprehensive Economic Development Survey document
- Crawford County Local Emergency Operations Plan (LEOP)
- Comprehensive plans of participating jurisdictions
- Master plans of participating jurisdictions
- Ordinances of participating jurisdictions
- Capital improvement plans and budgets
- Other plans in the planning area that currently exist or that are developed in the future, such as stormwater management plans, subdivision development ordinances, economic development plans and parks and recreation plans

Through active involvement in the Meramec Regional Planning Commission, Crawford County and its cities address regional planning and economic goals through the region's Comprehensive Economic Development Survey. The hazard mitigation plan provides a series of recommendations—several of which are closely related to the goals and objectives of existing planning programs. Crawford County will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

Upon adoption, the Crawford County Hazard Mitigation Plan will serve as a baseline of information on the natural hazards that impact the county and each of its cities. These goals and objectives will help local governments and other organizations plan for natural hazard mitigation in their own planning documents. The participating jurisdictions will encourage the incorporation of hazard mitigation principles into all other planning documents that are developed or updated in the future. Within two years of formal adoption of the mitigation plan, the recommendations listed in the plan should be incorporated into the process of existing planning mechanisms at the county level. The meetings of the hazard mitigation planning committee will provide an opportunity for committee members to report back on the progress made on the integration of mitigation planning elements into county/city planning documents and procedures.

Much of the information included in this plan, particularly the hazard analysis, can be used by the County EMD in the annual review and update of the county LEOP. By coordinating the annual review and update of these two planning documents, the County EMD can insure that the two plans will be integrated and complement one another.

HMPC members will also be responsible for assisting in plan review and update, as well as the integration of hazard mitigation principles and actions into planning documents in their respective jurisdictions.

5.4 Continued Public Participation in Plan Maintenance Process

44 CFR Requirement 201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Crawford County is dedicated to involving the public directly in review and updates of the hazard mitigation plan and will encourage the public to participate on the HMPC and to provide input into the plan document and implementation activities. The hazard mitigation planning committee members are responsible for the annual review and update of the plan.

The public will also have the opportunity to provide feedback about the plan. Copies of the plan will be catalogued and kept at all of the appropriate agencies in the county. A public meeting will also be held after each five-year evaluation or when deemed necessary by the hazard mitigation planning committee. The meetings will provide the public a forum for which they can express its concerns, opinions, or ideas about the plan. The county will be responsible for publicizing the meetings and maintaining public involvement through the public access channel, website and newspapers.

The update process will also provide an opportunity to publicize the plan, the HMPC's activities and successful hazard mitigation projects. Publicizing these activities will also be an opportunity to gather input from the public. Information will be released through local media outlets – both newspapers and internet websites. A public hearing will be held to receive public comment on plan maintenance and updating will be held during the review process. Public notice will be posted and public input will be invited through local media outlets.

5.5 Summary of Plan Changes

The Crawford County Multi-Hazard Mitigation Plan underwent a number of changes from the plan approved in 2004 and the plan revision that was approved in 2013. Essentially, the plan was completely reformatted to meet more stringent requirements and guidelines provided by FEMA. Although the 2004 plan was used as the starting point for the revision process, the revised plan bears little resemblance to the plan completed in 2004.

A summary of those changes are outlined in the table below:

Table 5.1 Crawford County Hazard Mitigation Plan Revisions 2004 - 2013

Chapter/Section	2004 Plan Document	2013 Revised Plan
Executive Summary	Part of Introduction	Plan purpose; participating jurisdictions; methodology of planning process; goals; summary of mitigation programs & action items; prerequisites; model adoption resolution
Introduction	Assurance statements of compliance; basis for planning authority; adoption; acknowledgements & special thanks; planning process; participants and jurisdictions represented; timeframe; executive summary	Plan purpose; background and scope; plan organization; planning process. The Introduction was reorganized as Chapter 1.
Section I/Chapter 1	Community profile including history, forms of government, population data, topography, climate, watershed info, environmentally sensitive areas, transportation, utilities, public facilities, emergency response services, building & fire codes, employment, media coverage	See above
Section II/Chapter 2	Hazard Analysis including risk assessment, hazard profile information on relevant hazards, worksheets, vulnerability assessment, cascading emergencies	Planning area profile & capabilities. All aspects of the profile & capabilities were expanded dramatically from the 2004 version. History, geography, topography, soil types, climate, population/demographics, schools, business/industry, agriculture, environmentally sensitive areas and species. Jurisdictional descriptions & capabilities
Section III/Chapter 3	Capability Assessment including existing plans, mitigation programs, capability assessment in regards to relevant hazards, local resources/capabilities, SEMA capabilities, worksheets	Risk Assessment including identification of relevant hazards; profiles of hazards; vulnerability assessment by hazard; future land use & development; summary of key issues
Section IV/Chapter 4	Vulnerability Assessment including overview of commitment, local laws, regulations & policies on hazard mitigation; incorporation of hazard	Mitigation Strategy including goals; identification and analysis of mitigation actions; implementation of mitigation actions; mitigation actions supporting NFIP

Chapter/Section	2004 Plan Document	2013 Revised Plan
	mitigation into local planning; prioritization; cost-effectiveness; funding options; recommendations; policies and development trends; worksheets	Minor changes were made to the action items and all activities that had occurred since 2004 were included in the update. Budget information for mitigation plans was updated, as well as responsible parties.
Section V/Chapter 5	Mitigation program including definition & categories of mitigation; benefits; goal & objective development; identification and analysis of mitigation measures; mitigation strategy and program development; actions by jurisdiction; 5 year matrix	Plan implementation & maintenance including monitoring, evaluating & updating; incorporating hazard mitigation into existing plans; public involvement Changes made to the plan document were added.
Section VI	Plan maintenance including adoption; monitoring, evaluating & updating; 5 year review; implementation; public involvement	No Chapter 6
Appendices	Appendix 1: hazard mitigation financial resource guide Appendix 2: repetitive loss listing Appendix 3: list of acronyms Appendix 4: bibliography	Appendix A: Planning process documentation Appendix B: References Appendix C: Adoption Resolutions Appendix D: Federal/State Mitigation programs, activities and initiatives

Appendix A

Planning Process



A Council of Local Governments
Serving the Meramec Area

MERAMEC REGIONAL PLANNING COMMISSION

4 Industrial Drive
St. James, MO 65559-1689
(573) 265-2993
FAX (573) 265-3550

MEMORANDUM

TO: County Commissions of Crawford, Maries, Osage and Washington counties

FROM: Richard Cavender, Executive Director

DATE: December 23, 2008

RE: Hazard Mitigation Plan Updates and Grants

I am writing to make you aware of grants that will become available to county governments for the purpose of updating your county hazard mitigation plans. As you may recall, MRPC wrote hazard mitigation plans for six of our eight counties approximately five years ago. The Missouri State Emergency Management Agency is now providing grant funds to update those plans.

The Hazard Mitigation Plan must be updated every five years in order to stay in compliance with SEMA and FEMA. If the county chooses not to update the plan, they will no longer be eligible for hazard mitigation grant funds. Examples of projects funded through hazard mitigation grants include buyouts of property located in the flood plain, upgrading bridges and roads to make them less susceptible to flood damage and building tornado safe rooms for schools. There has been a great deal of interest from schools in the region to take advantage of these grants to pay for tornado safe rooms.

SEMA is providing a grant of \$20,000 toward the cost of the update of the plan. FEMA requires a 25 percent match for this grant which is \$6,666.67. Up to \$3,000 of that can be provided as in-kind match – which is time spent by people on the advisory group for updating the plan. That would leave \$3,666.67 in cash match that would have to be provided by local jurisdictions. Other counties that had to come up with cash match were able to partner with the communities within their county to share the cost of the match.

We have contracts in place with Phelps and Gasconade counties. The next counties that will be coming due are Crawford and Osage followed by Washington and Maries counties later in 2009.

I just wanted to write to make you aware of the need to update your hazard mitigation plans and the match requirement on the grant from SEMA. If you have any questions, please do not hesitate to contact myself or Tamara Snodgrass by phone at (573) 265-2993 or via email at tsnodgrass@meramecregion.org.

RAC

Chairman: Laura Antolak
At-Large Representative for Small Business

Vice Chairman: Russell Scheulen
Presiding Commissioner, Osage County

Executive Director: Richard Cavender

Secretary: Gary Brown
Mayor, City of Salem

Treasurer: James Morgan
Mayor, City of Crocker

May 4, 2009

«First_Name» «Last_Name»
«Position»
«Address»
«City», «State_» «Zip»

Dear «First_Name»:

The Crawford County Multi-Jurisdictional Hazard Mitigation Plan that was put into place in November 2004 must be revised every five years. It is time to begin reviewing and revising this plan so that Crawford County can meet the deadlines set forth and remain eligible for Hazard Mitigation grant funding. The current plan describes the process for identifying hazards, assessing risks and vulnerabilities, and identifying and prioritizing mitigation actions.

All entities that might apply for hazard mitigation grants in the future must not only adopt the revised plan but participate in its updating. We encourage you to join us at the Crawford County Courthouse on **Monday, May 11, 2009 at 10:00 a.m.** to begin reviewing and revising the current plan. The plan can be accessed from our website, www.meramecregion.org, scroll toward the bottom on the left side of the page, and look for the following; *For Other Downloads (Nomination Forms, Grant Applications, Newsletters, Hazard Mitigation Plans)* click [here](#). After you click, the link will take you to the list of Hazard Mitigation Plans that we are working on. Click on Crawford County to download the existing approved plan. This document is several pages and may take a few minutes to download depending on your internet access.

Your input is crucial to update the plan and ensure that Crawford County and entities located in Crawford County remain eligible for funds available through this program. One of our first items of business will be to develop a list of hazard mitigation activities that have occurred in the last five years in Crawford County. The plan must not only plan for future projects but provide information on what has been accomplished since the plan was originally adopted. For instance, we have had ice storms and flooding events since this plan was put in place. Based on the events that took place, what has been done to rectify power lines being taken down by ice covered branches? Has any bridge or road work been done to prevent floodwater from eroding roadways? Has your school district incorporated a safe room for tornadoes? These are just a few examples and we encourage you to begin listing any projects that have been done that could be included in this revision.

If you have questions, please do not hesitate to contact me. If you are unable to attend but have information to share, please feel free to email me at tprice@meramecregion.org.

Sincerely,

Tonya Price
MRPC
573-265-2993
tprice@meramecregion.org

First Name	Last Name	Position	Address	City	State	Zip
Calvin	Bremer	Bourbon City Clerk	P.O. Box 164	Bourbon	MO	65441
Richard	Ramstein	Bourbon City Engineer	P.O. Box 164	Bourbon	MO	65481
Yeresa	Slawson	Bourbon EMD	219 Spruce Road	Bourbon	MO	65441
Darrell	Cunningham	Bourbon Fire Chief	P.O. Box 889	Bourbon	MO	65441
Dea	Taylor	Bourbon Police Chief	P.O. Box 986	Bourbon	MO	65441
Monty	Todd	Bourbon Utilities Superintendent	P.O. Box 164	Bourbon	MO	65441
John	Huwain	Crawford County Associate Commissioner	P.O. Box AS	Steelville	MO	65565
Richard	Martin	Crawford County Associate Commissioner	P.O. Box AS	Steelville	MO	65565
Franky	Todd	Crawford County Public Administrator	P.O. Box AS	Steelville	MO	65565
Connie	Smith	Crawford County Clerk	P.O. Box AS	Steelville	MO	65565
Charles	Witt	Crawford County EMD	P.O. Box 1313	Steelville	MO	65565
Shirley	Sculce	Crawford County Health Department	P.O. Box 367	Steelville	MO	65565
Ec	Worley	Crawford County Presiding Commissioner	P.O. Box AS	Steelville	MO	65565
Jean	King	Crawford County Red Cross	110 Cedar Lane	Steelville	MO	65565
Randy	Marlin	Crawford County Sheriff	P.O. Box 38	Steelville	MO	65565
Dan	Rlesi	Crawford Electric Cooperative	P.O. Box 10	Bourbon	MO	65441
Christine	Nash	Cuba City Clerk	P.O. Box X	Cuba	MO	65453
Les	Murdock	Cuba EMD	P.O. Box 37	Cuba	MO	65453
Joe	Cason	Cuba Water Superintendent	P.O. Box X	Cuba	MO	65453
Mike	Plank	Cuba Fire Chief	P.O. Box 311	Cuba	MO	65453
James	Happel	Cuba Natural Gas Superintendent	P.O. Box X	Cuba	MO	65453
Richard	Dilcine	Cuba Police Chief	602 S. Franklin	Cuba	MO	65453
Bob	Rowen	Cuba Electrical Superintendent	P.O. Box K	Cuba	MO	65453
Bob	Baldwin	Public Works Superintendent	P.O. Box X	Cuba	MO	65453
Mike	Myers	Cuba Sewer Superintendent	P.O. Box K	Cuba	MO	65453
Dennis	Chandler	Cuba Street Superintendent	P.O. Box K	Cuba	MO	65453
Dwayne	Cartwright	Intercounty Electric Cooperative	P.O. Box 209	Licking	MO	65547
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Kathy	Byrd	Leasburg Street Supervisor	P.O. Box 95	Leasburg	MO	65535
Michael	Bouse	Leasburg Water Supervisor	P.O. Box 95	Leasburg	MO	65535
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Kenny	Killeen	Mayor of Cuba	P.O. Box K	Cuba	MO	65453
Terry	Palmer	Mayor of Steelville	P.O. Box M	Steelville	MO	65555

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Robert Terry	Cornick Lunsford	Steelville City Electrician City Water Superintendent	P.O. Box M P.O. Box M	Steelville Steelville	MO MO	65565 65565
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J.V. Dave	Thurmond Cochran	Sullivan Light Commissioner Sullivan Parks & Recreation	210 W. Washington St. 210 W. Washington St.	Sullivan Sullivan	MO MO	63080 63080
George Tom	Counts Harman	Sullivan Police Chief Sullivan Water Commissioner	106 Progress Drive 210 W. Washington St.	Sullivan Sullivan	MO MO	63080 63080
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Board of Board of Board of Board of Board of Board of	Ardmen Ardmen Ardmen Aldermen Trustees Trustees	City of Steelville City of Bourbon City of Cuba City of Sullivan	P.O. Box M P.O. Box 164 P.O. Box K 210 W. Washington St.	Steelville Bourbon Cuba Sullivan	MO MO MO MO	65441 65453 63080 65535
Mike Norr	Siggins Deleo	Village of Leasburg Village of West Sullivan Crawford Electric Cooperative	P.O. Box 95 P.O. Box 765 P.O. Box 10 P.O. Box 531	Leasburg Sullivan Bourbon Cuba	MO MO MO MO	63080 65441 65453

Mark	Falloon	City of Sullivan	210 W. Washington St.	Sullivan	MO	63080
Doug	Lasley	Cuba Chamber of Commerce	P.O. Box 405	Cuba	MO	65453
Liz	Bennett	Steelville Chamber of Commerce	P.O. Box 956	Steelville	MO	65565
Tim	Petersen	Sullivan Chamber of Commerce	#2 W. Springfield	Sullivan	MO	63080

3/22/10

Attention Members of the Crawford County Hazard Mitigation Planning Committee and neighboring jurisdictions:

The final draft of the Crawford County Hazard Mitigation Plan is now available for review on the City of Sullivan website – <http://sullivan.mo.us>. Hard copies of the draft document are being mailed to each Crawford County city hall and the courthouse for public viewing as well. Please take some time to review the planning document, especially sections that have specifics regarding your jurisdiction. We have submitted a draft to SEMA for review, but they are allowing us some time for public input. Please notify me no later than April 6, 2010 with any recommended changes or corrections. Crawford County jurisdictions will still have another opportunity to review and adopt the plan after it has been approved by FEMA. Contact Tammy Snodgrass at (573) 265-2993 or via email at tsnodgrass@meramecregion.org.

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Oak Hill R-I
6200 Hwy 19 South
Salem, MO 65560

Superintendent Kevin Prugh
Green Forest R-II
6111 Hwy F
Salem, MO 65560

Superintendent Johnnie Brown
Dent-Phelps R-III
27870 Hwy C
Salem, MO 65560

Mayor Dana Pratt
Annapolis City Hall
204 School Street
Annapolis, MO 63620

City Clerk Sandy May
Annapolis City Hall
204 School Street
Annapolis, MO 63620

Mayor Roy Carr
Arcadia City Hall
PO Box 86
Arcadia, MO 63621

City Clerk Lisa Light
Arcadia City Hall
PO Box 86
Arcadia, MO 63621

Mayor Bob Halket
Ironton City Hall
123 North Main Street
Ironton, MO 63650

City Clerk Pat Baughman
Ironton City Hall
123 North Main Street
Ironton, MO 63650

Mayor Shelby Chan
Pilot Knob City Hall
PO Box 188
Pilot Knob, MO 63663

Clerk Cathy Bremer
Bourbon City Hall
P. O. Box 164
Bourbon, MO 65441

Mayor Leonard Armstrong
Bourbon City Hall
P. O. Box 164
Bourbon, MO 65441

Superintendent Thomas Sharp
Crawford Co. R-I School District
P.O. Box 40
Bourbon, MO 65441

Clerk Christine Nash
Cuba City Hall
PO Box K
Cuba, MO 65453

Mayor Kenny Killeen
Cuba City Hall
PO Box K
Cuba, MO 65453

Superintendent Mr. Waymon W. Boast
Crawford Co. R-II School District
#1 Wildcat Pride Dr.
Cuba, MO 65453

Chairman Kathy Byrd
Village of Leasburg
PO Box 95
Leasburg, MO 65535

Clerk Nicky Phillips
Village of Leasburg
PO Box 95
Leasburg, MO 65535

County Clerk Connie Smith
Crawford County Courthouse
PO Box AS
Steelville, MO 65565

Presiding Commissioner Ed Worley
Crawford County Courthouse
PO Box AS
Steelville, MO 65565

Superintendent Mr. Harvey Richards
Steelville R-III District
P.O. Box 339
Steelville, MO 65565

Clerk/Collector Sheila Anderson
Steelville City Hall
PO Box M
Steelville, MO 65565

Mayor Terry Palmer
Steelville City Hall
PO Box M
Steelville, MO 65565

Mr. Robert Hathman
CRAWFORD CO PWSD #1
539 Sappington Bridge Road
Sullivan, MO 63080

Superintendent Dr. Mickie Shank
Sullivan C-2
138 Taylor St.
Sullivan, MO 63080

Mayor J.T. Hardy
Sullivan City Hall
210 W. Washington
Sullivan, MO 63080

Clerk Jan Koch
Sullivan City Hall
210 W. Washington
Sullivan, MO 63080

Mr. Duane Cartwright
InterCounty Electric
PO Box 209
Licking, MO 65542

Mr. Dan Blesi
Crawford Electric Coop
PO Box 10
Bourbon, MO 65441

Presiding Comm Edward Hillhouse
Franklin County Courthouse
400 East Locust
Union, MO 63084

County Clerk Debbie Door
Franklin County Courthouse
400 East Locust
Union, MO 63084

Mayor Terry Black
City of Berger
404 Rosalie
Berger, MO 63014

Clerk LaVerne Sprick
City of Berger
404 Rosalie
Berger, MO 63014

Mayor Otis Schulte
Gerald City Hall
PO Box 59
Gerald, MO 63037

Clerk Sarah Wheeler
Gerald City Hall
PO Box 59
Gerald, MO 63037

Mayor George Panhorst
City of New Haven
PO Box 236
New Haven, MO 63068

Clerk Carolyn Scheer
City of New Haven
PO Box 236
New Haven, MO 63068

Chairman Ken Hayes
Village of Oak Grove
260 James St.
Sullivan, MO 63080

Clerk Denise Revelle
Village of Oak Grove
260 James St.
Sullivan, MO 63080

Mayor Herbert Adams
City of Pacific
300 Hoven Drive
Pacific, MO 63069

Clerk Kim Barfield
City of Pacific
300 Hoven Drive
Pacific, MO 63069

Mayor Ron Blum
City of St. Clair
#1 Paul Parks Drive
St. Clair, MO 63077

Clerk Chris Fawe
City of St. Clair
#1 Paul Parks Drive
St. Clair, MO 63077

Mayor Mike Livengood
City of Union
500 E. Locust
Union, MO 63084

Clerk Jonita Copeland
City of Union
500 E. Locust
Union, MO 63084

Mayor Richard Stratman
City of Washington
405 Jefferson Street
Washington, MO 63090

Clerk Brenda Mitchell
City of Washington
405 Jefferson Street
Washington, MO 63090

Superintendent Mr. Kyle Kruse
New Haven School District
100 Park Drive
New Haven, MO 63068

Superintendent Mr. Randy George
Meramec Valley R-III School District
126 N. Payne St.
Pacific, MO 63069

Superintendent Dr. Michael Murphy
St. Clair R-XIII School District
905 Bardot Street
St. Clair, MO 63077

Superintendent Dr. Veann Tilson
Union R-XI School District
PO Box 440
Union, MO 63084

Superintendent Dr. Lori VanLeer
Washington School District
220 Locust Street
Washington, MO 63090

Superintendent Ms. Carol Laboube
Franklin County R-II School District
3128 Hwy Y
New Haven, MO 63068

Superintendent Mr. Fred Vanbibber
Lonedell R-XIV School District
7466 Hwy FF
Lonedell, MO 63060

Superintendent Mrs. Joy Tucker
St. James School District
122 E. Scioto St.
St. James, MO 65559

Superintendent Mr. John Westerman
Newburg R-I
P.O. Box C
Newburg, MO 65550

Principal Mrs. Kay McMurtrey
Phelps R-III
17790 State Rt. M
Edgar Springs, MO 65462

Superintendent Dr. Jerry Giger
Rolla District 31
500A Forum Dr.
Rolla, MO 65401

Mayor Paul Smith
Doolittle City Hall
380 Eisenhower St.
Doolittle, MO 65401

Clerk Anne Wolfe
Doolittle City Hall
380 Eisenhower St.
Doolittle, MO 65401

Clerk Dennis Hale
Edgar Springs City Hall
PO Box 13
Edgar Springs, MO 65462

Mayor Pro-Tem Kurt Ross
Edgar Springs City Hall
PO Box 13
Edgar Springs, MO 65462

Clerk Phyllis Harris
Newburg City Hall
PO Drawer K
Newburg, MO 65550

Mayor Andrew Mattison
Newburg City Hall
PO Drawer K
Newburg, MO 65550

County Clerk Carol Bennett
Phelps County Courthouse
200 N. Main
Rolla, MO 65401

Clerk Carol Daniels
Rolla City Hall
PO Box 979
Rolla, MO 65402

Mayor William Jenks, III
Rolla City Hall
PO Box 979
Rolla, MO 65402

Presiding Commissioner Randy Verkamp
Phelps County Courthouse
200 N. Main
Rolla, MO 65401

ROBERT HAMLIN
PHELPS CO PWSD #1
PO Box 277
Edgar Springs, MO 65462

City Clerk Tami Bowers
Pilot Knob City Hall
PO Box 188
Pilot Knob, MO 63663

Mayor Len King
Viburnum City Hall
PO Box 596
Viburnum, MO 65566

City Clerk Dana Mayberry
Viburnum City Hall
PO Box 596
Viburnum, MO 65566

Presiding Commissioner Terry Nichols
Iron County Court House
PO Box 42
Ironton, MO 63650

County Clerk Virginia Queen
Iron County Court House
PO Box 42
Ironton, MO 63650

Superintendent Dr. Clifford Carver
Arcadia Valley R-II
750 Park Drive
Ironton, MO 63650

Superintendent Mr. Lawrence Naeger
Bellevue R-III
27431 Hwy 32
Bellevue, MO 63623

Superintendent Mr. Doug Ruck
Iron County C-4
Hwy 49 #35
Viburnum, MO 65566

Superintendent Mr. Donald Wakefield
South Iron County R-I
210 School Street
Annapolis, MO 63620

Advisory Committee Meetings

NOTICE OF OPEN MEETING

Date and time of posting: **May 7, 4:00 p.m.**

Notice is hereby given that the **Crawford County Hazard Mitigation Advisory Committee** will meet at **10:00 a.m.** on **Monday, May 11, 2009** at the Crawford County Courthouse located at 103 South Second Street in Steelville, MO.

The tentative agenda of this meeting includes:

- **Welcome**
- **Review of Action Items**
- **Review of Current Crawford County Hazard Mitigation Plan**
- **Discussion of Goals and Objectives and Progress Made in Five Years**
- **Discussion of Possible Changes to Goals and Objectives**
- **Set Date and Time for Next Meeting**
- **Adjournment**

Representatives of the news media may obtain copies of this notice by contacting:

Tonya Price or Tammy Snodgrass
#4 Industrial Drive
St. James, MO 65559
573-265-2993

If you require any accommodations (i.e. qualified interpreter, large print, hearing assistance) in order to attend this meeting, please notify this office at 573-265-2993 no later than 48 hours prior to the scheduled commencement of the meeting.

**Advisory Committee Meeting
Crawford County Hazard Mitigation Plan Update**

AGENDA

10:00 a.m. ~ May 11, 2009

Crawford County Courthouse

- I. Welcome and Introductions –Tammy Snodgrass/Tonya Price**

- II. Review of Action Items**
MRPC staff will go over what SEMA and FEMA are requiring in the plan updates and what deadlines are in effect.

- III. Review of Current Crawford County Hazard Mitigation Plan**
Staff will provide a review of the existing hazard mitigation plan and provide copies of the Capabilities Section and Mitigation Program Section

- IV. Discussion of Goals and Objectives and Progress Made in Five Years**
Staff will lead the discussion on what actions have been taken over the past five years on hazard mitigation projects/programs.

- V. Discussion of Possible Changes to Goals and Objectives for Next Five Years**

- VI. Setting of Date and Time for Next Meeting**

- VII. Adjourn**

Hazard Mitigation Plan Review Meeting
Crawford County
May 11, 2009
10:00 a.m.

Name	Business	Email Address	Phone #
1. Tom Murray	CITY OF STEELVILLE		(573) 775-2820
2. Kevin Halbert	City of Sullivan	spdl30@fidmail.com	573 468-8001
3. LESTER MURDOCK	CITY OF CUBA	L.MURDOCK@FIDNET.MO 573 885 7432 LBHURDOC@CHARTER.NET	573 205 0091
4. Tammy Snodgrass	MRPC staff		
5. Amy England	Steelville Star		573-775-5181
6. Connie Smith	Crawford County		573-775-2376
7. Ed Wotley	Crawford County		573-775-3539
8. Richard Martin	Crawford County		573 775-2552
9. Charles Will	Crawford EMD/EM/		573-775-4511 Crawco@misa.com
10.			
11.			
12.			
13.			
14.			

The Crawford County Hazard Mitigation Committee held an initial meeting last week to begin reviewing the current plan. This plan was written five years ago and it is time to revise and update that plan. A second meeting has been scheduled for **Monday, June 1, 2009 at 10:00** to continue the review process.

The document is available for you to download and review at, www.meramecregion.org/pages/downloads

Thank you for your time in reviewing the document as this is a county wide plan and anyone who may want to apply for Hazard Mitigation Grant funds must be included in the process and adopt the plan for their business or organization.

If you have any questions, comments or concerns, please feel free to contact us at 573-265-2993. You may also email changes to tprice@meramecregion.org.

Thank you for your assistance, Tammy Snodgrass and Tonya Price.

NOTICE OF OPEN MEETING

Date and time of posting 2:30, May 27, 2009

Notice is hereby given that the Crawford Co. Hazard Mitigation Advisory Committee

will conduct a meeting at 10:00 a.m. Tuesday, June 1, , 2009

at Crawford County Courthouse, 103 S. 2nd St., Steelville, MO

The tentative agende of this meeting includes:

Welcome & Introductions; Review of Action Items; Review of Current Crawford Co. Hazard Mitigation Plan; Discussion of Goals and Objectives; Progress Made in Five Years; Discussion of Possible Changes to Goals and Objectives for next Five Years; Adjourn.

Representatives of the news media may obtain copies of this notice by contacting:

Name: Tonya Price or Tammy Snodgrass at MRPC

Address: 4 Industrial Drive, St. James, MO 65559

Telephone: 573-265-2993

If you require any accommodation (i.e. qualified interpreter, large print, hearing assistance) in order to attend this meeting please notify this office at (573) 265-2993 no later than forty-eight (48) hours prior to the scheduled commencement of this meeting.

**Advisory Committee Meeting
Crawford County Hazard Mitigation Plan Update**

AGENDA

10:00 a.m. ~ June 1, 2009

Crawford County Courthouse

I. Welcome and Introductions –Tammy Snodgrass/Tonya Price

II. Review of Action Items

MRPC staff will go over the action items established in the plan and ask attendees to consider whether action items can remain the same, determine whether some have been completed and can be removed and determine if some action items are no longer applicable and can be removed.

III. Review of Current Crawford County Hazard Mitigation Plan

Staff will provide a review of the existing hazard mitigation plan and provide copies of sections that need to be reviewed and updated.

IV. Discussion of Goals and Objectives and Progress Made in Five Years

Staff will lead the discussion on what actions have been taken over the past five years on hazard mitigation projects/programs.

V. Discussion of Possible Changes to Goals and Objectives for Next Five Years

VI. Adjourn

Sign-In Sheet June 1, 2009

<u>Name</u>	<u>Organization</u>	<u>Phone</u>	<u>Email</u>
Kelin Albert-LESTER HURDORF	City of Sullivan CITY OF CUBA	573-466-8001 573-725-0091	spk150@Fidnet.com L.HURDORF@FIDNET.COM LB.HURDORF@CHARTER.NET
John Hewkin	County Commission	573-725-3539	Hewkin01@Fidnet.com
Ed Worley	Co. Comm	573-775-3539	
Richard Martin	Co. Comm	573-775-2552	
Charles Witt	CRAWFORD 91/EMD	573-775-4911	CRAWCO@MISN.COM
Connie Smith	Crawford County	573-775-2376	Coellk@misn.com or conrad@fidnet.com
Marik Kadow	MRPC		
Tony Price	MRPC		

Public Notices



A Council of Local Governments
Serving the Meramec Area

MERAMEC REGIONAL PLANNING COMMISSION

4 Industrial Drive
St. James, MO 65559-1689
(573) 265-2993
FAX (573) 265-3550

MEMORANDUM

TO: Crawford County Courthouse and City Halls of Crawford County Cities

FROM: Tammy Snodgrass, Environmental Programs Manager, MRPC

DATE: March 22, 2010

RE: Crawford County Multi-Jurisdictional Hazard Mitigation Plan

Enclosed please find a draft copy of the Crawford County Multi-Jurisdictional Hazard Mitigation Plan. MRPC has been working with volunteers from Crawford County to update the County's plan. The original plan was completed and approved in 2005. In the course of the update we have reformatted the plan and added a considerable amount of information.

Please make this draft document available for public viewing through April 6, 2010. It is also available on-line through the City of Sullivan's webpage - <http://sullivan.mo.us/>. I would also ask that local officials review the document to make sure that all the information pertaining to your jurisdiction is accurate. We are also submitting the draft plan to the State Emergency Management Agency (SEMA) for their review and approval. Once the plan has been reviewed and approved by both SEMA and FEMA, you will have the opportunity to review it again and formally adopt the plan.

Thank you for your assistance and please let me know if you have any questions or changes that need to be made to the planning document. I can be reached at (573) 265-2993 or tsnodgrass@meramecregion.org.

TS

Enclosure

Chairman: Laura Antolak
At-Large Representative for Small Business

Vice Chairman: Russell Scheulen
Presiding Commissioner, Osage County

www.missourimeramecregion.org

Secretary: Gary Brown
Mayor, City of Salem

Treasurer: Theresa Cook
Alderman, City of St. Robert

Executive Director: Richard Cavender

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A Council of Local Governments
Serving the Meramec Area

MERAMEC REGIONAL PLANNING COMMISSION

4 Industrial Drive
St. James, MO 65559-1689
(573) 265-2993
FAX (573) 265-3550

March 23, 2010

FOR IMMEDIATE RELEASE: BONNIE PRIGGE OR TAMMY SNODGRASS,
MRPC, 573-265-2993

DRAFT OF CRAWFORD COUNTY
HAZARD MITIGATION PLAN UPDATE AVAILABLE FOR PUBLIC REVIEW

The draft update of the Crawford County Hazard Mitigation Plan is now available on the web for public review. Meramec Regional Planning Commission, in partnership with Crawford County, has been updating the 2005 plan. Public meetings were held with city and county officials, school leaders, emergency management agencies and interested individuals.

Persons wishing to review the draft plan may access it on the city of Sullivan's website at <http://sullivan.mo.us>.

Paper copies of the plan will be available for review at the Crawford County Courthouse and at city halls within the county.

Deadline for comments and suggestions is April 6, 2010.

The county must have an approved hazard mitigation plan in order for Crawford County schools, cities, agencies and others to access state hazard mitigation grant funds. The plan includes an assessment of natural hazards, showcases past accomplishments and sets goals and action items to reduce the impact of natural hazards in the future.

Comments may be submitted in writing to MRPC, Attn. Tammy Snodgrass, 4 Industrial Drive, St. James, MO. 65559, or by email at tsnodgrass@meramecregion.org

MRPC will submit the plan to the State Emergency Management Agency and the Federal Emergency Management Agency for final approval. For more information on the plan, contact Tammy Snodgrass at MRPC, 573-265-2993.

Chairman: Laura Antolak
At-Large Representative for Small Business

Vice Chairman: Russell Scheulen
Presiding Commissioner, Osage County

Executive Director: Richard Cavender

Secretary: Gary Brown
Mayor, City of Salem

Treasurer: Theresa Cook
Alderman, City of St. Robert

Resolutions

MEMORANDUM

TO: Crawford County School Districts, Electric Cooperatives, Water and Sewer Districts and other Public Entities

FROM: Tamara Snodgrass, Environmental Programs Manager, Meramec Regional Planning Commission

SUBJECT: Crawford County Hazard Mitigation Plan and future eligibility for Hazard Mitigation Program Grants

DATE: October 29, 2009

I am writing to make you aware of what is required of cities, school districts and other public entities in order to be considered part of the Crawford County Hazard Mitigation Plan and be eligible for future funding opportunities.

As many of you are aware, Crawford County and entities located within Crawford County have not been able to apply for various grant programs because the county did not have an approved Multi-Jurisdictional Hazard Mitigation Plan. This has been a problem for Crawford County in the past. Examples of eligible projects would be tornado safe rooms for school districts, burying power lines for electric cooperatives or purchasing generators for pump stations for rural water or sewer districts.

FEMA and SEMA now require that any public entity that wants to apply for hazard mitigation related grant funds must actively participate in the hazard mitigation planning process. Active participation means attending meetings, reviewing and commenting on the plan, providing data or assisting in prioritizing goals or projects. Not all entities have the time or staff to spend on the hazard mitigation planning process. There is an alternative that I want to make you aware of and encourage you to implement.

There is an option, called "authorized representative" where you can authorize the "Plan Author", Meramec Regional Planning Commission, to prepare the plan on your organization's behalf. If you want to do this, you will need to adopt a resolution doing so and send a copy to Meramec Regional Planning Commission. A copy of a sample resolution is attached.

I will continue to keep you informed of progress on the plan. When the plan has been approved by both SEMA and FEMA, you will still be required to adopt the plan and submit a resolution of adoption at that time.

I strongly encourage you to consider adopting a resolution for authorized representation in order to insure that you will be recognized by SEMA and FEMA as part of the county plan. If you choose to take this option, please provide Meramec Regional Planning Commission with a copy of a signed resolution **before Friday, November 20, 2009**. I hope to submit the plan for review by Monday, November 30, 2009 and I must have your resolution included in the plan before the date of submittal.

If you have any questions or concerns, please do not hesitate to contact myself or Lisa Warnke at (573) 265-2993 or by email at tsnodgrass@meramecregion.org or lwarnke@meramecregion.org.

Sincerely,

Lisa M. Warnke
Meramec Regional Planning Commission
#4 Industrial Drive
St. James, MO 65559
Phone: 1-573-265-2993
Fax: 1-573-265-3550
lwarnke@meramecregion.org

SAMPLE RESOLUTION

Resolution for Authorized Representation

Resolution # _____

Name of Jurisdiction: **Town A or School District**

Governing Body: **City Council or School Board**

Address: **Street, City, Zip Code**

Whereas, Town A or School District has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission is able to act on behalf of Town A or School District in the analysis and development of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

Whereas, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

Now therefore be it resolved, Town A or City Council authorizes Meramec Regional Planning Commission on behalf of Town A or City Council to prepare the County B Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered by adoption by Town A City Council or School District Board upon completion.

Adopted this ____ day of _____, 20__ at the meeting of the City Council or School Board.

Authorizing Signature

Resolution for Authorized Representation

Resolution # _____

Name of Jurisdiction: _____

Governing Body: _____

Address: _____

Whereas, _____ has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission is able to act on behalf of _____ in the analysis and development of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

Whereas, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

Now therefore be it resolved, _____ authorizes Meramec Regional Planning Commission on behalf of _____ to prepare the _____ which shall be reviewed and considered by adoption by _____ upon completion.

Adopted this ____ day of _____, 20__ at the meeting of the _____.

Authorizing Signature

Resolution for Authorized Representation
Resolution # 3-11-10

Name of Jurisdiction: Public Water Supply District #1 of Crawford County

Governing Body: Board of Directors

Address: PO Box 807, Sullivan, MO 63080

Whereas, PWSD #1 has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission is able to act on behalf of PWSD #1 in the analysis and development of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

Whereas, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

Now therefore be it resolved, Board of Directors authorizes Meramec Regional Planning Commission on behalf of PWSD #1 to prepare the County B Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered by adoption by PWSD #1 upon completion.

Adopted this 11th day of March, 2010 at the meeting of the PWSD #1 Board of Directors.

Ervin Dierking

Authorizing Signature



VILLAGE OF LEASBURG, MISSOURI

Resolution for Authorized Representation

Resolution # 51

Name of Jurisdiction: Village of Leasburg, Crawford County, Missouri

Governing Body: Village of Leasburg, Board of Trustees

Address: Village Hall, P.O. Box 95, Leasburg, MO 65535

Whereas, the Village of Leasburg, Missouri has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

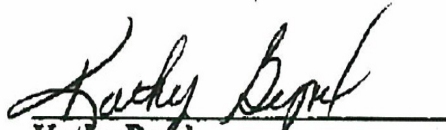
Whereas, Meramec Regional Planning Commission is able to act on behalf of the Village of Leasburg, Missouri in the analysis and development of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

Whereas, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

Now therefore be it resolved, the Village of Leasburg, Missouri authorizes Meramec Regional Planning Commission on behalf of the Village of Leasburg, Missouri to prepare the County B Multi-Jurisdictional Hazard Mitigation Plan, which shall be reviewed and considered by adoption by the Village of Leasburg, Missouri upon completion.

Adopted by majority vote of a quorum this 16th day of February, 2010 at the meeting of the Village of Leasburg, Board of Trustees.



Kathy Byrd

Chairperson of the Board of Trustees

Town of West Sullivan

Resolution for Authorized Representation

Resolution # 10-04

Name of Jurisdiction: Town of West Sullivan ("Town")

Governing Body: Board of Trustees ("Board")

Address: P.O. Box 765, Sullivan, MO 63080

WHEREAS, the Town has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

WHEREAS, Meramec Regional Planning Commission is able to act on behalf of Town in the analysis and development of a hazard mitigation plan; and

WHEREAS, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

WHEREAS, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

NOW THEREFORE BE IT RESOLVED, the Board authorizes Meramec Regional Planning Commission on behalf of Town to prepare the County B Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered by adoption by Town upon completion.

Adopted this 18th day of February, 2010 at a meeting of the Board.

Attest: Denise Revelle
Denise Revelle
Clerk

James Turntine
James Turntine
Chairman

Approved this 18 day of February, 2010.

Resolution for Authorized Representation
Resolution # 2010-1

Name of Jurisdiction: Steelville R-III School District

Governing Body: Steelville R-III School District

Address: 817 W Main St., Steelville, MO

65565

Whereas, Steelville R-III School District has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission is able to act on behalf of Steelville R-III School District in the analysis and development of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

Whereas, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

Now therefore be it resolved, Steelville R-III School Board authorizes Meramec Regional Planning Commission on behalf of Steelville R-III School District to prepare the Crawford County Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered by adoption by Steelville R-III School District Board upon completion.

Adopted this 8th day of February, 2010 at the meeting of the Steelville R-III School Board.



Authorized Signature

RESOLUTION NO. _____

**A RESOLUTION OF SUPPORT AND PARTICIPATION IN
THE ALL-HAZARD MITIGATION PLAN UPDATE.**

WHEREAS, the (Name of School District) Sullivan School Dist. recognizes that no community is immune from natural hazards whether it be flooding, severe weather, tornadoes, winter storms, earthquakes or wild fires, and recognize the importance to students and employees of enhancing its ability to resist natural hazards, and the importance of reducing the human suffering, property damage, interruption of public services and economic losses caused by those hazards; and,

WHEREAS, the (Name of School District) Sullivan School Dist. may have previously pursued mitigation measures such as tornado safe rooms, building codes, fire codes, floodplain management practices, building design considerations, and storm water management regulations to minimize the impact of natural hazards; and

WHEREAS, by participating in the *All-Hazard Mitigation Plan Update*, the (Name of School District) Sullivan School Dist. will be eligible to apply for pre-disaster mitigation grants and funds; and,

WHEREAS, the Federal Emergency Management Agency and the State Emergency Management Agency have developed All-Hazard plan programs that assist communities in their efforts to become disaster resistant communities; and,

WHEREAS, the (Name of School District) Sullivan School Dist. desires to work towards becoming a disaster resistant school district; and,

WHEREAS, the (Name of School District) Sullivan School Dist. intends to make a good faith effort in implementing mitigation projects or programs by incorporation into other campus planning opportunities where appropriate; and,

NOW, THEREFORE BE IT RESOLVED THAT:

The (Name of School District) Sullivan School District will use its best efforts to become a disaster-resistant community by participating in the All Hazard Plan and hazard identification and risk assessment to implement practices that can reduce vulnerability for students, staff and property.

Title/Name Marsha Dineen Date 8/24/09

Title/Name Sandra M. Coppock Date 8/24/09

RESOLUTION FOR AUTHORIZED REPRESENTATION

RESOLUTION #1109

**CITY OF BOURBON
BOARD OF ALDERMEN
P. O. BOX 164
BOURBON, MO 65441**

WHEREAS, the City of Bourbon has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

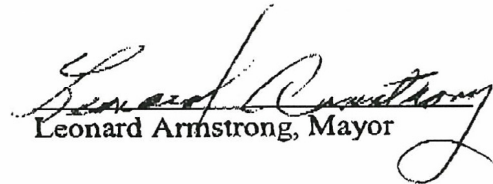
WHEREAS, Meramec Regional Planning Commission is able to act on behalf of the City of Bourbon, Missouri, in the analysis and development of a hazard mitigation plan; and

WHEREAS, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

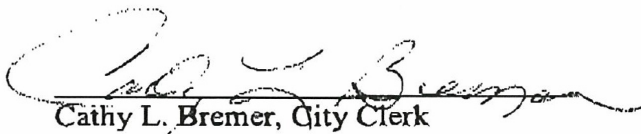
WHEREAS, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

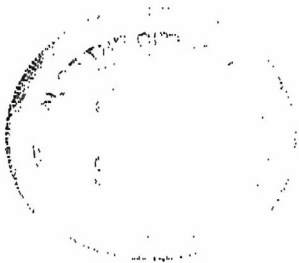
NOW THEREFORE, BE IT RESOLVED, The City of Bourbon, Missouri authorizes Meramec Regional Planning Commission on behalf of the City of Bourbon, Missouri, to prepare the Crawford County Multi-Jurisdictional Hazard Mitigation Plan, which shall be reviewed and considered by adoption by the City of Bourbon, Missouri, upon completion.

Adopted this 17 day of November, 2009 at the meeting of the Board of Aldermen.


Leonard Armstrong, Mayor

ATTEST:


Cathy L. Bremer, City Clerk



Resolution for Authorized Representation

Name of Jurisdiction: CRAWFORD COUNTY R-I SCHOOLS, #028-101

Governing Body: BOARD OF EDUCATION

Address: 1444 OLD HIGHWAY 66, BOURBON, MISSOURI 65441

Whereas, Crawford County R-I Schools has limited capacity to undertake extensive participation in the preparation of a hazard mitigation plan; and

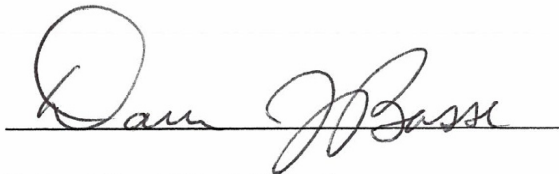
Whereas, Meramec Regional Planning Commission is able to act on behalf of Crawford County R-I Schools in the analysis and development of a hazard mitigation plan; and

Whereas, Meramec Regional Planning Commission shall prepare a hazard mitigation plan in accordance with 44 FEMA requirements at 44 CFR 201.6; and

Whereas, Meramec Regional Planning Commission shall make available a draft copy of the Plan for public comment as well as the governing body's comment during the planning process and prior to adoption.

Now therefore be it resolved, the Board of Education of Crawford County R-I Schools authorizes Meramec Regional Planning Commission on behalf of Crawford County R-I Schools to prepare the County B Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered for adoption by the Board of Education of Crawford County R-I Schools upon completion.

Adopted this 19th day of November, 2009, at the regular meeting of the Board of Education of Crawford County R-I Schools.



Board President Signature



Board Secretary Signature

Appendix B

References

**Repetitive Loss Properties
Crawford County, MO**

Community Name	Community Number	Mitigated?	Occupancy Type	Date of Loss	Date of Loss	Date of Loss
Crawford County	29075	No	Single-Family	04/05/2008	05/10/2002	07/26/1998
Crawford County	29075	No	Nonresidential	04/28/1994	04/11/1994	
Crawford County	29075	No	Nonresidential	04/30/1996	04/22/1996	
Crawford County	29075	No	Nonresidential	03/19/2008	07/26/1998	03/20/1998
Crawford County	29075	No	Nonresidential	07/25/1998	04/13/1994	

LIST OF ACRONYMS

ASM: Archaeological Survey of Missouri
BFE: Base Flood Elevation
BLM: Bureau of Land Management
CDBG: Community Development Block Grant
CEDS: Comprehensive Economic Development Strategy
CERI: Center for Earthquake Research and Information at the University of Memphis
CFR: Code of Federal Regulations
CPC: Climate Prediction Center
CRS: Community Rating System
DMA 2000: Disaster Mitigation Act of 2000
EDA: Economic Development Administration
EPA: Environmental Protection Agency
FEMA: Federal Emergency Management Agency
FIRM: Flood Insurance Rate Map
FMA: Flood Mitigation Assistance (FEMA Program)
FTE: Full Time Equivalent
GIS: Geographic Information System
HMGP: Hazard Mitigation Grant Program
HMST: Hazard Mitigation Survey Team
HUD: Housing and Urban Development (United States, Department of)
ICC: Increased Cost of Compliance
LMI: Labor Market Information
MACOG: Missouri Association of Councils of Governments
MCC: Midwestern Climate Center
MoDOT: Missouri Department of Transportation
MPA: Missouri Press Association
NAWQA: National Water Quality Assessment Program
NCDC: National Climate Data Center
NEHRP: National Earthquake Hazards Reduction Program
NFIP: National Flood Insurance Program
NFPA: National Fire Protection Association
NHMP: Natural Hazard Mitigation Plan
NIBS: National Institute of Building Sciences
NIFC: National Interagency Fire Center
NOAA: National Oceanic and Atmospheric Administration
NRHP: National Register of Historic Places
NRCS: Natural Resources Conservation Service
NWS: National Weather Service
PDM: Pre-Disaster Mitigation Program
PDSI: Palmer Drought Severity Index
SBA: Small Business Administration
SEMA: Missouri State Emergency Management Agency
SHMO: State Hazard Mitigation Officer
SPC: Storm Prediction Center
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USFA: United States Fire Administration
USFS: United States Forest Service
USFWS: United States Fish and Wildlife Service
USGS: United States Geological Survey

BIBLIOGRAPHY

1. 1997 & 2002 Census of Agriculture, USDA, National Agriculture Statistics Service
2. 2000 Missouri Drought Plan
3. 2002 Census of Retail Trade, U.S. Department of Commerce
 - a. <http://www.census.gov/prod/ec02/ec0244amott>
4. BOCA. www.bocai.org
5. Comprehensive Economic Development strategy, Meramec Regional Planning Commission, 2007
6. Census 2000, U.S. Census Bureau. www.census.gov
7. Center for Earthquake Research and Information at the University of Memphis (CERI)
8. Central U.S. Seismic Map, November 1996,
 - a. <http://www2.semo.edu/ces/CES2.HTML>
 - b. <http://folkworm.ceri.memphis.edu/recenteqs/Quakes/nmhwb0219a.html>
 - c. <http://www.sws.uiuc.edu/html/WxFAQ5.htm>
9. City of Bourbon, MO website – <http://www.bourbonmo.com>
10. City of Cuba, MO website – <http://www.cubamo.com>
11. City of Sullivan, MO website – <http://www.sullivanmo.com/index.php>
 - a. <http://www.sullivan.mo.us/>
12. Crawford County website – <http://www.crawfordcountymo.net/>
13. East Central Community College website – <http://www.eastcentral.edu/ecc/extcamp/SAC>
14. Federal Emergency Management Agency, <http://www.fema.gov/hazards/>
15. Hazardous Materials Response Plan, Meramec Regional Emergency Planning Committee, 2009
16. Kammer, William Ray, “The Meramec River: Then and Now” 3rd edition
17. Local Emergency Operations Plan
18. Midwestern Climate Center
19. Midwest Lakes Policy Center
 - a. <http://blog.midwestlakes.org>
20. Missouri Department of Conservation, “Missouri Animals of Conservation Concern”
21. Missouri Department of Conservation, “Missouri Plants of Conservation Concern”
22. Missouri Department of Conservation Atlas, 2003
23. Missouri Department of Elementary and Secondary Education
 - a. <http://dese.state.mo.us> <http://dese.mo.gov/directory>
24. Missouri Department of Health and Senior Services
 - a. <http://www.dhss.state.mo.us/showmelongtermcare>
 - b. <http://www.dhss.mo.gov/cgi-bin/nhomes2.pl?facid=15510>
 - c. <http://www.dhss.mo.gov/NursingHomes/ADC-licensed.pdf>
 - d. <http://ccregu.dhss.mo.gov/smcc/pnpCCSearch>
25. Missouri Department of Natural Resources, Water Resources Center
 - a. http://www.dnr.mo.gov/env/wrc/damsft/Crystal-Reports/crawford_dams.pdf
 - b. <http://www.dnr.mo.gov/env/wrc/springsandcaves.htm>
 - c. <http://www.dnr.state.mo.us/geology/wrp/WR69.pdf>
 - d. http://www.dnr.state.mo.us/geology/dir_ltr.htm
 - e. <http://www.dnr.state.mo.us/geology/damsft.bkgd.htm>
26. Missouri Department of Natural Resources, State Historic Preservation Office
 - a. <http://dnr.mo.gov/shpo/Crawford.htm>
27. Missouri Department of Natural Resources, Missouri Resources Magazine, Spring/Summer 2003 – Volume 20, Number 1, *That Sinking Feeling – A Void, A Collapse*, by Jim Van Dyke
28. Missouri Department of Transportation
29. Missouri State Government, Division of Budget & Planning
 - a. <http://www.oa.state.mo.us/bp/projections/scenario.html>
30. Missouri State Hazard Mitigation Plan, May 2007.
31. Missouri Veterans Commission

- a. <http://www.mvc.dps.mo.gov>
32. National Climate Data Center
 - a. <http://www4.ncdc.noaa.gov/cgiwin/wwcgi.dll?wwEvent~Storms>
33. National Disaster Education Coalition
 - a. <http://www.disastercenter.com/missouri>
 - b. <http://www.disastercenter.com/guide>
 - c. <http://www.disastercenter.com/missouri/heat.html>
 - d. <http://www.disastercenter.com/missouri/tornado.html>
 - e. <http://www.disastercenter.com/guide/thunder.html>
 - f. <http://www.disastercenter.com/guide/tornado.html>
34. National Drought Mitigation Center
 - a. www.drought.unl.edu/whatis/concept.htm
35. National Flood Insurance Program Community Status Report
36. National Oceanic and Atmospheric Administration (NOAA)
 - a. <http://www.nws.noaa.gov/om/windchill>
 - b. <http://www.crh.noaa.gov/lx/event.php>
 - c. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>
37. National Register of Historic Places
 - a. www.nationalregisterofhistoricplaces.com
38. National Weather Service
 - a. <http://weather.noaa.gov/weather/hwave.html>
39. Ozark Rivers Solid Waste Management District Plan, revised 2004
40. Region I Homeland Security Oversight Committee and American Red Cross lists of shelters.
41. Sinkhole.org
 - a. <http://www.sinkhole.org/CommonSigns.php>
42. State Emergency Management Agency, "Missouri Hazard Analysis", August 1999
43. The Alert. Spring 2006. "After the Deluge...What's Ahead for Taum Sauk?" by Dan Sherburne.
44. United States Army Corps of Engineers,
 - a. <http://www.mvs.usace.army.mil/>
45. United States Geological Survey
 - a. <http://neic.usgs.gov/neis/general/handouts/mercalli.html>
 - b. http://neic.usgs.gov/neis/states/missouri/missouri_history.html
46. United States Geological Survey Fact Sheet FS-027-96
 - a. <http://neic.usgs.gov/neis/general/handouts/mercalli.html>
 - b. http://neic.usgs.gov/neis/states/missouri/missouri_history.html
47. United States Geological Survey Fact Sheet 131-02. October 2002
48. United States Geological Survey Fact Sheet 2005-3156
49. United States Geological Survey. Damage Evaluation of the Taum Sauk Reservoir Failure using LiDAR.
 - a. http://mcgsc.usgs.gov/publications/t_sauk_failure.pdf
50. United States Geological Survey, Landslide Hazard Program, Landslides 101
 - a. <http://landslides.usgs.gov/learning/l101.php>
 - b. <http://landslides.usgs.gov/learning/prepare/?PHPSESSID=vdngtb7fu9n7rjflnkvqocbh55>
 - c. <http://ga.water.usgs.gov/edu/earthgwlandsubside.html>
51. United States Search and Rescue Task Force.
 - a. <http://www.ussartf.org/landslides.htm>

Appendix C
Adoption Resolutions

Appendix D

Federal/State Mitigation Programs, Activities and Initiatives



Building Disaster Resistant Communities



Hazard Mitigation Financial Resource Guide for Local Officials



**A Guide for Locating
Financial Assistance for
Hazard Mitigation & Ancillary Activities**

Missouri State Emergency Management Agency

Program / Activity	Type of Assistance	Agency & Contact
General Emergency Grants, Loans & Assistance	Pre/Post Disaster Mitigation, Relief, Recovery, Training, & Technical Assistance.	
Hazard Mitigation Grant Program	Grants to States and communities for implementing long-term hazard mitigation measures following a major disaster declaration.	Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193
Disaster Mitigation Planning and Technical Assistance	Technical and planning assistance for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces.	Department of Commerce (DOC), Economic Development Administration (EDA) (Note: May have grant funding): (800) 345-1222 EDA's Disaster Recovery Coordinator: (202) 482-6225 www.doc.gov/eda Missouri State Emergency Management Agency (SEMA) (Technical Assistance Only): Tel: (573) 526-9116 Fax: (573) 526-9193
Pre-Disaster Mitigation Project Impact, etc.	Funding and technical assistance to communities and States to implement a sustained pre-disaster mitigation program.	Missouri State Emergency Management Agency (SEMA) (Technical Assistance Only) Tel: (573) 526-9116 Fax: (573) 526-9193
Emergency Management / Mitigation Training	Training in disaster mitigation, preparedness, planning.	Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193
Post-Disaster Economic Recovery Grants and Assistance	Grant funding to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.	Department of Commerce (DOC) – Economic Development Administration (EDA) EDA Headquarters Disaster Recovery Coordinator: (202) 482-6225 Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146

<p>Physical Disaster Loans and Economic Injury Disaster Loans</p>	<p>Disaster loans to non-farm, private sector owners of disaster damaged property for uninsured losses. Loans can be increased by up to 20 percent for mitigation purposes.</p>	<p>Small Business Administration (SBA) National Headquarters Associate Administrator for Disaster Assistance: (202) 205-6734</p>
<p>Public Assistance Program (Infrastructure)</p>	<p>Grants to States and communities to repair damaged infrastructure and public facilities, and help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structure.</p>	<p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9112 Fax: (573) 526-9193 cmay@sema.state.mo.us</p>
<p>Public Infrastructure Grants (CDBG) Annual Competition – Public Facilities Annual Competition – Neighborhoods Annual Competition – Infrastructure Downtown Revitalization Emergencies</p>	<p><i>Public Facilities:</i> Grants for public improvement or facilities except work on general public office buildings, includes water facilities, flood and drainage facilities, fire protection facilities/equipment and bridges. <i>Neighborhoods:</i> Grants for housing and some public facilities. <i>Infrastructure:</i> Grants for storm sewers, drainage and land acquisitions. <i>Downtown Revitalization:</i> Grants for improving public infrastructure and facilities in a central business district. <i>Emergencies:</i> Grants for public improvement or facilities except work on general public office buildings, includes water facilities and solid waste disposal facilities.</p>	<p>Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146 Tel: (573) 751-3600 Fax: (573) 526-4157</p>

<p>Community Development Block Grant (CDBG) State Administered Program</p>	<p>Grants to States to develop viable communities (e.g., housing, a suitable living environment, expanded economic opportunities) in non-entitled areas, for low- and moderate-income persons.</p>	<p>US Department of Housing and Urban Development (HUD) State CDBG Program Manager Or State and Small Cities Division, Office of Block Grant Assistance, HUD Headquarters: (202) 708-3587</p> <p>Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146 Tel: (573) 751-3600 Fax: (573) 526-4157</p>
<p>Community Development Block Grant (CDBG) Entitlement Communities Program</p>	<p>Grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate-income persons.</p>	<p>HUD City and county applicants should call the Community Planning and Development staff of their appropriate HUD field office. As an alternative, they may call the Entitlement Communities Division, Office of Block Grant Assistance, HUD Headquarters: (202) 708-1577, 3587</p> <p>Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146</p>
<p>Disaster Recovery Initiative</p>	<p>Grants to fund gaps in available recovery assistance after disasters (including mitigation).</p>	<p>HUD Community Planning and Development Divisions in their respective HUD field offices or HUD Community Planning and Development: (202) 708-2605</p> <p>Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600</p>

<p>Public Housing Modernization Reserve for Disasters and Emergencies</p>	<p>Funding to public housing agencies for modernization needs resulting from natural disasters (including elevation, floodproofing, and retrofit).</p>	<p>HUD Director, Office of Capital Improvements: (202) 708-1640</p> <p>Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600</p>
<p>Indian Housing Assistance (Housing Improvement Program)</p>	<p>Project grants and technical assistance to substantially eliminate sub-standard Indian housing.</p>	<p>Department of Interior (DOI)-Bureau of Indian Affairs (BIA) Division of Housing Assistance, Office of Tribal Services: (202) 208-5427</p>
<p>Section 504 Loans for Housing</p>	<p>Repair loans, grants and technical assistance to very low-income senior homeowners living in rural areas to repair their homes and remove health and safety hazards.</p>	<p>US Department of Agriculture (USDA) – Rural Housing Service (RHS) Contact local RHS Field Office, or RHS Headquarters, Director, Single Family Housing Direct Loan Division: (202) 720-1474</p>
<p>Section 502 Loan and Guaranteed Loan Program</p>	<p>Provides loans, loan guarantees, and technical assistance to very low and low-income applicants to purchase, build, or rehabilitate a home in a rural area.</p>	<p>USDA-RHS Contact the Local RHS Field Office, or the Director, Single Family Housing Guaranteed Loan Division, RHS: (202) 720-1452</p>
<p>Farm Ownership Loans</p>	<p>Direct loans, guaranteed / insured loans, and technical assistance to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other necessary improvements.</p>	<p>USDA-FSA Director, Farm Programs Loan Making Division, FSA: (202) 720-1632</p> <p>Missouri Department of Agriculture (573) 751-4211</p>

<p>HOME Investments Partnerships Program</p>	<p>Grants to States, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.</p>	<p>HUD Community Planning and Development, Grant Programs, Office of Affordable Housing, HOME Investment Partnership Programs: (202) 708-2685 (202) 708 0614 extension 4594 1-800-998-9999</p> <p>Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600</p>
<p>Rural Development Assistance – Housing</p>	<p>Grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.</p>	<p>USDA-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Single Family Housing: (202) 720-3773 Multi Family Housing: (202) 720-5177 Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977</p>
<p>Rural Development Assistance -- Utilities</p>	<p>Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.</p>	<p>USDA-Rural Utilities Service (RUS) Program Support: (202) 720-1382</p> <p>Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977</p>
<p>Rural Development Assistance – Community Facility Direct Loans/Grants</p>	<p>Grants, loans, and technical assistance in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) facilities and equipment needs in primarily low-income rural areas.</p>	<p>USDA-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977</p>

<p>Rural Community Fire Protection</p>	<p>Grants for rural fire projects or assistance, including dry fire hydrants, equipment and training.</p>	<p>Missouri Department of Conservation (573) 751-4115 x-3111-Program Information (573) 346-2210-Applications, Program Information, & Grant Management www.conservation.state.mo.us/forest/</p>
<p>Section 108 Loan Guarantee Program</p>	<p>Loan guarantees to public entities for community and economic development (including mitigation measures).</p>	<p>HUD Community Planning and Development staff at appropriate HUD field office, or the Section 108 Office in HUD Headquarters: (202) 708-1871</p> <p>Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600</p>

<p><i>Floods/Flood Control Grants, Loans & Assistance</i></p>	<p>Floods/Flood Control Technical/Planning Assistance and Program Support.</p>	
<p>National Flood Insurance Program</p>	<p>Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements.</p>	<p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198 griedel@sema.state.mo.us</p>
<p>Flood Mitigation Assistance</p>	<p>Grants to States and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.</p> <p>Note: Requires flood mitigation plan to be developed by the community seeking grant funding.</p>	<p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193</p>
<p>Flood Control Planning Assistance</p>	<p>Technical and planning assistance for the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources.</p>	<p>Department of Defense (DOD) US Army Corps of Engineers (USACE) Contact the Floodplain Management Staff in the Appropriate USACE Regional Office N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156</p>

<p>Non-Structural Alternatives to Structural Rehabilitation of Damaged Flood Control Works</p>	<p>Direct planning and construction grants for non-structural alternatives to the structural rehabilitation of flood control works damaged in floods or coastal storms. \$9 million FY99</p>	<p>DOD-USACE Emergency Management contact in respective USACE field office: N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156</p>
<p>Floodplain Management Services</p>	<p>Technical and planning assistance at the local, regional, or national level needed to support effective floodplain management.</p>	<p>DOD-USACE (U.S. Army Corps of Engineers) N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156 Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193</p>
<p>Land Protection</p>	<p>Technical assistance for run-off retardation and soil erosion prevention to reduce hazards to life and property.</p>	<p>USDA-NRCS Applicants should contact the National NRCS office: (202) 720-4527</p>

<p>Stormwater Grant Program</p>	<p>Grants for planning and construction of stormwater facilities.</p> <ul style="list-style-type: none"> • Only 1st Class Counties, cities in 1st Class Counties, & St. Louis City eligible. • Funds based on population base. • County offices can approve/deny a city application (if population less than 25,000). <p>Missouri 1st Class Counties:</p> <table> <tr> <td>Boone</td> <td>Cole</td> <td></td> </tr> <tr> <td></td> <td>Jefferson</td> <td></td> </tr> <tr> <td>Buchanan</td> <td>Franklin</td> <td>Platte</td> </tr> <tr> <td>Camden</td> <td>Greene</td> <td>St.</td> </tr> <tr> <td>Charles</td> <td></td> <td></td> </tr> <tr> <td>Cape Girardeau</td> <td>Jackson</td> <td>St.</td> </tr> <tr> <td>Louis</td> <td></td> <td></td> </tr> <tr> <td>Clay</td> <td>Jasper</td> <td></td> </tr> </table>	Boone	Cole			Jefferson		Buchanan	Franklin	Platte	Camden	Greene	St.	Charles			Cape Girardeau	Jackson	St.	Louis			Clay	Jasper		<p>Missouri Department of Natural Resources (DNR) Stormwater Grant Program Tel: (573) 751-1302</p>
Boone	Cole																									
	Jefferson																									
Buchanan	Franklin	Platte																								
Camden	Greene	St.																								
Charles																										
Cape Girardeau	Jackson	St.																								
Louis																										
Clay	Jasper																									
<p>Dam Safety Programs</p>	<p>Technical assistance, training, and grants to help improve State dam safety programs.</p>	<p>Missouri Department of Natural Resources (DNR) Dam Safety Program Tel: (573) 368-2177 Fax: (573) 368-2111 1-800-334-6946 TDD: 1-800-379-2419E-mail: dams@mail.dnr.state.mo.us</p>																								

<p><i>Earthquake Grants, Loans & Assistance</i></p>	<p>Earthquake Mitigation, Relief, Recovery, Technical/Planning/Training Grant/Loan Assistance and Program Support.</p>	
<p>National Earthquake Hazard Reduction Program</p>	<p>Technical and planning assistance for activities associated with earthquake hazards mitigation.</p>	<p>FEMA, DOI-USGS Earthquake Program Coordinator: (703) 648-6785</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966 Egray01@mail.state.mo.us</p>
<p><i>Geological Survey Program</i></p>	<p>Acquire, maintain and manage basic geological data; identify and evaluate geological hazards. The Geological Survey Program assists Missourians, industry, and government in the wise use of the state's minerals, land, and water resources.</p>	<p>Department of Natural Resources Division of Geology and Land Survey Geological Survey Program (573) 368-2300 TDD: 1-800-379-2419 gspgeol@mail.dnr.state.mo.us</p>
<p>Other Earthquake Hazards Reduction Programs</p>	<p>Training, planning and technical assistance under grants to States or local jurisdictions.</p>	<p>DOI-USGS Earthquake Program Coordinator: (703) 648-6785</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966 Egray01@mail.state.mo.us</p>

<p><i>All-Hazard Mapping</i></p> <p><i>Grants, Loans & Assistance</i></p>	<p>All-Hazard Analysis & Mapping of Flood Plains, Watersheds, Earthquake Areas, At-Risk Populations Grant/Loan Assistance, Training, Technical Assistance and Program Support.</p>	
<p>National Flood Insurance Program: Flood Mapping;</p>	<p>Flood insurance rate maps and flood plain management maps for all NFIP communities;</p>	<p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198 griedel@sema.state.mo.us</p>
<p>National Flood Insurance Program: Technical Mapping Advisory Council</p>	<p>Technical guidance and advice to coordinate FEMA's map modernization efforts for the National Flood Insurance Program.</p>	<p>DOI-USGS USGS – National Mapping Division: (573) 308-3802</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198 griedel@sema.state.mo.us</p>
<p>National Digital Orthophoto Program</p>	<p>Develops topographic quadrangles for use in mapping of flood and other hazards.</p>	<p>DOI-USGS USGS – National Mapping Division: (573) 308-3802</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198 griedel@sema.state.mo.us</p>
<p>Stream Gaging and Flood Monitoring Network</p>	<p>Operation of a network of over 7,000 streamgaging stations that provide data on the flood characteristics of rivers.</p>	<p>DOE-USGS Chief, Office of Surface Water, (703) 648-5303</p>

<p>Mapping Standards Support</p>	<p>Expertise in mapping and digital data standards to support the National Flood Insurance Program.</p>	<p>DOI-USGS USGS – National Mapping Division: (573) 308-3802</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198 griedel@sema.state.mo.us</p>
<p>National Earthquake Hazards Reduction Program</p>	<p>Seismic mapping for U.S.</p>	<p>DOI-USGS Earthquake Program Coordinator: (703) 648-6785</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966</p> <p>Egray01@mail.state.mo.us</p>

<p><i>Ancillary Flood & Natural Resource Projects</i></p> <p><i>Grants, Loans & Assistance</i></p>	<p>Watershed Management, Clean Water, Conservation, Environmental, Forestry, Grant/Loan Assistance, Technical Aid, and Program Support</p>	
<p>Natural Resources Financial Assistance</p>	<p>DNR participates in a variety of financial and technical assistance programs that are available to Missouri communities.</p> <ul style="list-style-type: none"> • User Charge Analysis - Computer software assisted analysis of water and wastewater user charge systems. • Agriculture Loan Program - Loans to individual farmers for animal waste treatment facilities. • Cooperative Remonumentation Program - Contract with county commissions to remonument corners of the U.S. Public Land Survey System. • County Boundary Resurvey Program - Contract with county commissions to remonument county boundary lines where the location of the line is indefinite. • Geodetic Control Densification Project - Contract with county, city government and municipal utilities to establish horizontal and vertical control monuments used for mapping and the development of land survey information system. 	<p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443</p> <p>1-800-334-6946</p> <p>TDD: 1-800-379-2419</p> <p>E-mail: webmanager@mail.dnr.state.mo.us</p> <p>Technical Assistance Program (573) 526-6627</p> <p>Missouri Department of Agriculture (573) 751-2129</p> <p>State Surveyor (573) 368-2301</p> <p>State Surveyor (573) 368-2301</p>

	<ul style="list-style-type: none"> • Hazardous Substance Emergency Relief Loan Fund - Loans to political subdivisions or volunteer fire protection associations for reimbursement of actual costs incurred in responding to a hazardous substance emergency. • Local Government Reimbursement Program – Reimbursement up to \$25,000 for cost incurred in responding to a hazardous substance emergency. • Leaking Underground Storage Tank Cleanup Assistance - At eligible sites with pre-approved plans and costs, the Underground Storage Tank Fund can assist the responsible party with the cleanup costs. • Private Activity Bond Financing Issuance of tax-exempt and taxable revenue bonds for private and public companies for facilities and improvements with environmental and energy resource impacts. 	<p>State Surveyor (573) 368-2301</p> <p>Environmental Services Program (573) 526-3346</p> <p>U. S. EPA, Local Government Reimbursement Help Line 1-800-431-9209</p> <p>Hazardous Waste Management Program (573) 751-3176</p> <p>Environmental Improvement and Energy Resources Authority (573) 751-4919</p>
<p>Environmental Quality Incentives Program (EQIP)</p>	<p>Technical, educational, and limited financial assistance to encourage environmental enhancement.</p> <p>DNR Completed Audits, Cost-Share, Fees and Taxes, Financial Assurance Review, Grants, Loans, Non-Profit Reimbursement, State Revolving Fund (SRF), Vehicle Emissions Repair Assistance (VERA)</p>	<p>USDA-NRCS NRCS County Offices Or NRCS EQUIP Program Manager: (202) 720-1834 www.nrcs.usda.gov Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912 Fax: (573) 875-0913</p>

	<p>Air Pollution Control Program</p> <p>Air Pollution Control Sales Tax Exemptions, Vehicle Emissions Repair Assistance</p> <p>Environmental Services Program</p> <p>Hazardous Substance Emergency Relief Loan Fund</p> <p>Hazardous Waste Program</p> <p>Brownfield Pilot Projects, Fees and Taxes, Financial Assurance Review, Leaking Underground Storage Tank Cleanup Assistance, Natural Resources Damage Assessments, Petroleum Storage Tank Cleanup Assistance, Voluntary Cleanup Program Financial Incentives</p> <p>Public Drinking Water Program</p> <p>Rural Drinking Water Grant Program, State Revolving Fund (SRF Leveraged Loan Program</p> <p>Soil and Water Conservation Program</p> <p>Assistance to Districts, Cost- Share Grants, Cooperative Grants with the Missouri Department of Conservation, Loan Interest-Share, Research Grants, Special Area Land Treatment Program (SALT)</p> <p>Solid Waste Management Program</p>	<p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of Environmental Quality 1-800-334-6946 TDD: 1-800-379-2419 E-mail: tap@mail.dnr.state.mo.us</p>
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	<p>Completed District Audits, District Grants, District Administration Grants, Non-Profit Group Waste Tire Cleanup Cost Reimbursement Instruction Sheet, Financial Assurance Instruments, Waste Tire Grant information, Financial Assistance, Waste Reduction and Recycling Projects</p> <p>Technical Assistance Program</p> <p>Agricultural Assistance, Business Assistance, Government Assistance, On-site Assessment Team, Pollution Prevention, Small Business Assistance</p> <p>Water Pollution Control Program</p> <p>Nonpoint Source Minigrants, Nonpoint Source Animal Waste Treatment Facility Loan Program, Nonpoint Source Project Grants, State 40 Percent Construction Wastewater Grant Program, State Revolving Fund (SRF) Leveraged Load Program - Wastewater, Storm Water Grant and Loan Program, Water Pollution Equipment Sales Tax Exemption</p>	
<p>Clean Water Act Section 319 Grants</p>	<p>Grants to States to implement non-point source programs, including support for non-structural watershed resource restoration activities.</p>	<p>EPA Office of Water Chief, Non-Point Source Control Branch: (202) 260-7088, 7100</p> <p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443</p>

		Division of Environmental Quality Public Drinking Water Program 1-800-334-6946 TDD: 1-800-379-2419 E-mail: drinkingwater@mail.dnr.state.mo.us
Clean Water State Revolving Funds	Loans at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	EPA EPA Office of Water State Revolving Fund Branch Branch Chief: (202) 260-7359 A list of Regional Offices is available upon request
Wetlands Protection – Development Grants	Grants to support the development and enhancement of State and tribal wetlands protection programs.	US Environmental Protection Agency (EPA) EPA Wetlands Hotline: (800) 832-7828 Or EPA Headquarters, Office of Water Chief, Wetlands Strategies and State Programs: (202) 260-6045 Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443
Watershed Protection and Flood Prevention Program and Soil and Water Conservation Program	Technical and financial assistance for installing works of improvement to protect, develop, and utilize land or water resources in small watersheds under 250,000 acres.	USDA-NRCS Director, Watersheds and Wetlands Division: (202) 720-3042 (202) 690-4614 www.nrcs.usda.gov Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912 Fax: (573) 875-0913 Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of Environmental Quality Soil and Water Conservation Program 1-800-334-6946 TDD: 1-800-379-2419 E-mail: soils@mail.dnr.state.mo.us

<p>Watershed Surveys and Planning Small Watershed Protection Act (PL 566)</p>	<p>Surveys and planning studies for appraising water and related resources, and formulating alternative plans for conservation use and development. Grants and advisory/counseling services to assist w/planning and implementing improvement.</p>	<p>US Department of Agriculture (USDA) – National Resources Conservation Service (NRCS) Watersheds and Wetlands Division: (202) 720-4527 Deputy Chief for Programs: (202) 690-0848 www.nrcs.usda.gov Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912</p>
<p>Emergency Watershed Protection Program</p>	<p>Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events.</p>	<p>USDA – NRCS National Office – (202) 690-0848 Watersheds and Wetlands Division: (202) 720-3042</p>
<p>Wetlands Reserve Program</p>	<p>Financial and technical assistance to protect and restore wetlands through easements and restoration agreements.</p>	<p>USDA-NRCS National Policy Coordinator NRCS Watersheds and Wetlands Division: (202) 720-3042</p>
<p>Project Modifications for Improvement of the Environment</p>	<p>Provides for ecosystem restoration by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of an area.</p>	<p>DOD-USACE Chief of Planning @ appropriate USACE Regional Office N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156</p>

<p>Aquatic Ecosystem Restoration</p>	<p>Direct support for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.</p>	<p>DOD-USACE Chief of Planning @ appropriate USACE Regional Office</p> <p>(U.S. Army Corps of Engineers) N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156</p> <p>Streams for the Future Fisheries Division Missouri Department of Conservation (573) 751-4115</p>
<p>Water Resources Development Act or Challenge 21</p>	<p>Financial and technical assistance to prepare comprehensive plans for the development, use and conservation of water and related land resources.</p>	<p>DOD-USACE Chief of Planning @ appropriate USACE Regional Office</p> <p>(U.S. Army Corps of Engineers) N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156</p> <p>Streams for the Future Fisheries Division Missouri Department of Conservation (573) 751-4115</p>

Beneficial Uses of Dredged Materials	Direct assistance for projects that protect, restore, and create aquatic and ecologically-related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.	DOD-USACE Same as above
North American Wetland Conservation Fund	Cost-share grants to stimulate public/private partnerships for the protection, restoration and management of wetland habitats.	DOI-FWS North American Waterfowl and Wetlands Office: (703) 358-1784
Soil Survey	Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes.	USDA-NRCS NRCS – Deputy Chief for Soil Science and Resource Assessment: (202) 720-4630
Land Acquisition	Acquires or purchases easements on high-quality lands and waters for inclusion into the National Wildlife Refuge System.	DOI-FWS Division of Realty National Coordinator: (703) 358-1713
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Transfers title of certain inventory farm properties owned by FSA to Federal and State agencies for conservation purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential)	US Department of Agriculture (USDA) – Farm Service Agency (FSA) Farm Loan Programs National Office: (202) 720-3467, 1632
Federal Land Transfer / Federal Land to Parks Program	Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space.	DOI-NPS General Services Administration Offices Fort Worth, TX: (817) 334-2331 Boston, MA: (617) 835-5700 Or Federal Lands to Parks Leader NPS National Office: (202) 565-1184

Recreation and Parks Grants	Grants available to cities, counties and school districts to be used for outdoor recreation facilities and land acquisition.	Missouri Department of Natural Resources Division of Parks Tel: (573) 751-8560 Fax: (573) 526-4395
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	Department of Interior (DOI) – Fish and Wildlife Service (FWS) National Coordinator, Ecological Services: (703) 358-2201 A list of State and Regional contacts is available from the National Coordinator upon request.
<i>Tree Planting Program</i>	Grants for Planting Trees for improving Missouri’s erosion control, conservation, stream bank stabilization, etc.	Missouri Department of Conservation (573) 751-4115 x-3111-Program Information (573) 751-4115 x-3116-Applications, Program Information, & Grant Management www.conservation.state.mo.us/forest/
Conservation Contracts	Debt reduction for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.	USDA-FSA Farm Loan Programs FSA National Office: (202) 720-3467, 1632 or local FSA office
<i>Historic Preservation Fund Grants</i>	Federal matching grants, known as the Historic Preservation Fund (HPF), to assist the various states in carrying out historic preservation activities. Authorized by the National Historic Preservation Act of 1966. The program is sponsored by the Department of the Interior, National Park Service (NPS), and in Missouri, is administered through the Historic Preservation Program (HPP) of the Missouri Department of Natural Resources.	Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of State Parks Historic Preservation Program 1-800-334-6946 TDD: 1-800-379-2419 E-mail: mshpo@mail.dnr.state.mo.us
<i>The Foundation Directory</i>	Annual source of information about grants & loans from federal and private sources. Available for a fee.	The Foundation Directory (800) 424-9836 www.fconline.fdncenter.org/

<p>Federal Assistance Monitor</p>	<p>Published by CD Publications. Semi-monthly report on federal and private grants. Available for a fee.</p>	<p>CD Publications 8204 Fenton Street Silver Springs, MD 20910 Tel: (301) 588-6380 www.cdpublications.com/</p>
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<p><i>Basic & Applied Research/Development Grants, Loans & Assistance</i></p>	<p>Research and Educational Assistance Information, Grants/ Loans and Technical Assistance.</p>	
<p>Center for Integration of Natural Disaster Information</p>	<p>Technical Assistance: Develops and evaluates technology for information integration and dissemination</p>	<p>Department of Interior (DOI) – US Geological Survey (USGS) The Center for Integration of Natural Hazards Research: (703) 648-6059 hazinfo@usgs.gov</p>
<p>Hazard Reduction Program</p>	<p>Funding for research and related educational activities on hazards.</p>	<p>National Science Foundation (NSF), Directorate for Engineering, Division of Civil and Mechanical Systems, Hazard Reduction Program: (703) 306-1360</p>
<p>Decision, Risk, and Management Science Program</p>	<p>Funding for research and related educational activities on risk, perception, communication, and management (primarily technological hazards)</p>	<p>NSF – Directorate for Social, Behavioral and Economic Science, Division of Social Behavioral and Economic Research, Decision, Risk, and Management Science Program (DRMS): (703) 306-1757 www.nsf.gov/sbe/drms/start.htm</p>
<p>Societal Dimensions of Engineering, Science, and Technology Program</p>	<p>Funding for research and related educational activities on topics such as ethics, values, and the assessment, communication, management and perception of risk</p>	<p>NSF – Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of Engineering, Science and Technology Program: (703) 306-1743</p>
<p>National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences</p>	<p>Research into basic and applied earth and building sciences.</p>	<p>NSF – Directorate for Geosciences, Division of Earth Sciences: (703) 306-1550</p>

<p>Other Planning Information, Including Demographics, Societal Data, Transportation, Agricultural, Industrial & Other Commercial Economic Statistics</p>	<p>Low and/or No Cost Information Helpful for Determining At-Risk Populations and Potential Economic Damages & Information to Help Determine Avoidance of Losses.</p>	
<p>Demographics, Societal Statistics and Economic Statistics</p>	<p>Free Planning Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</p> <p>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under Historic Preservation Fund Grants on page 14 of this document).</p>	<p>U.S. Census Bureau Washington DC 20233</p> <p>General telephone inquiries: 301-457-4608 webmaster@census.gov</p> <p>Bureau of Economic Analysis (BEA) 1441 L Street NW Washington DC 20230</p> <p>Public Information Office 202-606-9900 BEA Order Desk 800-704-0415 bea.doc.gov webmaster@bea.doc.gov</p> <p>Bureau of Labor Statistics Division of Information Services 2 Massachusetts Avenue, N.E. Room 2860 Washington, D. C. 20212</p> <p>202-691-5200 800-877-8339 Fax 202-691-7890 blsdata_staff@bls.gov</p>

<p>Demographics, Societal Statistics and Economic Statistics (Continued)</p>	<p>Free Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p><i>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</i></p> <p><i>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under Historic Preservation Fund Grants on page 14 of this document).</i></p>	<p>Missouri State Census Data Center Missouri State Library 600 W. Main Street PO Box 387 Jefferson City, MO 65102</p> <p>Ms. Debbie Pitts (573) 526-7648 FAX (573) 751-3612 pittsd@sosmail.state.mo.us</p> <p>Small Business Research Information Center 104 Nagogami Terrace University of Missouri-Rolla Rolla, MO 65409</p> <p>Mr. Fred Goss Ms. Cathy Frank (573) 341-6484 Office of Administration 124 Capitol Building P.O. Box 809 Jefferson City, MO 65102 Mr. Ryan Burson (573) 751-2345 bursor@mail.oa.state.mo.us</p> <p>Office of Social & Economic Data Analysis University of Missouri-Columbia 626 Clark Hall Columbia, MO 65211 Mr. John Blodgett (573) 884-2727 FAX(573) 884-4635</p> <p>Ms. Evelyn J. Cleveland blodgettj@umsystem.edu clevelande@umsystem.edu</p> <p>Geographic Resources Center University of Missouri-Columbia 17 Stewart Hall Columbia, MO 65211</p>
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<p>Assistance to Firefighters Grants Program</p>	<p><i>Grants are used for personal protective equipment, firefighting equipment, vehicles, training and wellness and fitness programs.</i></p>	<p>Mr. Tim Haithcoat (573) 882-2324 haithcoatt@missouri.edu</p> <p>Center for Economic Information University of Missouri-Kansas City 207 Haag Hall Kansas City, MO 64131</p> <p>Mr. Peter Eaton (816) 235-2832 FAX (816) 235-5263 peaton@cctr.umkc.edu</p> <p>Missouri Agricultural Statistics Service 601 Business Loop 70 West Suite 240 Columbia, MO 65203</p> <p>800-551-1014 573-876-0950 573-876-0973 nass-mo@nass.usda.gov</p> <p>Missouri Department of Transportation Department of Transportation Building 105 West Capitol Avenue P. O. Box 270 Jefferson City 65102 573-751-2551</p> <p>Regional Office Information is available at modot.state.mo.us/local/local</p> <p>U.S. Fire Administration (USFA) USFA Grants Office Tel: (866) 274-0960 FAX: (866) 274-0942 E-mail: usfagrants@fema.gov</p>
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<p>Demographics, Societal Statistics and Economic Statistics (Continued)</p>	<p>Free Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p><i>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</i></p> <p><i>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under Historic Preservation Fund Grants on page 14 of this document).</i></p>	<p>Small Business Research Information Center 104 Nagogami Terrace University of Missouri-Rolla Rolla, MO 65409</p> <p>Mr. Fred Goss Ms. Cathy Frank (573) 341-6484</p> <p>Office of Administration 124 Capitol Building P.O. Box 809 Jefferson City, MO 65102 Mr. Ryan Burson (573) 751-2345 bursor@mail.oa.state.mo.us</p> <p>Office of Social & Economic Data Analysis University of Missouri-Columbia 626 Clark Hall Columbia, MO 65211 Mr. John Blodgett (573) 884-2727 FAX(573) 884-4635</p> <p>Ms. Evelyn J. Cleveland blodgettj@umsystem.edu clevelande@umsystem.edu</p> <p>Geographic Resources Center University of Missouri-Columbia 17 Stewart Hall Columbia, MO 65211</p> <p>Mr. Tim Haithcoat (573) 882-2324 haithcoatt@missouri.edu</p>
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<p>Assistance to Firefighters Grants Program</p>	<p><i>Grants are used for personal protective equipment, firefighting equipment, vehicles, training and wellness and fitness programs.</i></p>	<p>Center for Economic Information University of Missouri-Kansas City 207 Haag Hall Kansas City, MO 64131</p> <p>Mr. Peter Eaton (816) 235-2832 FAX (816) 235-5263 peaton@cctr.umkc.edu</p> <p>Missouri Agricultural Statistics Service 601 Business Loop 70 West Suite 240 Columbia, MO 65203</p> <p>800-551-1014 573-876-0950 573-876-0973 nass-mo@nass.usda.gov</p> <p>Missouri Department of Transportation Department of Transportation Building 105 West Capitol Avenue P. O. Box 270 Jefferson City 65102 573-751-2551</p> <p>Regional Office Information is available at modot.state.mo.us/local/local</p> <p>U.S. Fire Administration (USFA) USFA Grants Office Tel: (866) 274-0960 FAX: (866) 274-0942 E-mail: usfagrants@fema.gov</p>
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<p>Demographics, Societal Statistics and Economic Statistics</p>	<p>Free Planning Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document. (For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information</p>	<p>U.S. Census Bureau Washington DC 20233</p> <p>General telephone inquiries: 301-457-4608 webmaster@census.gov</p> <p>Bureau of Economic Analysis (BEA) 1441 L Street NW Washington DC 20230</p> <p>Public Information Office 202-606-9900 BEA Order Desk 800-704-0415 bea.doc.gov webmaster@bea.doc.gov</p> <p>Bureau of Labor Statistics Division of Information Services 2 Massachusetts Avenue, N.E. Room 2860 Washington, D. C. 20212</p> <p>202-691-5200 800-877-8339 Fax 202-691-7890 blsdata_staff@bls.gov</p> <p>Missouri State Census Data Center Missouri State Library 600 W. Main Street PO Box 387 Jefferson City, MO 65102</p> <p>Ms. Debbie Pitts (573) 526-7648 FAX (573) 751-3612 pittsd@sosmail.state.mo.us</p>
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	<p>under Historic Preservation Fund Grants on page 14 of this document).</p>	<p>Mr. Fred Goss Ms. Cathy Frank (573) 341-6484</p>
<p>Demographics, Societal Statistics and Economic Statistics (Continued)</p>	<p>Free Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p><i>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</i></p> <p><i>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under Historic Preservation Fund Grants on page 14 of this document)</i></p>	<p>Small Business Research Information Center 104 Nagogami Terrace University of Missouri-Rolla Rolla, MO 65409</p> <p>Office of Administration 124 Capitol Building P.O. Box 809 Jefferson City, MO 65102 Mr. Ryan Burson (573) 751-2345 bursor@mail.oe.state.mo.us</p> <p>Office of Social & Economic Data Analysis University of Missouri-Columbia 626 Clark Hall Columbia, MO 65211 Mr. John Blodgett (573) 884-2727 FAX(573) 884-4635</p> <p>Ms. Evelyn J. Cleveland blodgettj@umsystem.edu clevelande@umsystem.edu</p> <p>Geographic Resources Center University of Missouri-Columbia 17 Stewart Hall Columbia, MO 65211</p> <p>Mr. Tim Haithcoat (573) 882-2324 haithcoatt@missouri.edu</p> <p>Center for Economic Information University of Missouri-Kansas City 207 Haag Hall Kansas City, MO 64131</p>

<p>Assistance to Firefighters Grants Program</p>	<p><i>Grants are used for personal protective equipment, firefighting equipment, vehicles, training and wellness and fitness programs.</i></p>	<p>Mr. Peter Eaton (816) 235-2832 FAX (816) 235-5263 peaton@cctr.umkc.edu</p> <p>Missouri Agricultural Statistics Service 601 Business Loop 70 West Suite 240 Columbia, MO 65203</p> <p>800-551-1014 573-876-0950 573-876-0973 nass-mo@nass.usda.gov</p> <p>Missouri Department of Transportation Department of Transportation Building 105 West Capitol Avenue P. O. Box 270 Jefferson City 65102 573-751-2551</p> <p>Regional Office Information is available at modot.state.mo.us/local/local</p> <p>U.S. Fire Administration (USFA) USFA Grants Office Tel: (866) 274-0960 FAX: (866) 274-0942 E-mail: usfagrants@fema.gov</p>
<p>Demographics, Societal Statistics and Economic Statistics</p>	<p>Free Planning Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered</p>	<p>U.S. Census Bureau Washington DC 20233</p> <p>General telephone inquiries: 301-457-4608 webmaster@census.gov</p> <p>Bureau of Economic Analysis (BEA) 1441 L Street NW Washington DC 20230</p> <p>Public Information Office 202-606-9900 BEA Order Desk 800-704-0415 bea.doc.gov webmaster@bea.doc.gov</p>

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<p>Demographics, Societal Statistics and Economic Statistics (Continued)</p> <p>Assistance to Firefighters Grants Program</p>	<p><i>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</i></p> <p><i>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under Historic Preservation Fund Grants on page 14 of this document).</i></p> <p><i>Grants are used for personal protective equipment, firefighting equipment, vehicles, training and wellness and fitness programs.</i></p>	<p>Geographic Resources Center University of Missouri-Columbia 17 Stewart Hall Columbia, MO 65211</p> <p>Mr. Tim Haithcoat (573) 882-2324 haithcoatt@missouri.edu</p> <p>Center for Economic Information University of Missouri-Kansas City 207 Haag Hall Kansas City, MO 64131</p> <p>Mr. Peter Eaton (816) 235-2832 FAX (816) 235-5263 peaton@cctr.umkc.edu</p> <p>Missouri Agricultural Statistics Service 601 Business Loop 70 West Suite 240 Columbia, MO 65203</p> <p>800-551-1014 573-876-0950 573-876-0973 nass-mo@nass.usda.gov</p> <p>Missouri Department of Transportation Department of Transportation Building 105 West Capitol Avenue P. O. Box 270 Jefferson City 65102 573-751-2551</p> <p>Regional Office Information is available at modot.state.mo.us/local/local</p> <p>U.S. Fire Administration (USFA) USFA Grants Office Tel: (866) 274-0960 FAX: (866) 274-0942 E-mail:usfagrants@fema.gov</p>
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<p>Local Community Resources</p>	<p>Community Budget</p> <p>Chamber of Commerce</p> <p>Local Businesses & Industries</p> <p>Civic Groups</p> <p>Red Cross</p> <p>Utility Companies</p> <p>Electric Coops</p> <p>Federal & State Government</p>	<p>Developed by each local community.</p> <p>For example –</p> <p>More than 50 companies and service organizations have signed as partners with the City of Hannibal in helping to make the city safer. Continental Cement has agreed to supply the cement, lime and sand for pouring concrete walls and the floor of a tornado safe room in the 2001-2001 Building Trades Department Home. FirStar Bank and Hannibal National Bank have agreed to provide a ½% discount on Home Equity Fixed Rate Loans utilized for home repair in the event of a declared disaster. Southwestern Bell is providing free of charge a Project Impact page in next year’s phone book. Pillsbury, United Cities Gas, Abel Oil, Abney Home Improvement, and Gateway Financial Resources have all made financial donations to Hannibal’s partnership with SEMA and FEMA as a participating <i>Project Impact</i> community.</p> <p>Bolivar has partnered with SEMA and FEMA and signed several partner businesses that will provide concrete forms, concrete, and other materials to assist the community to construct a community tornado/storm safe room for about 150 people in the new sports complex. WalMart, Empire Gas and Radio Shack have teamed to help the community provide NOAA weather warning radios to non-profit daycare centers, schools and nursing homes.</p> <p>Neosho has partnered with SEMA, FEMA and the NRCS to perform flood buyouts, develop flood retention basins and construct a new greenway and recreational area. Neosho’s citizens partnered when they passed a city sales tax to help pay the local match for the projects.</p> <p>Piedmont has partnered with SEMA, FEMA, Conservation, the NWS/NOAA, MO DNR, private organizations, local businesses and private citizens to conduct flood buyouts, creek clean ups, a creek bank stabilization project, develop a new severe weather warning system and construct a new greenway and park.</p>
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