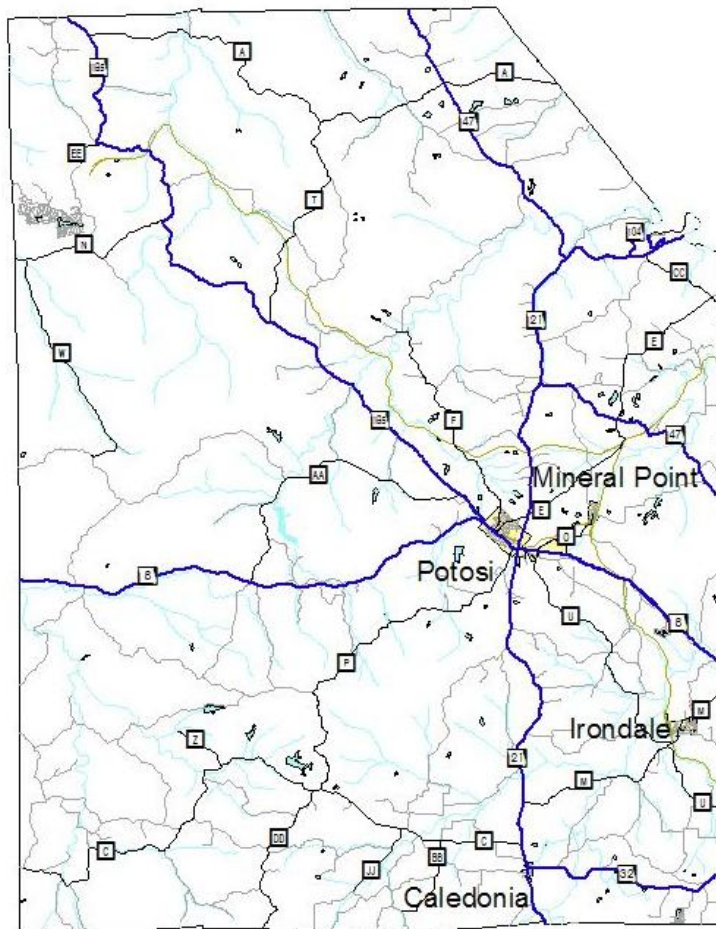


Washington County Multi-Jurisdiction Natural Hazard Mitigation Plan

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EXECUTIVE SUMMARY

The purpose of natural hazards mitigation is to reduce or eliminate long-term risk to people and property from natural hazards. Washington 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 Washington County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following local governments and organizations that participated in the planning process:

- Washington County
- Village of Caledonia
- City of Irondale
- Village of Mineral Point
- City of Potosi
- Kingston K-14 School District
- Potosi R-III School District
- Valley R-VI School District
- Richwoods R-VII School District

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 Washington County, participating jurisdictions and state and federal agencies. The Washington 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 Washington, Dent, Washington, Maries, Osage, Washington, 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 Washington 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 Washington 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 Washington County and All Jurisdictions

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	1.1.1 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.	Reducing Vulnerability of the People	1	High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	1.1.2 Continue to educate residents about precautions that should be taken during severe heat.			High	Extreme Heat
Washington County Caledonia Irondale Mineral Point Potosi	1.1.3 Promote the development of emergency plans by businesses/ government/schools.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	1.1.3 Continue to provide CERT training and encourage the development of CERT teams.			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	1.1.5 Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures	Reducing Vulnerability of the People	1	High	All Hazards
Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	1.1.6 Schools need to continue to conduct emergency preparedness exercises on a regular basis.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems			High	Flood Severe Storm Tornados Severe Winter Storm
Washington County Caledonia Irondale Mineral Point Potosi	1.2.2 Continue to promote the use of weather radios by local residents to ensure advanced warning about threatening weather			High	Flood Severe Storm Tornados Severe Winter Storm
Washington County Caledonia Irondale Mineral Point Potosi	1.2.3 Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.			High	Flood Severe Storm Tornados Severe Winter Storm
Washington County	1.2.4 Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.			High	Dam Failure Tornados Sinkholes/ Land Subsidence Wildfire
Washington County	1.3.1 Place water height gauges and signs near low water crossings.			High	Flood

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Washington County Caledonia Irondale Mineral Point Potosi	1.3.2 Continue to encourage tree trimming and dead tree removal by utility companies and local government.				Severe Storm Tornado Severe Winter Storm
Washington County	1.3.3 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.	Reducing Vulnerability of the People	1	High	Earthquake Tornado
Washington County	1.3.4 Establish cooling centers where residents can go during extreme heat or power outages.			High	Flood
Washington County	1.3.5 Regularly review and update school emergency plans			High	All Hazards
Washington County	1.3.6 Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.			Medium	Severe Storm Tornado
Washington County Caledonia Irondale Mineral Point Potosi	1.3.7 Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).			Medium	Severe Storm Tornado
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.	Property and Infrastructure Protection	2	Medium	Earthquake Tornado
Washington County Caledonia Irondale Mineral Point	2.1.2 Encourage businesses/government/schools to develop emergency plans.			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.		Property and Infrastructure Protection	2		
Washington County	2.1.3 Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Osage County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.			High	Dam Failure Tornados Sinkholes/Land Subsidence Wildfire
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	2.1.4 Continue to evaluate and update emergency operation plans.			High	All Hazards
Washington County Irondale Mineral Point Potosi	2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.			High	Flood
Washington County Irondale Mineral Point Potosi	2.2.2 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.			High	Flood
Washington County Caledonia Irondale Mineral Point	2.3.1 Encourage minimum standards for building codes in all cities.			Medium	Earthquake Flood Severe Storm Tornado Severe Winter Storm

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Washington County Caledonia Irondale Mineral Point Potosi	2.3.2 Encourage local governments to develop and implement regulations for the securing of hazardous materials tank and mobile homes to reduce hazards during flooding and high winds.	Property and Infrastructure Protection	2	Medium	All Hazards
Washington County	2.3.3 Encourage the Mark Twain National Forest to levy stricter fines for persons causing fire hazards.			High	Wildfire
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.	Outreach and Education	3	High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi	3.1.2 Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	3.2.1 Encourage local residents to purchase weather radios through press releases and brochures.			High	Extreme Heat Flood Severe Storm Tornado Severe Winter Storm
Washington County Caledonia Irondale	3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.		Outreach and Education	3		
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	3.3.2 Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi	3.4.1 Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi	3.4.2 Publicize county or citywide drills.			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.					
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation planning.	Communication Enhancement	4	High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	4.1.2 Continue to encourage joint training (or drills) between agencies, public and private entities (including schools and businesses).			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	4.1.3 Pool different agency resources to achieve widespread mitigation results.			High	All Hazards
Washington County Caledonia Irondale	4.2.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with			High	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	emergency operations plans and procedures.	Communication Enhancement	4		
Washington County Irondale Mineral Point	5.1.1 Encourage communities to budget for enhanced warning systems.	Long-Term Planning	5	High	Flood Severe Storms Tornados Severe Winter Storms
Caledonia Irondale Mineral Point Potosi	5.1.2 Encourage all communities to develop storm water management plans.			Low	Flood Severe Storms Severe Winter Storms
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	5.1.3 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.			High	All Hazards
Caledonia Irondale Mineral Point Potosi	5.1.4 Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.			Medium	Flood Severe Storms Severe Winter Storms
Washington County Irondale Mineral Point Potosi	5.2.1 Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.			Low	Flood
Washington County Irondale Mineral Point	5.2.2 Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.			Medium	Flood

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Potosi					
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.	Securing Resources for Mitigation Activities	6	High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi	6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.			High	Flood
Caledonia Irondale Mineral Point Potosi	6.1.3 Work with state/local/federal agencies to include mitigation in all economic and community development projects.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	6.1.4 Encourage local jurisdictions to budget for mitigation projects.			High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi	6.2.1 Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the jurisdiction as a whole.			Medium	All Hazards

Jurisdiction	Action/Measure	Mitigation Program	Goal #	Priority	Hazard Addressed
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private.	Securing Resources for Mitigation Activities	6	High	All Hazards
Washington County Caledonia Irondale Mineral Point Potosi Kingston K-14 School Dist. Potosi R-III School Dist. Valley R-VI School Dist. Richwoods R-VII School Dist.	6.3.1 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.

- Washington County
- Village of Caledonia
- City of Irondale
- Village of Mineral Point
- City of Potosi
- Kingston K-14 School District
- Potosi R-III School District
- Richwoods R-VI School District
- Valley R-VI 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, Washington County contracted with the Meramec Regional Planning Commission and participated fully in the preparation of the plan. Once this plan is approved, Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the participating jurisdictions within the County’s borders, including the following:

- Washington County
- Village of Caledonia
- City of Irondale
- Village of Mineral Point
- City of Potosi

Jurisdictions added in the 2009 revision:

- Kingston K-14 School District
- Potosi R-III School District
- Richwoods R-VII School District
- Valley R-VI School District

Table 1.1 Continuing, New or Discontinued Jurisdictions Participating in the Plan

Jurisdiction name	Continuing Jurisdiction	New Jurisdiction	Discontinued Jurisdiction
Washington County	X		
Village of Caledonia	X		
City of Irondale	X		
Village of Mineral Point	X		
City of Potosi	X		
Kingston K-14 Schools		X	
Potosi R-III Schools		X	
Richwoods R-VII Schools		X	
Valley R-VI Schools		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. Washington 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 Washington 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 Washington 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 Washington 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 Washington 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. Washington County's hazard mitigation plan was originally developed by the Meramec Regional Planning Commission. MRPC assisted the county in forming a planning committee comprised of representatives from each of Washington County's cities, city and rural fire departments, police departments, the county health department, local businesses, utility companies, the American Red Cross, and 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 Washington 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 April 27, 2009 and the second on May 14, 2009. All meetings were advertised on MRPC's website and public notices were provided through the Washington County Courthouse. Sign in sheets and meeting notices from each of the meetings are included in Appendix A: Planning Process Documentation. Much of the information gathering for the plan was done by written and electronic correspondence as well as by phone.

The Washington County Multi-Hazard Mitigation Plan was developed as a result of a collaborative effort among Washington County, the cities of Caledonia, Irondale, Mineral Point and Potosi, Kingston K-14 School District, Potosi R-III School District, Richwoods R-VII School District, Valley R-VI School District and public agencies, no-profit organizations, the private sector as well as regional, state and federal agencies. MRPC contacted and asked 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 Washington County.

Washington 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, Washington 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:

- Kraig Bone, Buckman Laboratories
- Curtis Bouse, Potosi Street, Water, and Sewer Supervisor
- Arthur Brockschmidt, Village of Caledonia Chairperson
- Bill Byers, Irondale Fire Chief
- Scott Couch, Richwoods Fire Chief
- Jesse Douglas, Washington County Health Department
- Doug Haguewood, Potosi Natural Gas Superintendent
- Steve Hatfield, Potosi Emergency Management Director
- Kevin Isgrig, Washington County Associate Commissioner
- Oscar Johner, Belgrade Volunteer Fire District Fire Chief
- Ronald Kennon, Mayor of Irondale
- Paul Lashley, Caledonia Water Superintendent
- Roy Logsdon, Potosi Chief of Police
- John Lucas, Caledonia Fire Chief
- William Mal Gum, Washington County Ambulance District Manager
- Wayne Malugen, Mayor of Potosi

- Paul Merrill, Washington County Emergency Management Director
- Norman W. Nichols, Belleview Volunteer Fire Department Fire Chief
- Robert Reed, Washington County Presiding Commissioner
- Greg Riddle, Washington County Memorial Hospital
- Edward Vincent, Potosi Building Commissioner
- Robert Vinyard, Village of Caledonia
- Doug Voyles, Irondale Chief of Police
- Tom Wilkerson, Irondale Water Superintendent
- Roger Williams, Village of Mineral Point Chairperson
- Judith Wright, Washington County Health Department
- Gary Young, Washington County Associate Commissioner
- Gary W. Yount, Washington County Sheriff

During the 2009 Update and Revision, Washington 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:

- Bob Reed, Washington County Presiding Commissioner
- Todd Moyers, Washington County Associate Commissioner
- Randy O’Neal, Washington County Associate Commissioner
- Janet Adams, Washington County Clerk
- Andy Skiles, Washington County Sheriff
- Doris Coffman, Washington County EMD
- Leah Osbahr, Washington County Memorial Hospital
- Judy Wright, Washington County Health Department
- William Mal Gum, Washington County Ambulance District
- Doug Howlett, Washington County Chamber of Commerce
- Board of Trustees, Village of Caledonia
- Robert Vinyard, Clerk of Caledonia
- John Lucas, Water Superintendent of Caledonia
- Board of Aldermen, City of Irondale
- Ron Kennon, Mayor of Irondale
- Bill Byers, Fire Chief of Irondale
- Cassandra Hartz, Clerk of Irondale
- Board of Trustees, Village of Mineral Point
- Tina Patterson, Chairperson of Mineral Point
- Patricia Graves, Clerk of Mineral Point
- Board of Aldermen, City of Potosi
- T. R. Dudley, Mayor of Potosi
- Roger Coleman, Clerk of Potosi
- Roy Logsdon, Potosi Chief of Police
- Edward Vincent, Potosi Building Commissioner
- Doris Coffman, Potosi EMD

- Curtis Bouse, Potosi Street/Water/Sewer Superintendent
- Sam Johnson, Potosi Natural Gas Superintendent
- Paul Merrill, Potosi Fire Protection District
- Scott Couch, Richwoods Fire Department
- Oscar Johner, Belgrade Volunteer Fire Department
- Norman Nichols, Belleview Volunteer Fire Department
- Gary Milner, Superintendent of Kingston K-14 School District
- Randy Davis, Superintendent of Potosi R-III School District
- John Westerman, Superintendent of Richwoods R-VII School District
- Steve Yount, Superintendent of Valley R-VI School District
- Neil Richards, Independent Journal
- Dan Blesi, Crawford Electric Cooperative
- Jim Porter
- Kraig Bone
- Ameren UE

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 1.3. Documentation of meetings, including sign-in sheets are included in Appendix A: Planning Process Documentation.

1.4.2 The Planning Process

Washington 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 Washington County Commission meeting on April 27, 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 Washington County’s cities, city and rural fire departments, ambulance districts, police departments, the county health department, local businesses, and utility companies. This cross section of local representatives was chosen for their experience and expertise in emergency planning and community planning for Washington 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.

Washington 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 Washington County Hazard Mitigation Planning Meetings

Meeting	Topics Covered	Date
Washington 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	April 27, 2009

Meeting	Topics Covered	Date
Washington 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	May 14, 2009

Agenda items at the first meeting included a review of the plan update requirements; a review of the current Washington 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 jurisdiction, attended the first planning committee meeting:

- Matthew Jackson, Washington County 9-1-1
- T.R. Dudley, Mayor of Potosi
- Doris Coffman, Washington County and Potosi EMD
- John Lucas, Village of Caledonia
- Janet Adams, Washington County Clerk
- Todd Moyers, Washington County Associate Commissioner
- Randy O'Neil, Washington County Associate Commissioner
- Bob Reed, Washington County Presiding Commissioner
- Sandy Allison, Washington County Economic Developer
- Paul Merrill, Potosi Fire Department
- Andy Skiles, Washington County Sheriff's Office

The following jurisdictions and organizations were in attendance at the May 14, 2009 meeting of the Washington County HMPC:

- Bob Reed, Washington County Presiding Commissioner
- Todd Moyers, Washington County Associate Commissioner
- Andy Skiles, Washington County Sheriff's Office
- Paul Merrill, Potosi Fire Department
- Doris Coffman, Washington County and Potosi EMD

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 Washington County Hazard Mitigation Planning Meetings

Jurisdiction	Participating Jurisdiction	Participated in Planning Process	HMPC April 27, 2009 Meeting	HMPC May 14, 2009 Meeting	Signed Authorized Representative Resolution	Completed Surveys/ Provided Information
Washington County	X	X	X	X		X
Village of Caledonia	X	X	X			X
City of Irondale	X				X	X
Village of Mineral Point	X					X
City of Potosi	X	X	X			X
Kingston K-14 School District	X					X
Potosi R-III School District	X				X	X
Richwoods R-VII School District	X				X	X
Valley R-VI 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 included 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, Village of Mineral Point and Kingston K-14 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 Washington County Plan

Name	Jurisdiction	Completed Survey	Provided Information
Linda Adams, County Clerk	Washington County		X
Bob Reed, Presiding Commissioner	Washington County	X	X
Doris Coffman, County EMD	Washington County		X
Nick Hughey, Health Dept.	Washington County Health Dept.		X
John Lucas, Secretary/Water Supt.	Village of Caledonia	X	X
Charles (Bill) Byers, Water/Street/ Waste Supt.	City of Irondale	X	X
Cassandra Hartz, City Clerk	City of Irondale	X	X
Paula Williams, Water/Sewer Manager	Village of Mineral Point	X	X
T. R. Dudley	City of Potosi		X
Roger Coleman, City Clerk/Collector	City of Potosi	X	X
Gary Milner, Superintendent	Kingston K-14 School District		X
Randy Davis, Superintendent	Potosi R-III School District	X	X
Laurie Huff, Superintendent	Richwoods R-VII School District	X	X
Brad Crocker	Valley R-VI 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 MRPC website where a copy of the draft plan could be viewed or downloaded. Hard copies of the final 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. Copies of public notices and press releases are included in Appendix A: Planning Process Documentation.

In addition Washington 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. Washington 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 Washington 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 MRPC’s 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 Washington 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 MRPC 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 Washington 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 Washington County Profile

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

2.1.1 History and Development

It is not known when the first permanent white settlement was made in the territory now included in Washington County. Historians agree that the first white men who explored this part of Missouri were Frenchmen. About 1760 Francis Breton discovered a mine near Potosi that bears his name, Mine-a-Breton.” A mining camp was established near the present site of Potosi, and in 1765 families located there. Near the end of the century the Spanish government made concessions to individuals, and the first recorded permanent village, Mine-a-Breton was established. Early settlers were drawn to Washington County because of its abundant mineral resources. Lead, iron ore, zinc, barite, and silver have been mined in Washington County. The first metallic zinc made west of the Mississippi was smelted in Alex Anderson’s furnace near Potosi. Iron ore and barite have been extensively mined until recently. Currently there are no active mining operations within Washington County.

Washington County was organized on August 21, 1813, and was named after George Washington, the first president of the United States. The territory of which the county is composed was previously a part of Saint Genevieve County. Saint Genevieve County was one of the original five districts of which the Territory of Missouri had been composed at the time of its organization in 1812. As it was originally laid out, the county contained more territory than it does at the present time. In 1857 by subsequent acts of the Legislature, the county had been reduced in size to its present limits.

The commissioners appointed to select a county seat site designated the village of Mine a Breton as the temporary seat of justice for the county. On February 26, 1814, the permanent county seat was established on 40 acres of land donated by Moses Austin and 10 acres of land donated by John Rice Jones. The new



Washington County Courthouse. Photo taken April 1969. Photo by [Calvin Beale](#).

town was briefly named St. George, but was later renamed Potosi in honor of the Spanish silver mining town in Bolivia. Potosi and Mine a Breton remained separate villages until May 2, 1826, when they were incorporated under the single name of Potosi.

The county government primarily consists of the County Commission. Washington 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.

A large courthouse, suitable for a future state capital was planned for Potosi. In the Territorial convention, Potosi lost its bid for the site of the capital to Jefferson City. Although Potosi was not successful in becoming the capital of the new state, the State Supreme Court met twice a year in Potosi between 1837 and 1843.

In May 1861, the citizens of Potosi went on record in favor of armed neutrality in the Civil War and organized a home guard to maintain their neutrality. Later that month, Union troops overran the town and arrested several southern sympathizers. In August, Colonel White and a Confederate Calvary detachment invaded Potosi, but left shortly thereafter. In September 1864, General Shelby and his troops invaded the town, only to be met by a resistance force that had barricaded itself in the courthouse. The defenders were unsuccessful, and several of them were shot on the courthouse lawn following the engagement.

Potosi is a fourth-class city with a four-member board of aldermen and a mayor. The city is located in the east central part of the county at the convergence of Highways 8, 21 and 185. Potosi is the largest community in Washington County.

Caledonia is a portion of the Miles Gorforth Spanish Grant. The community was founded in the early 1800's by Alexander Craighead, a Scotsman, who named the village after his native Scotland in 1819. The first school in the area was built in 1804. A two-room school was built in Caledonia in the 1830s. The Bellevue Collegiate Institute was built by the St. Louis Conference of the Methodist Church South in 1864 closing around 1902. The building was used as a public school until 1952 when the structure was demolished. In 1936 the Caledonia High School was built also serving as an Elementary School.

Caledonia is incorporated as a village. Three trustees and a chairperson make decisions regarding city issues. The village is located on Highway 21 in the southwest corner of Washington County.

Irondale is one of the oldest towns in the vicinity, established in 1807. Irondale was incorporated as a village in 1910. It is situated between some of the most beautiful hills of the Ozarks, northeast of Hughes Mountain. Grenia Springs, Thompson Spring and the Big River, along with various tributaries, as well as the abundance of iron ore made this a choice area for settlers. Many industries were started. The Iron Furnace which manufactured pig iron, and the Washington County Mining Company manufactured oxide zinc. Irondale also was the home of a

soda bottling plant, saw and grist mill, brick factory and a dairy producing butter, cream, milk and cheese.

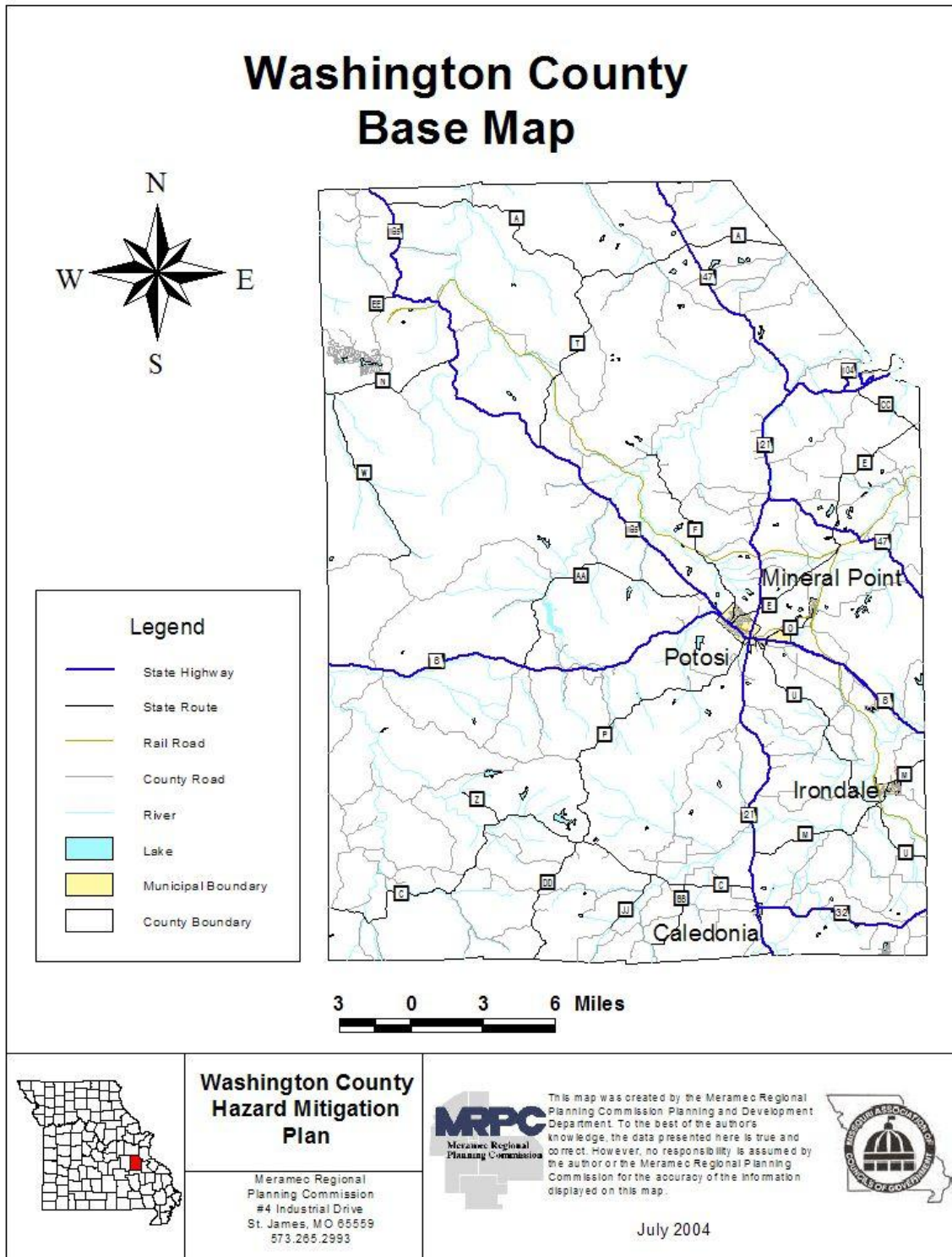
In 1864 during the Civil War, General Price's Army came to town, raided the stores, lived off the people and burned the railroad bridge over Big River north of town.

Irondale, a fourth-class city, has three aldermen and a mayor. The community is located in the southeast portion of Washington County, very near the St. Francois County line on Highway M.

The town of Mineral Point is located west of Potosi on Highway O and was laid out in 1858 by William C. Inks. It was originally located on the St. Louis Iron Mountain & Southern Railway which was later changed to a branch of the Missouri Pacific Railways. The oldest part of town is around the railroad tracks and still has a general store and the old Mineral Point Hotel which is no longer used.ⁱ

Mineral Point was incorporated as a village in 1905. A four-member board of trustees and a chairperson make decisions regarding village issues.

Figure 2-1 Base Map of Washington County

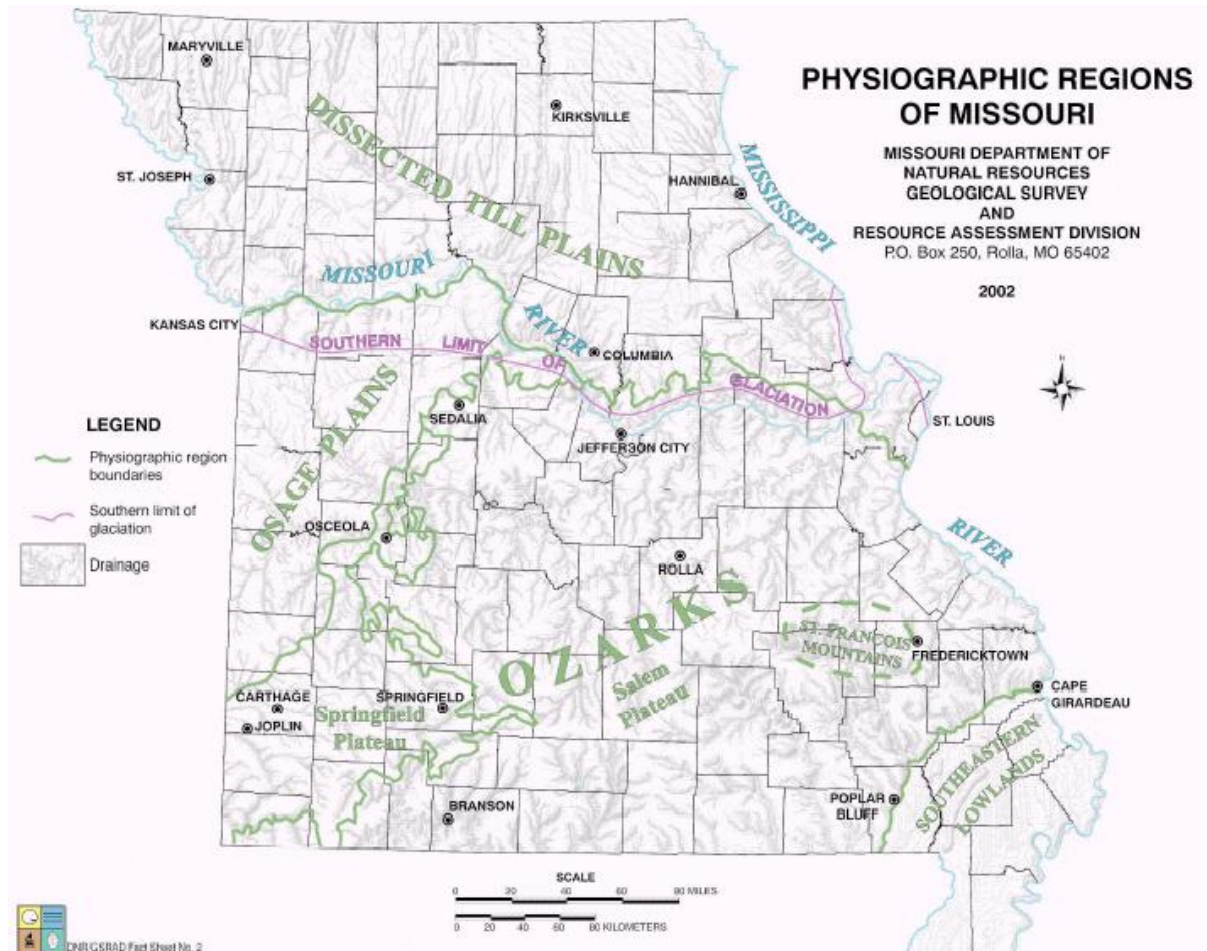


2.1.2 Geography and Topography

A line coinciding with Highway 21 divides the topography of Washington County. The topography west of Highway 21 is very hilly. The ridges in this area are sharp and the hills are steep sloping. East of Highway 21, the topography is gentle with broad valleys and rounded ridges. The maximum relief in the county is approximately 700 feet.

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.

Figure 2-2
Physiographic Regions of Missouri



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 stream banks 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.ⁱⁱ

Washington County is located in three river basins: Big, Upper St. Francis 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—seven in Washington County. The Big River includes the following tributaries: Mineral Fork, Cedar Creek, Terr Bleue Creek, Flat River, Mill Creek, Heads Creek, Dry Creek and Belew Creek. Only a small portion of the southeast corner of the county is included in the St. Francis River Watershed.

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.ⁱⁱⁱ

The Big River basin is located in east-central Missouri and drains 955 square miles of the Ozark Plateau in parts of six counties. The river has eight tributaries and flows northward for 138 miles until it reaches the Meramec River. The majority of land use is forest and pasture with some row cropping along stream bottoms. However, urbanization is rapidly increasing in the lower basin. Only one public water supply withdrawal uses significant amounts (0.75 million gallons/day) of basin surface water. Additionally, 10 wells with a maximum pumping capacity of 24.5 million gallons/day operate within the basin.

Only five percent of the basin is owned by state and federal agencies. Basin streams exhibit typical Ozarkian characteristics: good water quality and fish habitat. Nineteen sensitive natural communities, including good examples of Ozark creeks and Ozark springs and spring branches are present. However, damage to some aquatic habitats and the potential for serious damage to several streams exists due to past lead and barite mining activity. Stabilization and reclamation projects are beginning to address some of these problems. Unsafe mine dams and poorly-stored mine waste continue to degrade habitat or biota in about 110 miles of basin streams. The United States Army Corps of Engineers predicts catastrophic results from 27 high-hazard, unsafe dams during a moderate earthquake or major flood.

Riparian corridors are negatively affected by riparian land use, especially along tributary streams. Overall, stream habitat is good with rockslides, boulders, gravel, water willow, downed logs, and rootwads. A fish consumption advisory for some fish species is present on Big River due to lead contamination. The basin exhibits good aquatic biodiversity. One hundred fish species, 34 mussel species, eight crayfish species, and 107 aquatic insect taxa have been found within the basin. Four fish and three mussel species are either endangered, rare, or on the State watch list.

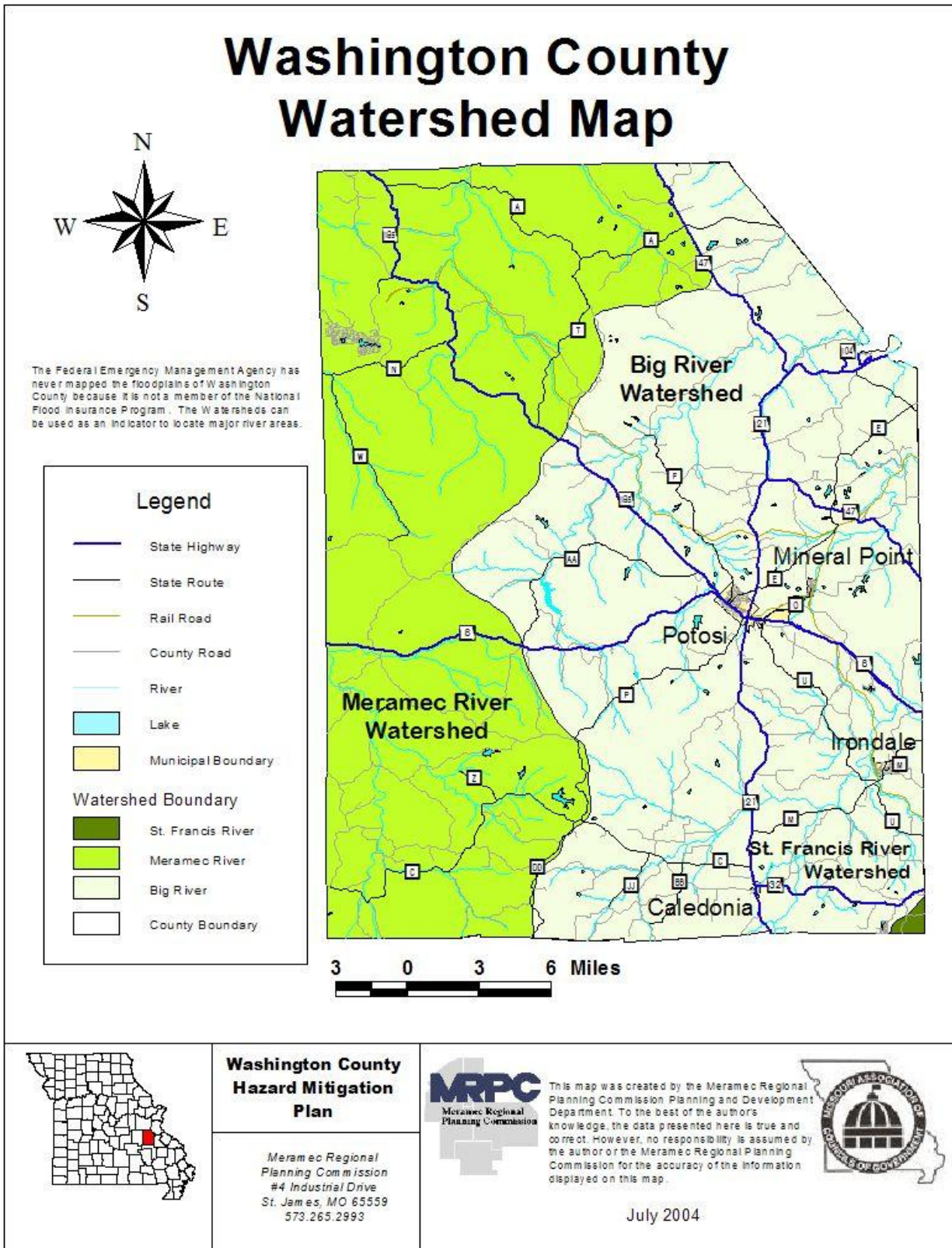
The riparian corridor condition is fair to poor. Generally, Big River's corridors were in better condition than its tributaries. Sixty percent of Big River sites exhibited a timbered stream corridor of 75 ft., versus 44 percent for tributary stream sites. Row cropping and hay production took place near Big River, but generally comprised a smaller portion of the riparian corridor. Corridor width is being reduced along streams with increasing amounts of urbanization.

The basin contains 102 point sources of pollution, including five storm water sources from landfills and quarries, and 16 mining sources. Approximately, eight miles of the basin streams are affected by municipal sewage facilities, primarily from lagoons. The Big River basin receives non-point source pollution from 65 sites, mainly runoff from poultry farms and mines. Mining is responsible for 98 percent of the basin's non-point source pollution.

Caledonia is not a participant in the National Flood Insurance Program. However, the City of Potosi has been a participant in the NFIP since September 1985, Mineral Point since March 1993, and Irondale since July 2003 and Washington County since May 2010.^{iv}

Washington County, Irondale, Potosi, and Mineral Point require 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. City 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. Each jurisdiction participating in the NFIP has an appointed floodplain manager. Washington County's Presiding Commissioner serves as floodplain manager for the county. Figure 2-3 is a watershed map for Washington County.

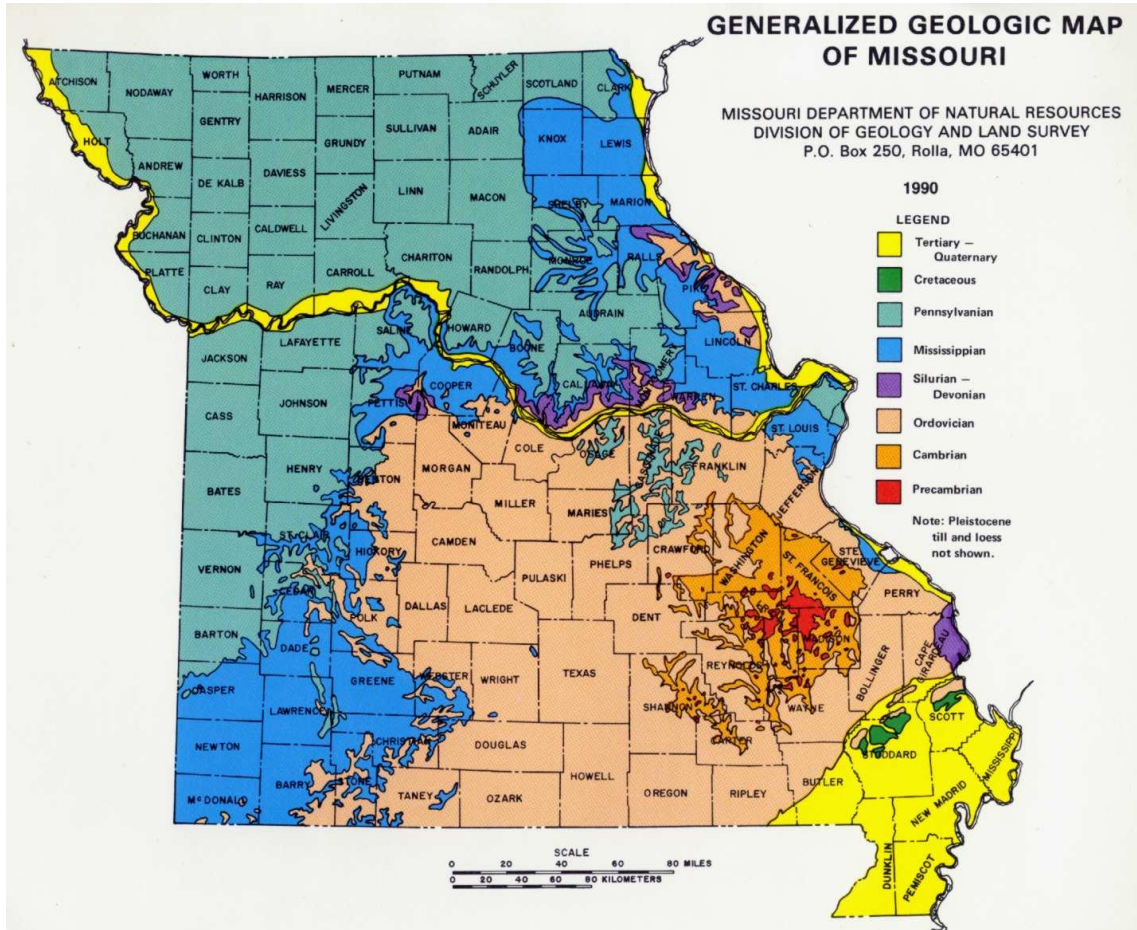
Figure 2-3



2.1.3 Soil Types

The topography of Washington County is divided by a line coincident with Highway 21. The topography west of Highway 21 is very hilly. The ridges in this area are sharp and the hills are steep sloping. East of Highway 21 the topography is gentle with broad valleys and rounded ridges. The maximum relief in the county is approximately 1,100 feet, with the lowest point at the northeast corner of the county, and the highest point is near the center of the southern boundary of the county.

Figure 2-4



Two basic soil types are found in Washington County – The Ozark soils and Ozarks Dome soils. 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 the western part of Washington County. The Ozarks soils include the Lebanon-Goss-Bardley-Peridge, Needleye-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.

The Ozark Dome soils are located on mountainous slopes of rhyolite flows, granite domes and valley slopes on dolomite and sandstone formations. These soils are found in south-eastern Washington County. The Ozark Dome soil include Knobtop-Irondale-Selassus-Syenite and Peridge-Cantwell-Gasconade soil associations.^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 Washington County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Inches	2.3	2.6	4.3	4.4	4.8	3.7	3.8	4.3	3.9	3.1	4.5	3.8	45.5

Source: <http://countrystudies.us/united-states/weather/missouri/potosi>

Because of its inland location, Missouri and Washington County are subject to frequent changes in temperature. The mean annual temperature is in the mid-50s with the January mean of about 31 degrees and July mean of about 77 degrees.

Table 2.2 Average Low and High Temperatures for Washington County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg-Low	21	25	34	44	53	62	67	65	57	46	35	24	44.4
Mean	31	36	45	55	64	72	77	75	68	57	45	33	54.8
Avg-High	40	46	55	66	74	81	86	85	78	67	55	45	64.6

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

Source: <http://www.weather.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

According to the 2010 U.S. Census, the population of Washington County was 25,195. With the county being 762 square miles, this translates to a population density of 33.0 persons per square mile. The 2010 Census indicates that the county’s population increased since 2000 by 7.9 percent. Other communities in the county and their 2010 U.S. Census population figures are reflected in Table 2.3. Approximately 85.7 percent of the county’s population lives in unincorporated areas.

Table 2.3 County/City Population from Census 2010

Jurisdiction	Population
Washington County	25,195
Caledonia	130
Irondale	445
Mineral Point	351
Potosi	2,660

Source: 2010 US Census

Over the past 60 years the county’s population has steadily increased. In 1950 the county’s population was 14,689. By 1960 the population had increased to 14,346. By 1970 the population had made a small increase to 15,086. Since 1970, the county’s population has grown over 10,000 residents to the 2010 census figure of 25,195.^{vii} Table 2.4 shows population trends for the county and communities in Washington County from 1950 to 2000.

Table 2.4 Population Trends of Washington County & Communities 1950-2010

Community	1950	1960	1970	1980	1990	2000	2000
Washington County	14,689	14,346	15,086	17,983	20,380	23,344	25,195
Caledonia	143	119	113	162	142	158	130
Irondale	443	335	319	349	474	437	445
Mineral Point	304	332	369	358	384	363	351
Potosi	2,359	2,805	2,761	2,528	2,683	2,662	2,660

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

Three of the county's four communities lost population from 2000 to 2010 – Caledonia, Mineral Point and Potosi. The other community, Irondale experienced a 1.8 percent increase in population during the same timeframe. The Missouri Office of Administration, Division of Budget and Planning projections show Washington County's population growing slightly through 2030. But the projections indicate the county's population will likely remain below 30,000 during that time period.

According to the 2010 U.S. Census Bureau statistics, 95.56 percent of Washington County's population is white. The racial breakdown of the remaining 4.2 percent of the population is shown in Table 2.5. As is demonstrated in the table, the racial diversity in the county increased from 1970 to 2010 by 3.31 percent.

Table 2.5 Washington County Population Trends and Breakdown of Racial Groups

Year	1970	1980	1990	2000	2010
Total Population	15,086	17,983	20,380	23,344	25,195
White Alone	14,951	17,807	19,914	22,286	24,142
Black/African American Alone	113	99	378	578	557
Amer. Indian/ AK Native Alone	**	68	47	155	100
Asian Alone	**	2	23	35	48
Hawaiian/ Pacific Islander Alone	**	Included with Asian	Included with Asian	2	5
Some Other Race Alone	22	7	17	36	37
Two or More Races	**	**	**	252	306
% White	99.11	99.02	97.71	95.47	95.82
% Non-White	.089	0.98	2.28	4.53	4.18

Source: 1970, 1980, 1990, 2000, 2010 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 2000 and 2010.

Table 2.6 Age-Sex Composition for Washington County 2000-2010

Age Group	2010				2000			
	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	811	3.2	840	3.3	780	6.5	765	6.8
5-9	857	3.4	794	3.2	825	6.9	817	7.2
10-14	874	3.5	827	3.3	955	7.9	876	7.7
15-19	814	3.2	860	3.4	1,005	8.4	866	7.7
20-24	761	3.0	689	2.7	886	7.4	711	6.3
25-29	829	3.3	705	2.8	830	6.9	743	6.6
30-34	837	3.3	719	2.9	843	7.0	701	6.2
35-39	895	3.6	786	3.1	1,020	8.5	855	7.6
40-44	927	3.7	765	3.0	972	8.1	854	7.6
45-49	1,135	4.5	955	3.8	808	6.7	784	6.9
50-54	1,032	4.1	939	3.7	732	6.1	699	6.2
55-59	846	3.4	861	3.4	615	5.1	608	5.4
60-64	721	2.9	738	2.9	528	4.4	533	4.7
65-69	569	2.3	603	2.4	476	4.0	476	4.2
70-74	458	1.8	450	1.8	332	2.8	359	3.2
75-79	290	1.2	350	1.4	242	2.0	274	2.4
80-84	174	0.7	217	0.9	103	0.9	200	1.8
85+	94	0.4	173	0.7	84	0.7	187	1.7
Totals	12,924	51.3%	12,271	48.7%	12,036	51.6%	11,308	48.4%

Source: 2000, 2010 U.S. Census of Population, Bureau of the Census, US Department of Commerce

Table 2.7 shows the median age of the population of Washington County for 1970 through 2010. In 1970 the average age of the population was 26.1. Since 1970 the average age of the population has increased steadily by 13.1-years to 39.2 years of age, a significant jump in a 40 year period. Notably during the period of 2000 to 2010, the average age of the male population increased by 7.4 years compared to the female population increase of 1.5 years. This likely reflects the aging populations of the county as younger males migrate from the area.

Table 2.7 Median Age In Years for Washington County: 1970-2010

1970			1980			1990			2000			2010		
Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
25.4	26.7	26.1	27.5	29.4	28.4	31.0	32.9	31.9	31.4	37.7	34.9	38.8	39.5	39.2

Source: 1970, 1980, 1990, 2000, 2010 Census, U.S. Department of Commerce

Table 2.8 compares the family income of Washington County residents with the rest of the Meramec Region, State of Missouri and United States. This table shows that Washington County has a higher percentage of families living on \$34,999 or less than the rest of the region, state and nation – 52.1 percent compared to 42.4 percent for the region, 38.2 percent for the state and 34.6 percent for the nation. 22.5 percent of the county population has an annual income of \$14,999 or less compared to the region, state and nation at 15.9 percent, 14.3 percent and 13 percent respectfully.

Table 2.8 Washington County Family Income – 2011

	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
Washington County	868 9.3 %	1,228 13.2%	676 7.3%	776 8.3%	726 7.8%	577 6.2%	4,461 47.9%
Meramec Region	6,247 8.6%	5,327 7.3%	4,616 6.3%	5,277 7.3%	4,994 6.9%	4,335 6.0%	26,348 57.6%
State of Missouri	190,559 8.1%	145,390 6.2%	142,611 6.1%	144,260 6.1%	138,306 5.9%	136,677 5.8%	1,457,459 61.8%
United States	8,529,677 7.4%	6,472,374 5.6%	6,326,462 5.5%	6,329,273 5.5%	6,084,213 5.3%	6,052,286 5.3%	75,137,579 65.4%

Source: 2009 – 2011 American Community Survey

Table 2.9 compares Washington County’s median income with the rest of the Meramec Region, State of Missouri and nation. Washington County’s median income is lower than the region’s average and as with most rural counties in south central Missouri, lower than the State and National averages. These figures are based on the 2006-2010 American Community Survey.

Table 2.9 Washington County Median Income Comparison

Location	Median Family Income	Percent of U.S. Median	Persons in Poverty	Percent in Poverty
Washington County	\$42,120	66.9	4,886	20.7
Meramec Region	\$48,794	77.5	28,735	15.8
State of Missouri	\$57,661	91.6	802,596	14.0
United States	\$62,982	100.0	40,917,513	13.8

Source: 2006 – 2010 American Community Survey

Table 2.10 shows the educational attainment of Washington County residents – both the number and percentage of the population of 16,802 25-years of age and older as demonstrated by the table, 28.6 percent of the population has some education beyond high school, with 4.2 percent holding an associate degree, 4.5 percent holding a bachelors degree and 3.2 percent with graduate or professional degrees. Disturbingly, 29.7 percent of the population has not attained a high school diploma.

Table 2.10 Washington County General Education Attainment (2010)

Education Attainment	Elementary - High School No Diploma	High School Diploma	Some College No Degree	Associate Degree	Bachelors Degree	Graduate or Professional Degree
Number of Population	4,988	7,004	2,808	707	749	546
Percent of Population	29.7	41.7	16.7	4.2	4.5	3.2

Source: 2006 – 2010 American Community Survey

The civilian labor force in the Meramec Region increased 53.2 percent between 1980 and 2010, while the civilian labor force in Missouri grew 31.6 percent for the same time period. From 1980 – 2010 the male civilian labor force in Missouri increased by 19.6 percent compared to 39.2 percent in the Meramec Region, while the female civilian labor force increased by 73.1 percent within the region compared to 47.6 percent for statewide.

As shown in Table 2.11, Washington County’s civilian labor force increased by 132 percent and the unemployed person percentage decreased from 18.6 percent in 1980 to 13.7 percent in 2010. The female civilian labor force percentage of unemployed dropped from 15.5 percent in 1980 to 11.7 percent in 2010. According to the Department of Labor, Bureau of Labor Statistics, unemployment for the United States has risen from 7.1 percent in 1980 to 9.6 percent in 2010. The Missouri and regional rates closely mirror those percentages and usually are a few tenths of a point less than the national figure. According to statistics from 2010, Washington County had an unemployment rate of 13.7 percent, much higher than the region, state and national rates documented by the Department of Labor of 9.2 percent, 9.4 percent and 9.6 percent respectively. Since 1980 Washington County has mostly experienced unemployment rates between 13 percent and over 18 percent. The exception was recorded during the 2000 Census when the County unemployment was 7.8 percent and the yearly average for the county was reported by the Bureau of Labor Statistics as 5.7 percent.

Table 2.11 Washington County Labor Force

2010	Total	Male	Female
Persons 16 years & Older	19,575	10,126	9,449
Total Labor Force	10,154	5,429	4,725
Civilian Labor Force (CLF)	10,154	5,429	4,725
Persons Employed	8,763	4,589	4,174
Persons Unemployed	1,391	840	551
% Unemployed CLF	13.7%	15.5%	11.7%
Persons not in Labor Force	9,421	4,697	4,724
2000	Total	Male	Female
Persons 16 years & Older	17,957	9,252	8,705
Total Labor Force	9,454	5,129	4,325
Civilian Labor Force (CLF)	9,454	5,129	4,325
Persons Employed	8,721	4,730	3,991
Persons Unemployed	733	399	334
% Unemployed CLF	7.8%	7.8%	7.7%
Persons not in Labor Force	8,498	4,118	4,380
1990	Total	Male	Female
Persons 16 years & Older	15,024	7,539	7,485
Total Labor Force	7,879	4,732	3,147
Civilian Labor Force (CLF)	7,879	4,732	3,147
Persons Employed	6,824	4,008	2,816
Persons Unemployed	1,055	724	331
% Unemployed CLF	13.4%	15.3%	10.5%
Persons not in Labor Force	7,232	2,855	4,377
1980	Total	Male	Female
Persons 16 years & Older	12,670	6,143	6,527
Total Labor Force	4,377	2,779	1,598
Civilian Labor Force (CLF)	4,377	2,779	1,598
Persons Employed	3,565	2,214	1,351
Persons Unemployed	812	565	247
% Unemployed CLF	18.6%	20.3%	15.5%
Persons not in Labor Force	8,293	3,364	4,929

SOURCE: 2006-2010 American community survey 5-year Estimates

SOURCE: 1980-2000 census of Population

2.1.6 Schools/Vocational/Technological Schools/Colleges/Universities

Washington County has four public school districts, one state school district and one parochial school. There is one college located within the county; Mineral Area College Annex is a satellite campus of Mineral Area College located in Park Hills, Missouri. The school districts and the size of the student population are identified in Table 2.12.

Table 2.12 Washington County School Districts and Student Enrollment 2011

School District	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI	Citadel State School	St. Joachim
Student Enrollment	744	2,376	175	375	15	51

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

Kingston K-14 has four facilities: Kingston Primary School, Kingston Elementary School, Kingston Middle School and Kingston High School are co-located on the same campus located at 10047 Diamond Road, Cadet, Missouri.

Potosi R-III has four facilities: Potosi Elementary School is located at 205 State Highway P, Trojan Intermediate School is located at 367 Intermediate Drive, John A. Evans Middle School is located at 303 S. Lead Street, and Potosi High School is located at 1 Trojan Drive. All four facilities are located within the city limits of Potosi, Missouri.

Richwoods R-VII has one facility. Richwoods Elementary School is located at 10788 State Highway A, Richwoods, Missouri.

Valley R-VI has three facilities: Caledonia Elementary School and Valley High School are co-located on the same campus located at 1 Viking Drive, Caledonia, Missouri. Belgrade Elementary School is located at 18437 Delbridge Road, Belgrade, Missouri.

Citadel State School is located in Potosi, MO and is one of 35 schools in State Schools for the Severely Disabled (MSSD) program. It is a state operated program serving students aged 5 through 21 with severe disabilities (special physical, mental, or learning needs). The Citadel State School serves 15 students in grades K-12. Citadel State School is located at 400 South Mine, Potosi, Missouri.

St. Joachim Elementary School, a Roman Catholic Parochial School, has one facility located at 10121 Crest Road, Old Mines, Missouri.

Mineral Area College Annex –located at 1201 Louise Street, Potosi, Missouri offers a variety of degree and certificate programs. Students can earn complete two-year degrees or transfer degrees into a four year program. Additionally, Continuing Education courses are offered to help enrich the lives of residents in the community.

2.1.7 Business/Industry

The major private employers located in Washington County are YMCA of the Ozarks in Potosi with 250 employees and Red Wing Shoe Company in Potosi with 200 employees. Other large employers include; Wal-Mart with 155 employees, Purcell Tire & Rubber Co. with 215 employees and Deaconess Long Term Care of Missouri Incorporated with 80 employees. Large public employers in the county include Potosi Correctional Center with 400 employees, Washington County Schools with 300 employees, Washington County Hospital with 300 employees, and Washington County Government with 110 employees.

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

Category	Number
Total Employed:	8718
Agriculture, forestry, fishing and hunting, mining:	484
Construction	869
Manufacturing	1,509
Wholesale trade	142
Retail trade	1,231
Transportation and warehousing, and Utilities	321
Information	174
Finance, insurance, real estate and rental and leasing:	147
Professional, scientific, management, administrative and waste management services:	325
Educational services, and health care, and social assistance:	2,040
Arts, entertainment, recreation, accommodation and food services:	605
Other services, except public administration	444
Public administration	427

Source: 2007-2011 American Community Survey 5-Year Estimates

According to the 2007 Census of Retail Trade, conducted by the U.S. Department of Commerce, there are 53 retail trade establishments in Washington County, with annual combined sales of \$124,339,000.^{viii}

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, Washington County had 561 farms with an average farm size of 245 acres. Five years later in the 2002 Census of Agriculture, the number of farms had slightly risen to 576 and the average farm size had decreased to 230 acres. In 2007 the number of farms dropped to 558 but the average farm size grew to 246 acres. In 2007 the county had 31 farms with 1,000 or more acres, 5.6 percent of the total number of farms in the county.^{ix} Due to the rugged nature of the region, row crop farming is for the most part limited to the river valleys. According to the 2007 Census of Agriculture, Washington County's market value of crop sales was \$711,000 and value of livestock sales was \$8,018,000.

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 Washington County.

Table 2.14 Timber Resources of Washington County

Category	Total	Softwoods	Hardwoods
All Live Trees on Timberland (in cubic feet)	421,819,910	68,325,826	353,494,084
Net Volume of Growing-Stock on Timberland (in cubic feet)	394,309,961	64,869,426	329,440,535
Average Annual Mortality of Growing-Stock on Timberland(in cubic feet)	3,657,878	131,202	3,526,675
Average Number of Growing Trees on Timberland (in cubic feet)	12,080,198	1,634,801	10,445,397

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 Washington 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.^x

National Forest

Mark Twain National Forest owns several acres of land in Washington 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 Washington 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.

The Mark Twain National Forest contains several recreational opportunities in Washington County. Trails and wilderness provide adequate opportunity for hiking, biking, horseback riding or ATV/motorcycle. MTNF maintains Berryman Recreation Area, Council Bluff Recreation Area and Brazil Creek Area in Washington County.

State Parks

Nestled in the forest lands of the eastern Ozarks, Washington State Park once was a ceremonial ground for prehistoric Indians. Today, the petroglyphs-rock carvings that are remnants of the Indian culture-are a special attraction. The 1,855-acre park has a modern swimming pool, and Big River, which borders the park, provides opportunities for canoeing and fishing. Kitchen-equipped rental cabins, a camper store, canoe rentals and shaded campsites are available in the park.

A 68-acre portion of Washington State Park can be accessed by the Thousand Steps Trail, which begins along the road east of the dining lodge. It features a mesic limestone forest located in the Mississippi River Section of the Ozark Border Natural Division; the hardwood forest has developed over broken down talus at the base of a dolomite bluff. Dominant trees include northern red oak, chinquapin oak, white oak and Kentucky coffee tree with many of the overstory trees older than 150 years. The area is noted for its luxuriant and diverse spring wildflowers.

Table 2.15 Summary of Public Use Areas and Conservation Areas

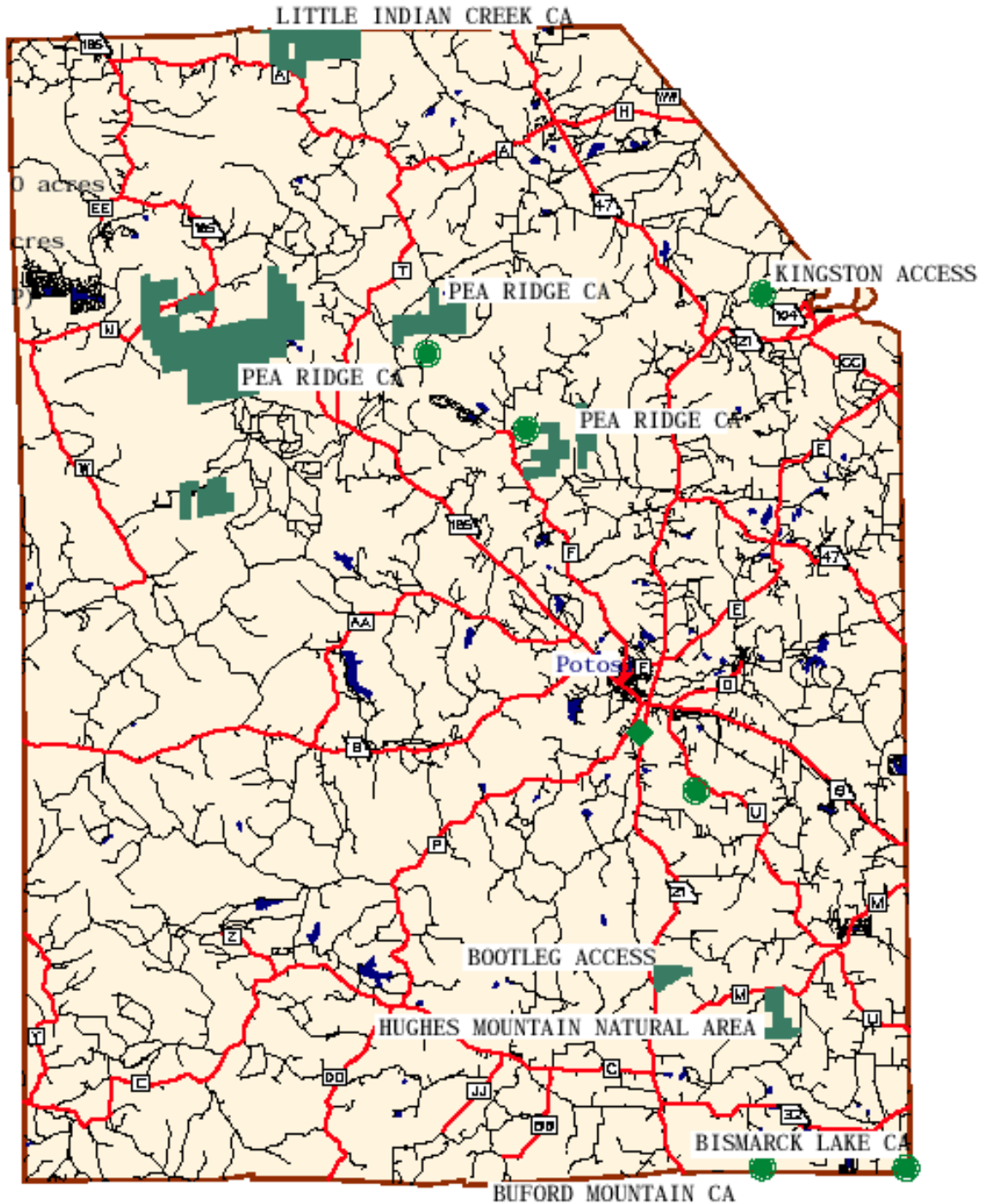
County	Area
Washington	Bismarck Conservation Area Bootleg Access Buford Mountain Conservation Area Hughes Mountain Natural Area Kingston Access Little Indian Creek Conservation Area Mark Twain National Forest Pea Ridge Conservation Area Potosi (Roger Bilderback Lake) Washington State Park

Source: Missouri Department of Conservation Atlas, 2003, and Missouri Department of Natural Resources

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

Washington County is located in three river basins: Big, Upper St. Francis 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—seven in Washington County.

Figure 2.5 Missouri Department of Conservation Lands in Washington County



Source: Missouri Department of Conservation, 2003.

Big River

The Big River basin is located in east-central Missouri and drains 955 square miles of the Ozark Plateau in parts of six counties. The river has eight tributaries and flows northward for 138 miles until it reaches the Meramec River. The majority of land use is forest and pasture with some row cropping along stream bottoms. However, urbanization is rapidly increasing in the lower basin. Only one public water supply withdrawal uses significant amounts (0.75 million gallons/day) of basin surface water. Additionally, 10 wells with a maximum pumping capacity of 24.5 million gallons/day operate within the basin.

Only five percent of the basin is owned by state and federal agencies. Basin streams exhibit typical Ozarkian characteristics: good water quality and fish habitat. Nineteen sensitive natural communities, including good examples of Ozark creeks and Ozark springs and spring branches are present. However, damage to some aquatic habitats and the potential for serious damage to several streams exists due to past lead and barite mining activity. Stabilization and reclamation projects are beginning to address some of these problems. Unsafe mine dams and poorly-stored mine waste continue to degrade habitat or biota in about 110 miles of basin streams. The United States Army Corps of Engineers predicts catastrophic results from 27 high-hazard, unsafe dams during a moderate earthquake or major flood.

Riparian corridors are negatively affected by riparian land use, especially along tributary streams. Overall, stream habitat is good with rockslides, boulders, gravel, water willow, downed logs, and rootwads. A fish consumption advisory for some fish species is present on Big River due to lead contamination. The basin exhibits good aquatic biodiversity. One hundred fish species, 34 mussel species, eight crayfish species, and 107 aquatic insect taxa have been found within the basin. Four fish and three mussel species are either endangered, rare, or on the State watch list.

The riparian corridor condition is fair to poor. Generally, Big River's corridors were in better condition than its tributaries. Sixty percent of Big River sites exhibited a timbered stream corridor greater than 75 ft., versus 44 percent for tributary stream sites. Row cropping and hay production took place near Big River, but generally comprised a smaller portion of the riparian corridor. Corridor width is being reduced along streams with increasing amounts of urbanization.

The basin contains 102 point sources of pollution, including five storm water sources from landfills and quarries, and 16 mining sources. Approximately, eight miles of the basin streams are affected by municipal sewage facilities, primarily from lagoons. The Big River basin receives non-point source pollution from 65 sites, mainly runoff from poultry farms and mines. Mining is responsible for 98 percent of the basin's non-point source pollution.

2.1.10 Endangered Species and Species of Concern

Washington County is home to some of Missouri's endangered species. The migratory Gray and Indiana bats are cave dwellers that typically thrive in caves and old mines. Gray bats can fly up to 60 miles an hour and only weigh six to nine grams; however pesticides and human disruption are threatening their lives. Indiana bats are similar in size and dwell in caves, but migrate north in the summer. Both bats depend heavily on cave life and the threat to losing them also threatens

the life of other cave-dwelling animals. Another cave-dwelling endangered species is the Central Missouri cave amphipod. The crustacean lives under rocks and sticks in caves and springs and can be found nowhere else in the world. Polluted waters are threatening the small, shrimp-like animal and are putting it alarmingly close to extinction. The last endangered species in Washington County is the Cerulean Warbler, a small, insect-eating bird. Logging and deforestation have made the birds susceptible to harm due to their need of unbroken, mature forests. The destruction of their breeding habitats is quickly bringing the destruction of the species.

According to the Missouri Department of Conservation, the American burying beetle, the largest carrion beetle of its kind in North America is found in Washington County and is considered rare and threatened.

Gray Bat



Photo by Adam Mann, Environmental Solutions and Innovations

Indiana Bat



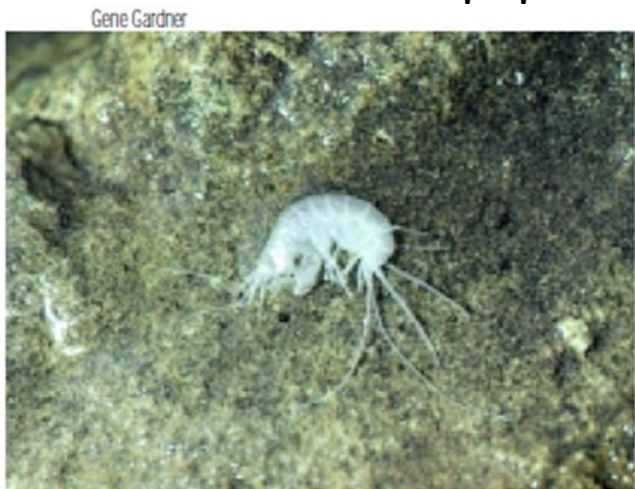
Jim Rahert

Cerulean Warbler



Photo by Stuart Tingley

Central Missouri Cave Amphipod



Gene Gardner

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 Washington County

Washington County



Current Washington County Courthouse

Overview

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

Washington 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 generally is the final authority on county issues. Other county officials include the county clerk, assessor, circuit clerk, recorder, collector, treasurer, prosecuting attorney, sheriff, associate circuit judge, coroner, public administrator, surveyor and emergency management director.

Washington County has staff resources in floodplain management and emergency management. The Presiding Commissioner serves as the floodplain manager for the county. The county has an emergency management director that is appointed through the ambulance district. The county has Central Communications Center that is located at 12252 North State Highway 21, Cadet, MO, 63630. Table 2.16 outlines Washington County's personnel resources in 2009.

Table 2.16 Washington County Administrative and Technical Resources

Personnel Resources	Department/Position	Comments
Floodplain Manager	Presiding Commissioner	
Emergency Management Director	Office of Emergency Management	Appointed through Ambulance District

There are five fire protection districts located in the county. All are volunteer departments with the exception of Potosi which has a full-time staff of three in addition to more than 50 volunteers. Those departments include Richwoods Fire Protection District, Irondale Fire Protection District, Belgrade Fire Protection District and Caledonia Fire Department.

The county is served by the Washington County Ambulance District located in Potosi. Washington County Memorial Hospital is also located in Potosi.

Existing Plans and Policies

Washington County participates in the National Flood Insurance Program. The county does have a flood plain ordinance. The Presiding Commissioner serves as the floodplain administrator for the county. Construction occurring in the floodplain in unincorporated areas of the county is not required to obtain a permit from the County. Washington County does not have building codes or require building permits or inspections. The county has a local emergency operations plan (LEOP) that is administered and maintained by the Emergency Management Director. Washington County also has an Economic Development Plan.

Other Mitigation Activities

The County Emergency Management Director, local fire departments, Sheriff's Department and the Washington County Health Department periodically conduct 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). The County EMD works with the local school districts, SEMA area coordinator and emergency response agencies on joint drills and trainings. The County joined the NFIP in 2010 and now regulates floodplain development in unincorporated areas.

2.2.2 Cities

Four 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.

Village of Caledonia

Overview

Caledonia is located southwest of Irondale, in the Bellevue Valley. Caledonia was founded by Alexander Craighead, a Scotchman, who opened a frontier store on Goose Creek and constructed his home in 1816 which still stands today.

The first school was built in 1804. A two-room school was built in Caledonia in the 1830s. The Bellevue Collegiate Institute was built by the St. Louis Conference of the Methodist Church

South in 1864 closing around 1902. The building was used as a public school until 1952 when the structure was demolished. In 1936 the Caledonia High School was built also serving as an Elementary School.

According to the 2010 Census, the community has a population of 130. Caledonia is incorporated as a village. Three trustees and a chairperson make decisions regarding city issues.

Technical and Fiscal Resources

Caledonia does not participate in the National Flood Insurance Program and does not have a Flood Insurance Study. Because of this, there is not a Flood Plain Manager. Law enforcement for Caledonia is provided by the Washington County Sherriff's Department which is located in Potosi. The city has one warning siren. The warning siren is controlled by 911 in Potosi.

Caledonia does not currently have a Central Communications Center. 911 capabilities are provided through Potosi. The Washington County Ambulance Service provides ambulance service for Caledonia. There is a Rural/Volunteer Fire Protection District located in Caledonia. The Fire Department provides Certified Emergency Response Training classes.

Caledonia does not have Building Codes. Therefore, there is not a need for an administrator to enforce codes or an inspector.

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.

Existing Plans and Policies

Caledonia's Fire Department has an ISO rating of nine inside the city limits and ten outside of the city limits. The city has an Emergency Operations Plan on file. The city is included in the county LEOP.

Other Mitigation Activities

The local fire department provides education/awareness and emergency preparedness programs for their firefighters.

City of Irondale

Overview

Irondale is one of the larger towns in Washington County and is located nine miles southeast of Mineral Point in Concord Township. Irondale was laid out in 1858 by the Hon. John G. Scott. The Irondale Furnace was located here and the St. Louis, Iron Mountain & Southern Railway went through Irondale as it did Mineral Point.

Irondale furnace was owned by John G. Schott and manufactured pig iron which was then transported to St. Genevieve for shipping downriver. The construction of the railroad in 1856

was a more efficient means of transporting iron by rail rather than using the tedious, overland journey to St. Genevieve.

The Big River, which runs by Irondale, provided an abundant source of clay. A brick manufacturing business, utilizing this source of clay, operated for around twenty years in Irondale. This brick was used to make some of the older buildings still remaining in Irondale such as the old Company Hotel, the Terrill Saloon, and part of the United Methodist Church.

The United Methodist Church was once the Methodist Episcopal Church, South. The split between Methodist Church North and South occurred during the Civil War. The Civil War also left its mark on Irondale when in 1864, General Price and his troops raided the town, looting the stores and burning the railroad bridge which was built over the Big River. After the Civil War the Churches reunited to create the United Methodist Church. There are many older churches in Irondale and many older houses reminiscent of its age and history.^{xi}

According to the 2010 Census, the community has a population of 445. Irondale, a fourth-class city, has three aldermen and a mayor to make decisions regarding city issues.

Technical and Fiscal Resources

Irondale currently participates in the National Flood Insurance Program. Irondale has a Flood Plain Management Ordinance, Flood Plain Manager and a Flood Insurance Study. Elevation Certificates are not maintained. Irondale does not have a police department. Law enforcement in the community is provided by contracted municipal officers through Washington County Sheriff's Department. The city's volunteer fire department and rural fire protection district provides fire protection for the area. The Central Communications Center (911) is located at 12252 North Highway 21, Cadet, MO. As a backup, Irondale uses a mobile communications trailer. The Washington County Ambulance Service accommodates the county, including the city of Irondale.

Irondale's city officials enforce all building codes and ordinances. There is not a state 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 1992 as well as building codes that are enforced by the Public Works Director. Irondale has an Emergency Operations Plan and an Economic Development Plan. The rural fire district's ISO rating is seven and the city ISO rating is also seven. The city is also part of the county LEOP.

Other Mitigation Activities

The local fire department provides education/awareness programs on fire safety to the local school district.

Village of Mineral Point

Overview

The town of Mineral Point is located west of Potosi and was laid out in 1858 by William C. Inks. It was originally located on the St. Louis Iron Mountain & Southern Railway which was later changed to a branch of the Missouri Pacific Railways. The oldest part of town is around the railroad tracks and still has a general store and the old Mineral Point Hotel which is no longer used.^{xii}

According to 2010 Census, the community has a population of 351. Mineral Point was incorporated as a village in 1905. A four-member board of trustees and a chairperson make decisions regarding village issues.

Technical and Fiscal Resources

Mineral Point participates in the National Flood Insurance Program. Mineral Point has a flood plain ordinance and a flood plain manager. Mineral Point has a stormwater management ordinance and adopted building codes enforced by the city council. The building codes require site plan review and building permits for new construction and renovations.

Law enforcement is provided by the Washington County Sheriff's Department. The village does not have a Central Communications Center. 9-1-1 dispatch is provided by the county. The Washington County Ambulance Service provides ambulance service for Mineral Point. The Potosi Fire Protection District provides fire protection. The village has no warning sirens.

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

Mineral Point is a member of the National Flood Insurance Program, maintains an Economic Development Plan and Emergency Operations Plan. The fire department's ISO rating is 6/8B. The city is also part of the county LEOP.

Other Mitigation Activities

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

City of Potosi

Overview

Moses Austin is credited as the “Founding Father of Potosi”. After hearing about the rich lead mines of the southeast Missouri Territory (at that time called Upper Louisiana) Moses Austin, set out from Virginia in 1796 to investigate. Austin, a wealthy, ambitious business man, received a grant for 7,153 arpents [pre-metric French unit of area] of land and transformed lead mining and smelting into Missouri’s first major industry. Austin sank the first mine shaft in Missouri and built the first reveratory furnace west of the Mississippi River. As a condition of Austin’s grant, Austin provided many improvements for the area. He, and his forty or fifty slaves and employees built bridges, roads, a store, a blacksmith shop, a flour mill, a saw mill, a shot tower, and turned out the first sheet lead and cannonballs made in Missouri. In 1798 Austin moved his wife and family to the area where they resided in Durham Hall.

In 1807 the village of Mine Au Breton had about forty houses. From the time of the discovery of lead a continuous settlement has existed there.

When Washington County was organized in August of 1813, Moses Austin donated forty acres of land on the north side of Breton Creek for the establishment of a county seat. Lots and a public square were laid out and a new town evolved around Durham Hall. The town was named Potosi in honor of a silver mining town in Bolivia. Potosi acquired a post office and was the home of two distilleries. The first courthouse was built in 1814-15.

Potosi was located on the north side of Breton Creek and Mine Au Breton. In 1826 the towns consolidated under the sole name of Potosi.

Moses Austin died on June 10, 1821 and was buried at Hazel Run. In 1828 his body was moved and reburied in the Potosi City Cemetery where it remains today. There are cracks in Austin’s tomb made in 1938 when Texans tried to steal Moses Austin’s body and move it to Texas. The undertaker from Texas was caught chipping away at the tomb, thinking that the body was just inside (the body is down in the ground). The Marshall was called and the Texans fled back to Texas. A few weeks later the Governor sent the Secretary of the State of Texas to Potosi with a public apology for the incident. To this day Potosians like to brag that they are the only town that took on the state of Texas and won.^{xiii}

According to the 2010 Census, the community has a population of 2,660. Potosi is a fourth-class city with a four-member board of aldermen and a mayor.

Technical and Fiscal Resources

Potosi participates in the National Flood Insurance Program, has a Flood Plain Management Ordinance, employs a Flood Plain Manager, has a Flood Insurance Study and maintains certificates of elevation.

Law enforcement in the community is provided by a police department located at #1 Police Plaza in Potosi, MO. Potosi has a Central Communications Center (911) located at 12252 North Highway 21, Cadet, MO. As a backup location, Potosi uses a Communications Trailer. The

Washington County Ambulance District provides ambulance service for the county, including the City of Potosi. The Potosi Fire Protection District provides fire protection. The city has four warning sirens which are controlled by 911.

Potosi’s Police Department administers and enforces all building codes and ordinances. There is also one 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 and taxes for specific purposes, 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

Potosi is a member of the National Flood Insurance Program, maintains an Economic Development Plan, Comprehensive Plan, Capital Improvements Plan, Emergency Operations Plan, and an Infrastructure Plan. The fire department’s ISO rating is 6/8B. The city is also part of the county LEOP.

Other Mitigation Activities

The local fire department provides education/awareness and emergency preparedness programs for their firefighters.

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

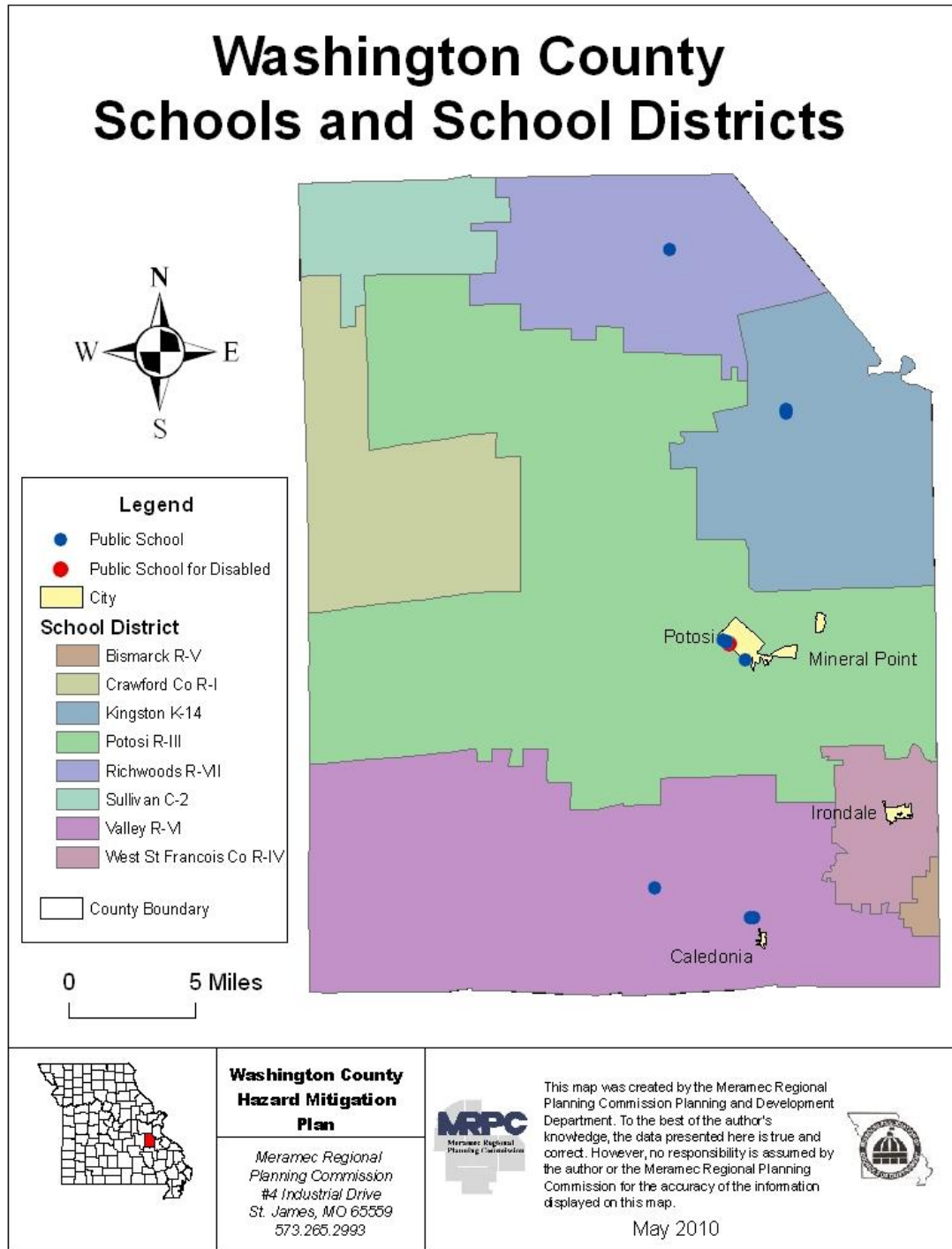
Capability	Washington County	Caledonia	Irondale	Mineral Point	Potosi
Emergency Operations Plan	Y	Y	Y	Y	Y
Building Code/Year	N	N	Y	Y/2985	Y
Fire Department ISO Rating	N/A	9/10	7/7	N/A	6/8B
Floodplain Management Ordinance	Y	N	Y	Y	Y
Zoning Ordinance	N	N	Y/1992	N	Y
Site Plan Review Requirements	N	N	Y	Y	Y
National Flood Insurance Program	Y	N	Y	Y	Y
Economic Development Plan/Policy	Y	N	Y	Y	Y
Stormwater Management Ordinance	N	Y/1990’s	N	Y	Y
Flood Insurance Study	N	N	Y	N	Y
Elevations Certificates Maintained	Y	N	N	N	Y

2.2.3 School Districts

The following school districts are participating jurisdictions in this plan: Potosi R-III, Valley R-VI (Caledonia), Richwoods R-VII (Richwoods), and Kingston K-14 (Cadet). As public

institutions responsible for the care and education of the county's children, these school districts share an interest with Washington County in public safety and hazard mitigation planning. Figure 2-6 provides the boundaries of the school districts participating in this planning process.

Figure 2-6



Technical and Fiscal Resources

The school districts in Washington 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 districts in the county have fire alarms and NOAA weather radios. All schools except Richwoods R-VII have public address systems capable of providing specific instructions in the event of an emergency. Potosi R-III, Valley R-VI and Kingston K-14 each 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. Potosi R-III is the only district to participate in the Emergency Response Information Portal (ERIP) program sponsored by the Missouri Department of Homeland Security. 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 2011-12 Enrollment

Kingston K-14	2011-12 Enrollment – Total: 744
Kingston Primary School (PK-2)	191
Kingston Elementary School (3-5)	177
Kingston Middle School	159
Kingston High School	217
Potosi R-III	2011-12 Enrollment – Total: 2,376
Potosi Elementary School (PK-3)	765
Trojan Intermediate School (4-6)	553
John A. Evans Middle School	395
Potosi High School	663
Richwoods R-VII	2011-12 Enrollment – Total: 175
Richwoods Elementary School (PK-8)	175

Valley R-VI	2011-12 Enrollment – Total: 375
Belegrade Elementary School (PK-2)	83
Caledonia Elementary School (3-6)	110
Valley High School (7-12)	182

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

2.2.4 Colleges/Universities

Mineral Area College Annex is located in the City of Potosi. Mineral Area College offers a variety of degree and certificate programs. Students can earn complete two-year degrees or transfer degrees into a four year program. Additionally, Continuing Education courses are offered to help enrich the lives of residents in the community. Students can take these non-credit courses for personal satisfaction or job enhancement.

Table 2.19 College/University Satellite Campuses Located in Washington County

College/University	Location	Description
Mineral Area College Annex	1201 Louise Street, Potosi, Missouri	Main campus in Park Hills, MO Associate degrees and continuing education

ⁱ History of Washington County October 1, 1984-August 31, 1985; pages 12-13

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

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

^{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} Community Economic Development Strategy – 2007 Update, Meramec Regional Planning Commission

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

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

^x U.S. Geological Survey Fact Sheet FS-027-96

^{xi} History of Washington County October 1, 1984-August 31, 1985; pages 13-14

^{xii} Ibid

^{xiii} <http://carrollscorner.net/Potosi%2CMissouri.htm>

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 Washington 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 Washington 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. Washington 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 Washington 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 Washington County Hazard Mitigation Plan:

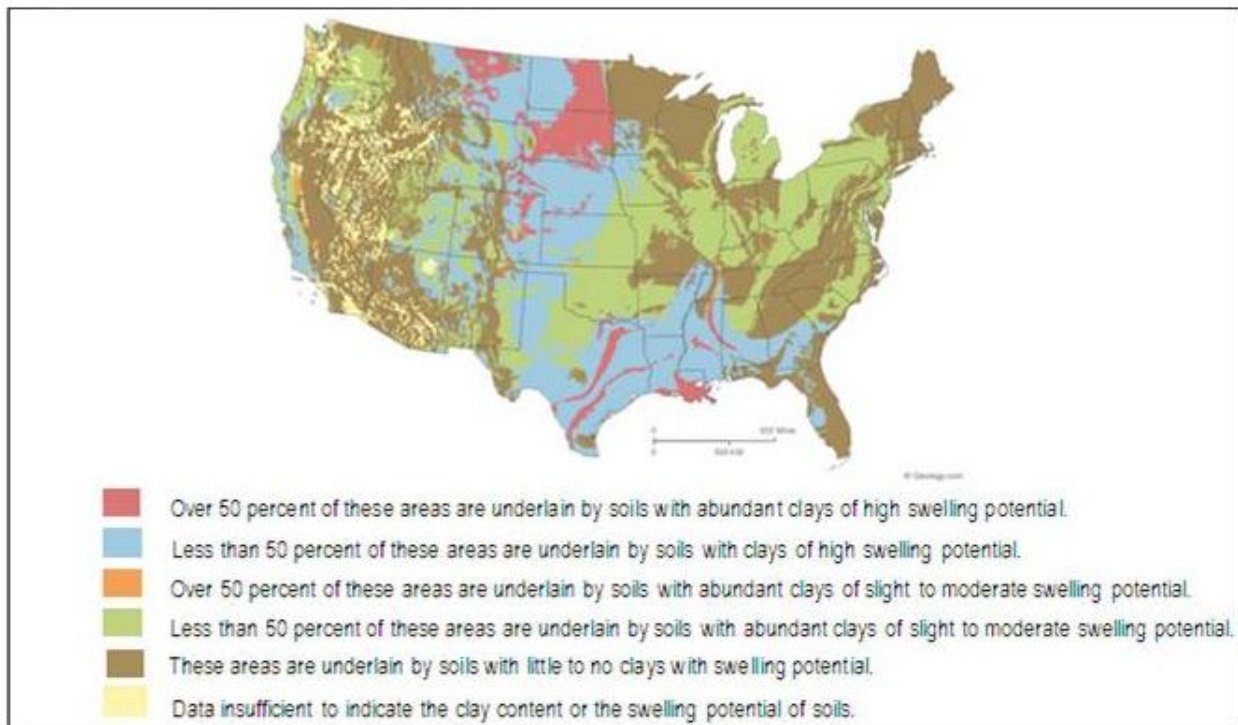
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Landslide
- Land Subsidence/Sinkholes
- Severe Storm (Hailstorm/Windstorm)/Tornado
- Severe Winter Weather
- Wildfire

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 Washington 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. Shrock, R. Schneider & R. Schuster

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

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 Washington 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 Washington County Plan and Affected Jurisdictions

Hazard	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI
Dam Failure	X	X	X	X	X	X	X	X	X
Drought	X	X	X	X	X	X	X	X	X
Earthquake	X	X	X	X	X	X	X	X	X
Extreme Heat	X	X	X	X	X	X	X	X	X
Flood	X	X	X	X	X	X	X	X	X
Landslide	X	X	X	X	X	X	X	X	X
Severe Storms-Hail/Wind	X	X	X	X	X	X	X	X	X
Tornado	X	X	X	X	X	X	X	X	X
Severe Winter Weather	X	X	X	X	X	X	X	X	X
Land Subsidence/Sinkholes	X	X	X	X	X	X	X	X	X
Wildfire	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 Washington 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 62 federally declared disasters since 1957. Of those, 32 have occurred between 2000 and 2011. 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 Washington County from 2000 through 2011.

Table 3.3 Disaster Declaration History of Washington County 2000-2011

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
EM-3317	2/3/2011	Severe Winter Storm	Public Assistance	Adair, Andrew, Atchison, Audrain, Barry, Barton, Bates, Benton, Bollinger, Boone, Buchanan, Butler, Caldwell, Callaway, Camden, Cape Girardeau, Carroll, Carter, Cass, Cedar, Chariton, Christian, Clark, Clay, Clinton, Cole, Cooper, Crawford, Dade County, Dallas, Daviess, DeKalb, Dent, Douglas, Dunklin, Franklin, Gasconade, Gentry, Greene, Grundy, Harrison, Henry, Hickory, Holt, Howard, Howell, Iron, Jackson, Jasper, Jefferson, Johnson, Knox, Laclede, Lafayette, Lawrence, Lewis, Lincoln, Linn, Livingston, Macon, Madison, Maries, Marion, McDonald, Mercer, Miller, Mississippi, Moniteau, Monroe, Montgomery, Morgan, New Madrid, Newton, Nodaway, Oregon, Osage, Ozark, Pemiscot, Perry, Pettis, Phelps, Pike, Platte, Polk, Pulaski, Putnam, Ralls, Randolph, Ray, Reynolds, Ripley, Saint Charles, Saint Clair, Saint Francois,

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
				Saint Louis City, Saint Louis, Sainte Genevieve, Saline, Schuyler, Scotland, Scott, Shannon, Shelby, Stoddard, Stone, Sullivan, Taney, Texas, Vernon, Warren, Washington , Wayne, Webster, Worth and Wright
DR-1847	6/19/2009	Severe Storms, Tornadoes, and Flooding	Individual and Public Assistance	Adair, Barton, Bollinger, Camden, Cape Girardeau, Cedar, Crawford, Dade, Dallas, Dent, Douglas, Greene, Grundy, Hickory, Howell, Iron, Jasper, Knox, Laclede, Lewis, Livingston, Madison, Maries, Marion, Miller, Newton, Oregon, Ozark, Perry, Phelps, Polk, Pulaski, Ray, Reynolds, Ripley, Saint Francois, Sainte Genevieve, Saline, Shannon, Shelby, Stone, Sullivan, Texas, Vernon, Washington , Wayne, Webster and Wright.
EM-3303	1/30/2009	Severe Winter Storm	Public Assistance	Adair, Andrew, Atchison, Audrain, Barry, Barton, Bates, Benton, Bollinger, Boone, Buchanan, Butler, Caldwell, Callaway, Camden, Cape Girardeau, Carroll, Carter, Cass, Cedar, Chariton, Christian, Clark, Clay, Clinton, Cole, Cooper, Crawford, Dade, Dallas, Daviess, DeKalb, Dent, Douglas, Dunklin, Franklin, Gasconade, Gentry, Greene, Grundy, Harrison, Henry, Hickory, Holt, Howard, Howell, Iron, Jackson, Jasper, Jefferson, Johnson, Knox, Laclede, Lafayette, Lawrence, Lewis, Lincoln, Linn, Livingston, Macon, Madison, Maries, Marion, McDonald, Mercer, Miller, Mississippi, Moniteau, Monroe, Montgomery, Morgan, New Madrid, Newton, Nodaway, Oregon, Osage, Ozark, Pemiscot, Perry, Pettis, Phelps, Pike, Platte, Polk, Pulaski, Putnam, Ralls, Randolph, Ray, Reynolds, Ripley, Saint Charles, Saint Clair, Saint Francois, Saint Louis City, Saint Louis, Sainte Genevieve, Saline, Schuyler, Scotland, Scott, Shannon, Shelby, Stoddard, Stone, Sullivan, Taney, Texas, Vernon, Warren, Washington , Wayne, Webster, Worth and Wright.

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
DR-1749	3/19/2008	Severe Storms and Flooding	Individual and Public Assistance	Barry, Barton, Bollinger, Boone, Butler, Camden, Cape Girardeau, Carter, Cedar, Christian, Crawford, Dade, Dallas, Dent, Douglas, Franklin, Gasconade, Howard, Howell, Iron, Jefferson, Laclede, Lawrence, Madison, Maries, McDonald, Miller, Mississippi, Montgomery, New Madrid, Newton, Oregon, Osage, Ozark, Pemiscot, Perry, Phelps, Pulaski, Reynolds, Ripley, Saint Clair, Scott, Shannon, Stoddard, Stone, Taney, Texas, Vernon, Washington , Wayne, Webster and Wright.
EM-3281	12/12/2007	Severe Winter Storms	Public Assistance	Adair, Andrew, Atchison, Audrain, Barry, Barton, Bates, Benton, Bollinger, Boone, Buchanan, Butler, Caldwell, Callaway, Camden, Cape Girardeau, Carroll, Carter, Cass, Cedar, Chariton, Christian, Clark, Clay, Clinton, Cole, Cooper, Crawford, Dade, Dallas, Daviess, DeKalb, Dent, Douglas, Dunklin, Franklin, Gasconade, Greene, Grundy, Harrison, Hickory, Howard, Howell, Iron, Jasper, Jefferson, Johnson, Knox, Laclede, Lafayette, Lewis, Linn, Macon, Madison, Maries, Marion, McDonald, Mercer, Miller, Mississippi, Moniteau, Monroe, Montgomery, Morgan, New Madrid, Newton, Nodaway, Oregon, Osage, Ozark, Pemiscot, Perry, Pettis, Phelps, Pike, Platte, Polk, Pulaski, Putnam, Ralls, Randolph, Ray, Reynolds, Ripley, Saint Charles, Saint Clair, Saint Francois, Saint Louis City, Saint Louis, Sainte Genevieve, Saline, Schuyler, Scotland, Scott, Shannon, Shelby, Stoddard, Stone, Sullivan, Taney, Texas, Vernon, Warren, Washington , Wayne, Webster, Worth and Wright.
DR-1673	12/29/2006	Severe Winter Storms	Public Assistance	Boone, Callaway, Camden, Cole, Greene, Iron, Marion, Miller, Reynolds, Saint Francois, Saint Louis City, Saint Louis, Sainte Genevieve and Washington .
EM-3267	7/21/2006	Severe Storms	Public Assistance	Dent, Iron, Jefferson, Oregon, Saint Charles, Saint Louis City, Saint Louis and Washington .
DR-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

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
EM-3232	9/10/2005	Hurricane Katrina Evacuation	Public Assistance	Adair, Andrew, Atchison, Audrain, Barry, Barton, Bates, Benton, Bollinger, Boone, Buchanan, Butler, Caldwell, Callaway, Camden, Cape Girardeau, Carroll, Carter, Cass, Cedar, Chariton, Christian, Clark, Clay, Clinton, Cole, Cooper, Crawford, Dade, Dallas, Daviess, DeKalb, Dent, Douglas, Dunklin, Franklin, Gasconade, Gentry, Greene, Grundy, Harrison, Henry, Hickory, Holt, Howard, Howell, Iron, Jackson, Jasper, Jefferson, Johnson, Knox, Laclede, Lafayette, Lawrence, Lewis, Lincoln, Linn, Livingston, Macon, Madison, Maries, Marion, McDonald, Mercer, Miller, Mississippi, Moniteau, Monroe, Montgomery, Morgan, New Madrid, Newton, Nodaway, Oregon, Osage, Ozark, Pemiscot, Perry, Pettis, Phelps, Pike, Platte, Polk, Pulaski, Putnam, Ralls, Randolph, Ray, Reynolds, Ripley, Saint Charles, Saint Clair, Saint Francois, Saint Louis City, Saint Louis, Sainte Genevieve, Saline, Schuyler, Scotland, Scott, Shannon, Shelby, Stoddard, Stone, Sullivan, Taney, Texas, Vernon, Warren, Washington , Wayne, Webster, Worth and Wright.
DR-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
DR-1328	5/12/2000	Severe Thunderstorm and Flash Flooding	Individual Assistance	Crawford, Franklin, Gasconade, Jefferson, St. Charles, Ste. Genevieve, St. Francois, St. Louis, Warren and Washington

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

3.2 Profile of Hazards Affecting Washington 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 Washington 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 Washington 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™:

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

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 Washington County Hazard Profile Summary

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Dam Failure - Caledonia Valley R-VI -Washington Co. Irondale Mineral Point Potosi Kingston K-14 Potosi R-III Richwoods R-VII	1	1	4	3	1.65	Low
Drought	1	1	1	4	1.3	Low
Earthquake	2	1	4	4	2.05	Moderate
Extreme Heat	4	3	1	3	3.15	High
Flood -Washington Co. -Caledonia Irondale Mineral Point Potosi Kingston K-14 Potosi R-III Richwoods R-VII Valley R-VI	4	1	4	3	3.0	High
Landslide	1	1	4	1	1.45	Low
Land Subsidence/ Sinkholes	1	1	4	3	1.45	Low
Severe Storm (Hail storm/Wind storm)	4	1	4	1	3	High
Tornado	2	3	4	1	3.15	High
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: Washington 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 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. It is estimated that 50 percent of the dams within Washington County are tailing dams. These dams are constructed of various materials including tailings, cyclone sand tailings, mine waste, earth fill and rock fill. These dams were made to contain mining waste or tailings which are made up of leftover minerals after the milling process and deposited in slurry form within the 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 October 2009, Missouri had 5,239 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 5,239, only about 679 fall under state regulations, while another 64 dams are under federal control.

According to Stanford University's National Performance of Dams Program, there were 84 dam incidents in Missouri between 1968 and 2001. Of these 84 incidents, 18 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 provided to MSDIS by the Missouri Department of Natural Resources Water Resources Center (MDNR-WRC), there are a total of 120 dams located in Washington County. The majority are privately owned. 58 of the 120 dams are at least 35 feet in height and are regulated by the state. Of those 58 dams, 49 are rated as high risk dams – Ashley Branch Dam, Belgrade Dam, Big Four Mine Dam, Black Tailings Dam, Blackwell Mine Dam, Blue Heron Dam, Cadet Mine Tailings Dam, Cadet No. 1 Dam, Cadet No.2 Dam, Casey Lake Dam, Desoto Mine Pit & Plant A Dam, Desoto Pit & Plant B Dam, Dorlac Lake Dam, Dresser Ind. Old #1, Dresser No. 4 Dam, Emerald Lake Dam, Eshbaugh-Martin Dam, Flying S Ranch Dam #2, Forest Lake Dam, Gibson Memorial Dam, Gun Club Lake Dam, Heimos Lake Dam, Howell Mine Dam, Indian Creek Mine Dam – Lower, Keyes Branch Mine Dam, King Arthur's Dam, Kingston No. 1 Dam, Lac Shayne Dam, Lake Apache Dam, Lakeview Dam, Little Indian Creek Dam, Luttrell Lake Dam Lower, Luttrell Lake Upper Dam, Mineral Point #1, Mineral Point #2, Minnetonka Lake Dam, National Lead Industries Dam, Old Mines Tailings Dam, Old Wolf Dam, Palmer Mine Dam, Parole Mine Dam, Pea Ridge Tailings Dam, Pinson Gravel Company Dam, Racola Railings Dam, Richwoods Mine B Dam, Sayersbrook Dam, Settle Mine Dam #2, Spring Lake Dam, and Sun Mine Dam. There are a total of 79 high risk dams in Washington County. Only one dam is rated as a significant hazard. The remaining 33 dams are considered low risk. All of the dams registered with the Missouri Department of Natural Resources (MDNR) and their hazard risk are listed in Table 3.5. The non-regulated dams vary in height from 0 to 34 feet.

Figure 3-2 is a map of the dams in Washington County that shows high hazard dams and also categorizes the dams by dam height.

Figure 3-2

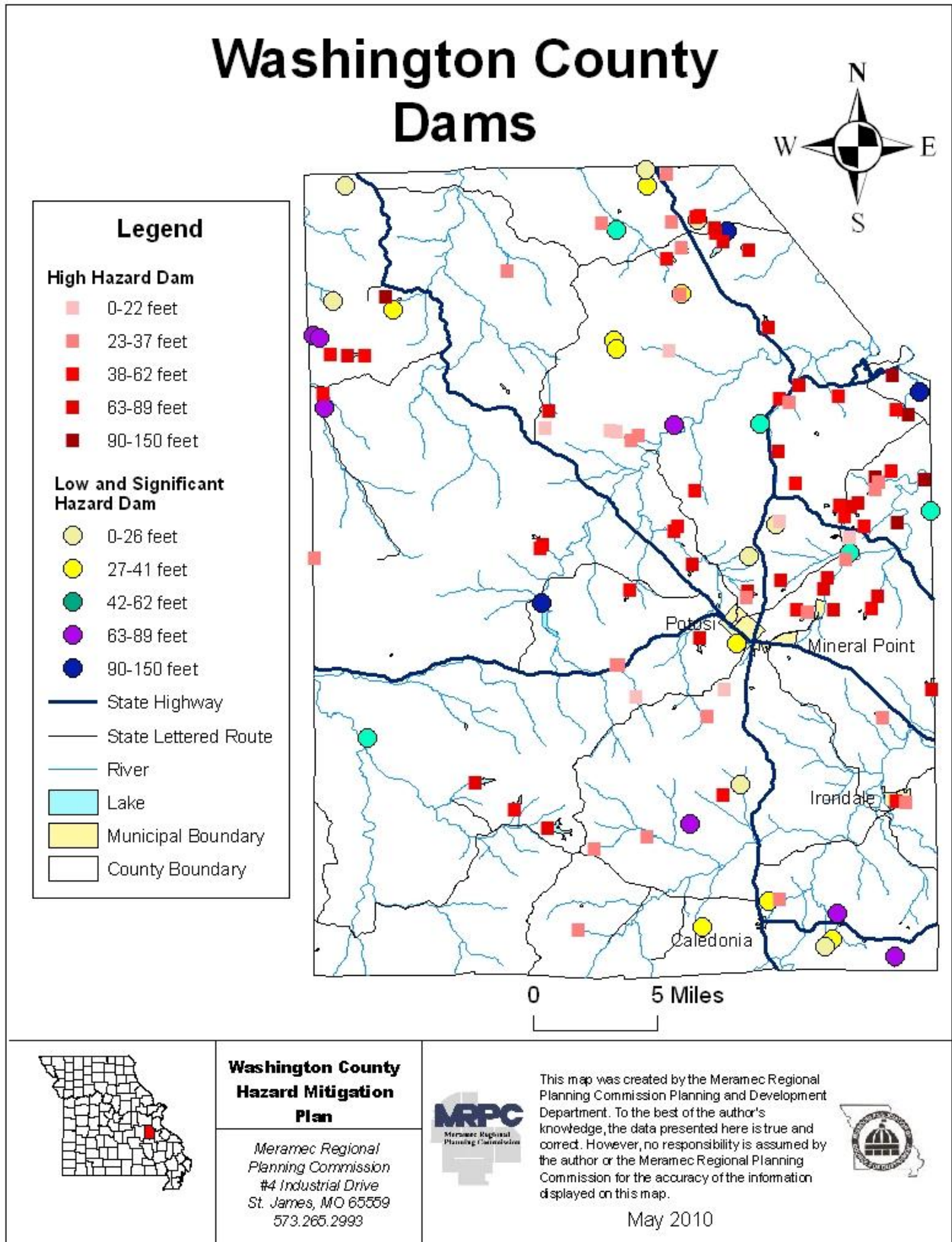


Table 3.5 shows a listing of dams in Washington County, dam height, maximum storage, lake area and their hazard risk. There are 79 dams in the county that are categorized as high risk. This means that a failure of the dam could result in not only property losses but injuries and deaths. There is only one dam categorized as having significant risk – this means that a failure of the dam could result in significant property damage. The remaining 33 regulated 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. Based on the locations of the dams in Washington County, and in particular the high hazard dams, the jurisdictions most vulnerable to dam failure are the cities of Potosi and Irondale, Kingston K-14 and Richwoods R-VII School Districts and portions of Washington 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 Washington County Dams

Name of Dam	Dam Height (ft)	Max Storage (ac-ft)	Lake Area (ac)	Hazard Risk
Abney Lake Dam	36	117	8	Low
Arnault Branch Mine Dam	46	582	41	High
Artesian Lake Dam	26	195	14	High
Ashley Branch Dam	58	1970	105	High
Assaf Lake Dam	30	160	10	Low
Baha Trail Lake Dam	30	433	27	High
Belgrade Dam	55	281	9	High
Bell-Settle Lake Dam	33	230	13	High
Big Four Mine Dam	73	1980	85	High
Black Tailings Dam	70	22	9	High
Blackwell Mine Dam	97	2100	58	High
Blue Heron Dam	51	2176	57	High
Bottom Diggins Dam	41	300	38	High
Bressie Lake	23	74	6	Low
Bust Lake Dam (Breached)	25	80	6	Low
Cadet Mine Tailings Dam	97	103	2	High
Cadet No. 1 Dam	53	264	13.1	High
Cadet No. 2 Dam	77	33	20	High
Cadet No. 3 Dam	74	765	27	High
Carter Lake Dam	62	80	5	Low
Casey Lake Dam	56	120	6	High
Cates Lake Dam	33	212	12	Low
Click Lake Dam	25	67	5	Low
Crystal Lake Dam	65	1770	52	High
Davis Lake Dam	30	48	3	High

Name of Dam	Dam Height (ft)	Max Storage (ac-ft)	Lake Area (ac)	Hazard Risk
Del Lago Lake Dam	33	106	6	Low
Del Vista Lake Dam	33	88	5	Low
Desoto Mine Pit & Plant A Dam	78	3700	180	High
Desoto Pit & Plant B Dam	54	248	12	High
Dessieux Lake Dam	28	470	18	High
Ditch Creek Dam	60	1500	14	High
Dorlac Lake Dam	45	758	31	High
Dresser #1 Dam	30	1295	44	High
Dresser Ind. Old #1	45	1300	39	High
Dresser Minerals #7 Dam North (Dry)	15	305	38	High
Dresser Minerals #7 Dam South (Dry)	34.6	80	37	High
Dresser Minerals Dam Sec 24 (Dry)	29	528	34	Low
Dresser Minerals No 7 Dam (Dry)	30	650	31	Low
Dresser No. 4 Dam (Failed)	105	4325	77	High
Emerald Lake Dam	46	405	23	High
Eshbaugh-Martin Dam	115	81	11	High
Floyd Lake Dam	21	90	8	High
Flying S Ranch Dam #2	62	127	8	High
Forest Lake Dam	50	409	39	High
Four Winds Way Dam	31	199	12	High
Gibson Memorial Dam	45	184	6	High
Gudaitis Lake Dam	25	158	6	High
Gun Club Lake Dam	85	1400	60	High
Hahn Lake Dam	30	241	15	High
Heimos Lake Dam	37	610	35	High
Hematite Lake Dam (Breached)	25	80	6	Low
Henpeck Hollow Dam	24	141	11	High
Hill View Lake Dam Sourth	20	96	9	Low
Hill View Lake Dam	25	67	5	Low
Hoffman Lake Dam	25	134	10	High
Hopkins Lake Dam	30	80	5	Low
Howell Mine Dam	58	1460	71	High
Indian Creek Mine Dam-Upper	0	791	10	High
Indian Creek Mine Dam-Lower	84	875	32	High
Jones Lake Dam	34	200	11	Low
Keuss Dam	45	378	21	Significant
Keyes Branch Mine Dam	77	1192	61	High
King Arthur's Dam	80	2000	33	High
Kingston No. 1 Dam	85	1700	60	High
Kirkpatrick Lake Dam	20	11	1	High
Lac Shayne Dam	72	2475	51	High
Lake Apache Dam	41	142	5	High
Lake Cherokee Dam	27	72	5	High

Name of Dam	Dam Height (ft)	Max Storage (ac-ft)	Lake Area (ac)	Hazard Risk
Lake 2 Dam	15	104	13	Low
Lake Melissa Dam	34.9	20	3	Low
Lakeview Dam	68	1750	80	High
Lane Lake Dam (Federal)	30	160	10	Low
Little Indian Creek Dam	58	1280	60	High
Lower Dresser No. 4 Dam	31	116	7	High
Luttrell Lake Dam Lower	41	132	9	High
Luttrell Lake Upper Dam	44	257	20	High
Mineral Point #1	72	2200	68	High
Mineral Point #2	89	1191	25	High
Minnetonka Lake Dam	74	2500	90	High
Mononame 267	16	51	6	Low
Mononame 551	15	48	6	Low
Mononame 558	26	42	3	Low
Mononame 563	20	64	6	Low
Mononame 582	20	171	16	Low
Mononame 588	20	75	7	Low
Mononame 862	12	32	5	Low
Mononame 866	15	Not Available	6	Low
Mononame 875	20	235	22	High
Moosehorn Lake Dam	20	54	5	Low
National Lead Industries Dam	99	363	25	High
Old Mines Tailings Dam	61	286	36	High
Old Wolf Dam	48	182	8	High
Palmer Mine Dam	76	1460	112	High
Parole Mine Dam	64	1000	71	High
Pea Ridge Tailings Dam	150	4100	80	High
Pine Tree Lake East Dam	33	159	9	High
Pine Tree Lake West Dam	28	120	8	High
Pinson Gravel Company Dam	79	875	3	High
Pioneer Rod & Gun Club Dam	25	120	9	Low
Podorski Lake Dam	26	83	6	High
Potosi Lake Dam	33	438	20	High
Powder Spring Lake Dam	28	195	13	High
Racola Railings Dam	78	29	4	High
Richwoods Mine B Dam	48	1000	57	High
Rieffer Lake Dam	23	86	7	Low
Rogue Creek Upper Dam	17	109	12	High
Russel Elsey Dam	21	224	18	High
Sampson Lake Dam	25	54	4	Low
Sayersbrook Dam	67	1080	36	High
Schnelle Lake Dam	25	134	10	High
Settle Mine Dam #2	68	300	26	High

Name of Dam	Dam Height (ft)	Max Storage (ac-ft)	Lake Area (ac)	Hazard Risk
Something Green A Dam	27	347	24	High
Something Green B Dam	22	118	10	High
Spring Glen Lake Dam	33	194	11	High
Spring Lake Dam	27	92	6	High
Spring Lake Dam	41	191	12	High
Sun Mine Dam	56	2100	80	High
Sunnen Dam	51	5000	198	Low
The Place Lake Dam	16	94	7	High
Wing Lake Dam	32	428	25	Low

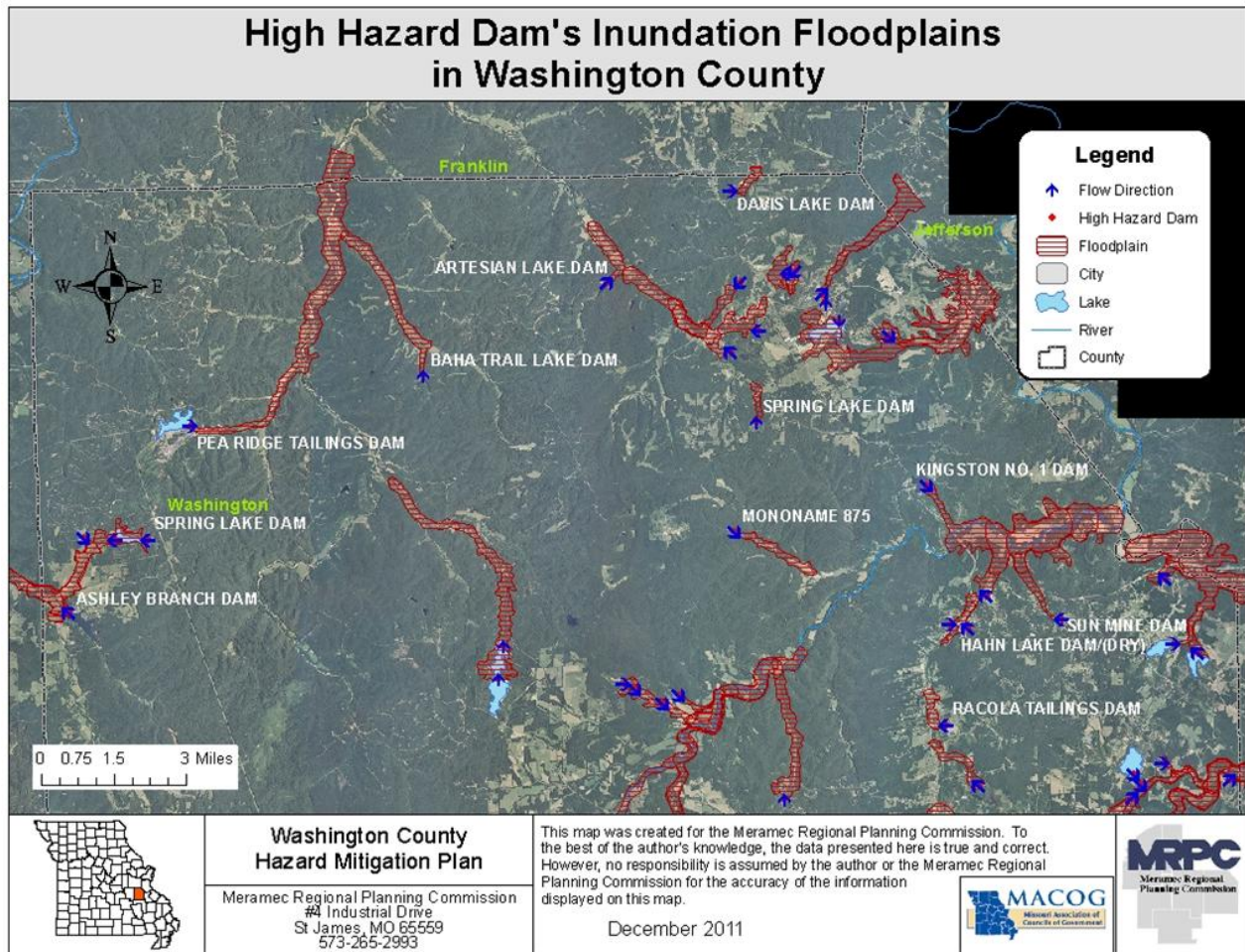
Source: Washington County Emergency Operations Plan and Missouri Department of Natural Resources – website: http://www.dnr.mo.gov/env/wrc/damsft/Crystal_Reports^k

An insufficiency exists in the data for dams in Washington 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. 120 of the dams are classified by MDNR as high hazard dams. Many of these high hazard dams have structures or infrastructure located below the dam. The aerial maps included in Figure 3-2 through 3-9 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.

There are eleven high risk dams located in the north east portion of Washington County. Desoto Pit & Plant B Dam is located in the northeast portion of Washington County. Several homes, a farm and a few local roads might be damaged if a dam failure occurred. Richwoods Mine B Dam does not have any structures in danger of damage and would drain directly into a natural waterway surrounded by forest. Ditch Creek Dam would most likely affect State Highway H located one tenth of a mile from the dam. Desoto Mine Pit & Plant A Dam is located in a sparsely populated area, but a dirt track, several mobile homes and a few homes may be affected. Big Four Mine Dam is located primarily near farm ground and forest areas, with two homes which may be affected if the dam fails. Kingston No.1 Dam is located in a sparsely populated area, however a farm located 1.4 miles from the dam and Highway 47 which runs parallel to the inundation area may be damaged. Pinson Gravel Company Dam drains under Highway 21 to a water way two-tenths of a mile from the dam then runs parallel to the highway. Although not directly in the mapped inundation zone it is important to note that Kingston Middle and Kingston Elementary Schools are located eight-tenths of a mile from the dam and may be damaged during a failure. Two additional dams are in close proximity to the Kingston schools – Casey Lake Dam and Hahn Lake Dam are both less than two-tenths of a mile from the schools and the school buildings are believed to be in the inundation zones of both dams. Highway 21/47 will also most likely see some damage during a dam failure. Dorlac Lake Dam flows to a water way below the dam, five-tenths of a mile downstream are two homes which may receive

damage. Kirkpatrick Lake Dam is located six-tenths of a mile from a subdivision and Highway 21 as well as two farms one mile away and County Road 317 located 1.6 miles from the dam. Sun Mine Dam may affect three homes and Highway CC which is located less than a half mile from the dam. Highway 21, three houses and 15 mobile homes are located within a quarter mile of Eshbaugh-Martin Dam. Blackwell Mine Dam is surrounded by pasture and forest. The only dam in the county which is identified as a significant risk is also located in the north east portion of the county. Keuss Dam is located a half mile from an industrial site and Highway H.

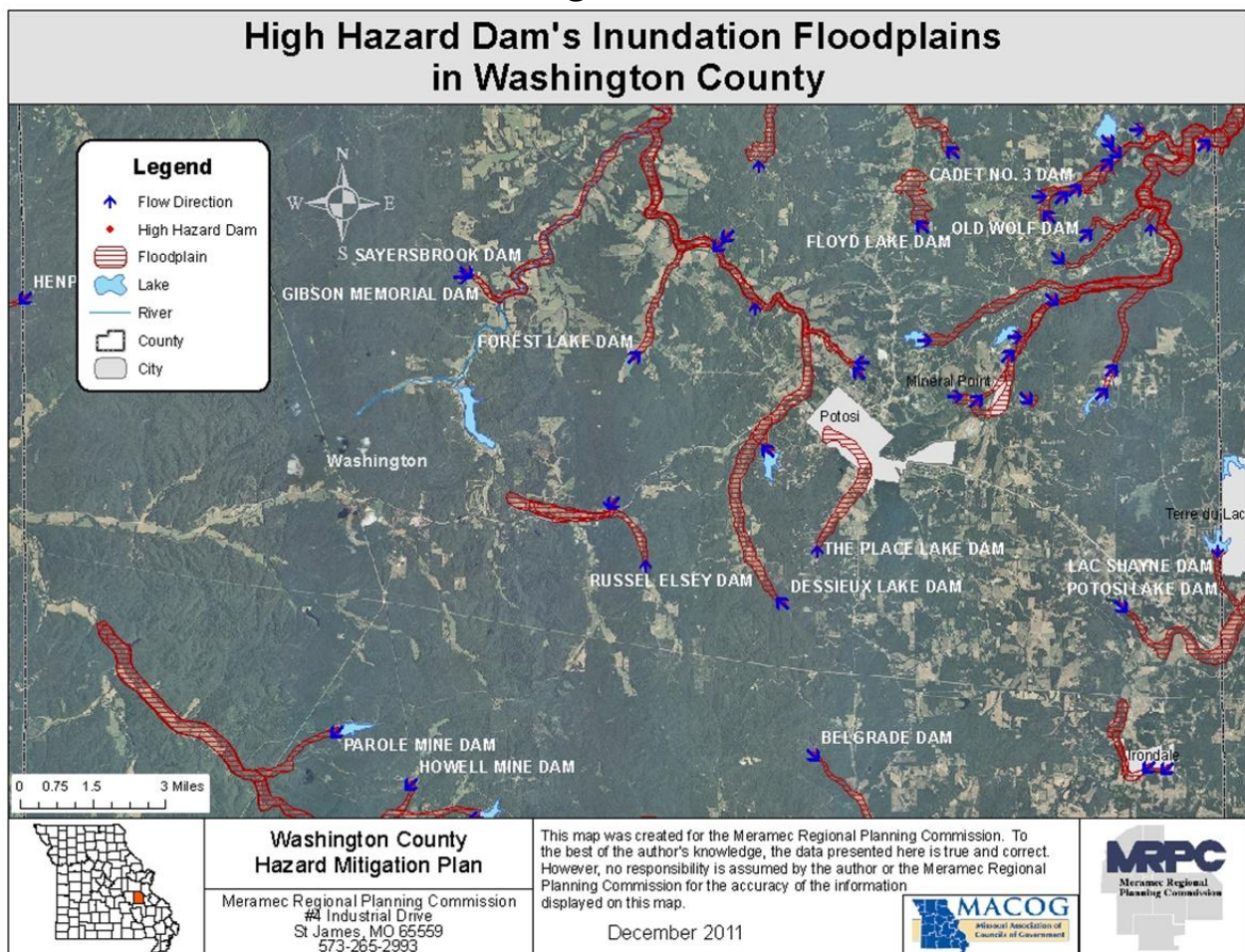
Figure 3-3



Ten high risk dams are located in the north central portion of Washington County. Artesian Lake Dam is located in a predominately forested area with one home located at the base of the dam. Baha Trail Lake Dam is predominately surrounded by pasture and forest, some homes exist but they are not identified as being in the inundation zone if a failure occurs. Davis Lake Dam is located in a predominately forested area. Damage from a dam breach would likely be limited to a single phase electric easement located a quarter mile from the dam and a private road. No homes appear to be in the inundation zone. Hoffman Lake Dam is located near a manufactured home

park with 17 homes. In addition, County Road 306 and Highway A are located within one mile of the dam and presumed to be within the inundation zone. One farm is located three-tenths of a mile from the dam and also presumed to be in the inundation zone if a failure were to occur. Minnetonka Lake Dam is located west of Hoffman Lake Dam in a much more sparsely populated area; one home is located approximately one mile from the dam along with several unimproved roads. Heimos Lake Dam and Little Indian Creek Dam are both located less than a half mile from the unincorporated area known as Richwoods. Richwoods predominately falls within the inundation zone of both dams as well as County Road 306, County Road 348 and Highway A. Richwoods is a primarily residential area with a few commercial businesses and one school. Richwoods Elementary School, located on Highway A, would most likely receive damage if either dam failed. There are two farms, one house, County Road 306 and the junction of Carp Lake Road and Valle Road located less than seven-tenths of a mile from Spring Lake Dam in the inundation zone. Mononame 875 is located in a predominately forested area but two farms may receive damage in the event of a failure. The area surrounding Indian Creek Mine Dam-Lower is mostly uninhabited with the closest home more than two miles away. However a branch of the Union Pacific Railroad is located a quarter mile from the dam and would most likely be damaged.

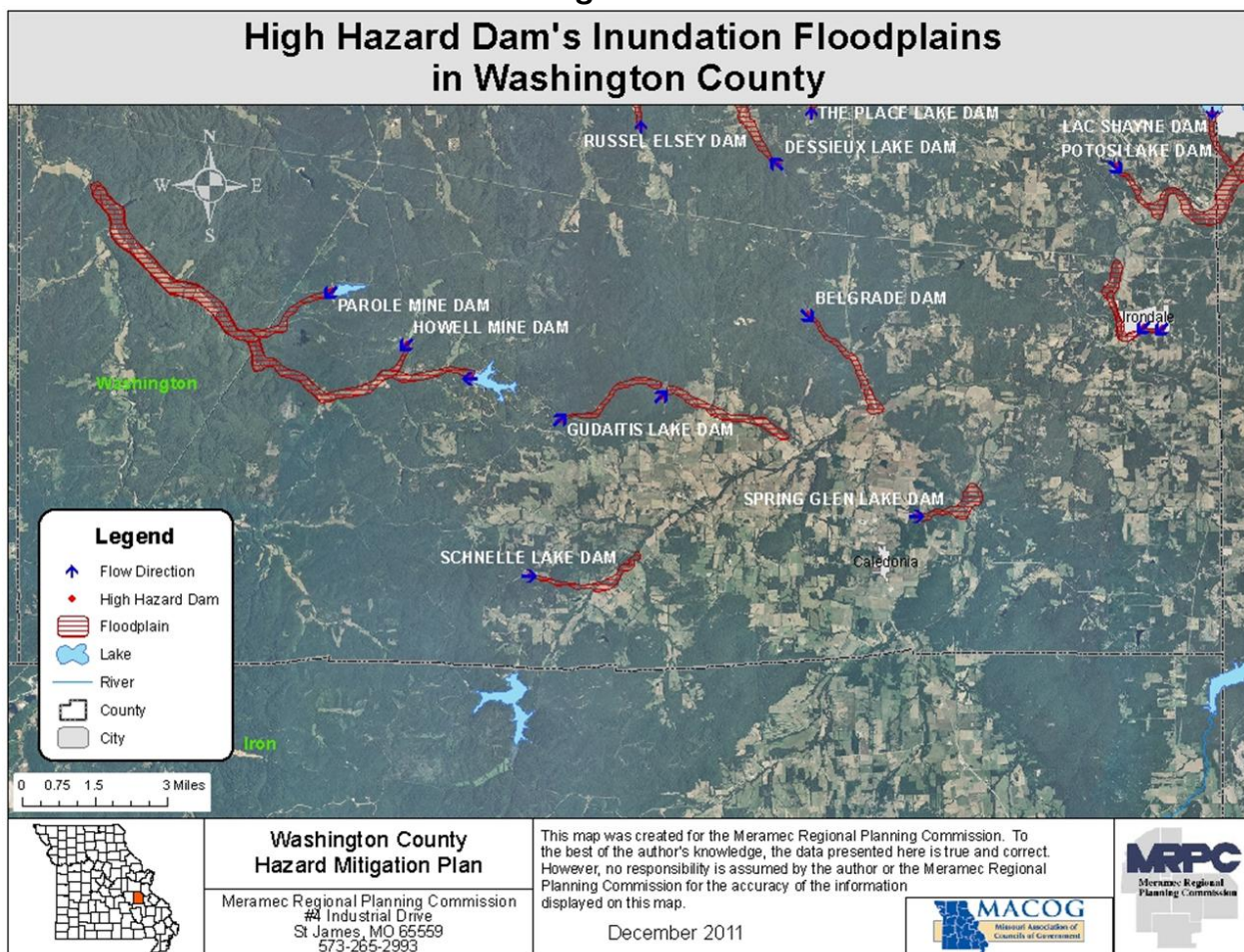
Figure 3-4



Five dams categorized as high risk are located within the northwest portion of Washington County. Ashley Branch Dam is located in a sparsely populated area of forest and farmland. Crystal Lake Dam, Emerald Lake Dam, and Spring Lake Dam are in close proximity to one another. Spring Lake Dam drains into Crystal Lake. Both Crystal Lake Dam and Emerald Lake Dam share an inundation zone. The area for these dams is predominately pasture ground with a single farm located approximately one mile from the dams. Pea Ridge Tailings Dam is located in a forested area with no homes found in the inundation zone. A branch of the Union Pacific Railroad located a tenth of a mile from the dam would most likely be affected by a failure.

The east central portion of the county near the communities of Potosi and Mineral Point has 25 high risk dams identified. Racola Tailings Dam drains to a natural waterway approximately three tenths of a mile from the dam. Highway 21 is in close proximity to the waterway and may receive damage during a failure. Five homes and one business were observed in the possible inundation zone. The inundation zone of the Flying S Ranch Dam #2 contains one home a tenth of a mile and one barn three tenths of a mile from the dam. Dresser No. 4 Dam is located about one tenth of a mile from County Road 410 which could receive damage during a failure. Lower Dresser No. 4 Dam and Powder Spring Lake Dam are predominately in a forested area, no

Figure 3-5



structures were observed in the inundation area. The Union Pacific Railroad has a line approximately a quarter mile from Lead Industries Dam. The dam drains to a natural waterway approximately a tenth of a mile from the dam. No structures were observed in the inundation zone. Old Mines Tailings Dam drains to a small lake two-tenths of a mile north. Villmer Road is three tenths of a mile, County Road 437 is six-tenths of a mile and County Road 402 is 1.6 miles from the dam. Between County Road 402 and the dam are a total of 16 homes possibly located in the inundation zone. The inundation area of Floyd Lake Dam is predominately wooded. The failure of Bottom Diggins Dam would affect State Highway E, Powder Springs Road and one home all located within two-tenths of a mile of the dam. Cadet No.1 Dam would affect Highway E, three homes, farmland and a junk yard. Cadet No.2 Dam and Cadet No.3 Dam would affect Powder Springs Lake Road, forest and farmland. It is doubtful that residences would receive damage. Cadet Mine Tailings Dam would mainly affect forest and some pasture before it reached the natural waterway. It is important to note the waters would travel under the Union Pacific Railroad possibly causing damage to the existing trestle bridge. Old Wolf Dam is located in a heavily forested area. However, five homes appear to be in the inundation zone. Dresser Minerals #7 Dam North and Dresser Minerals #7 Dam South are both located on spurs of the Union Pacific Railroad. Settle Mine Dam #2 and Bell-Settle Lake Dam's inundation zones are primarily made up of farmland. An asphalt road named Westview Lane and three farms may receive damage in the event of a dam breach. Although the area of Keyes Branch Mine Dam is populated, no homes appear to be in the inundation zone. It is likely damage will be restricted to undeveloped property and Radio Station Road. Mineral Point #1 and Mineral Point #2 dams are located north of the town of Mineral Point. Based on the inundation zone analysis, if a breach were to occur it would not affect the community. Damage would be to mostly forested areas and the Union Pacific Railroad located approximately a quarter mile from the dams. Drainage from the Blue Heron Dam would flow a short distance to a recreational lake with a dam known as King Arthur's Dam causing damage to Rainbow Springs Road. King Arthur's Dam if breached would cause damage to County Road 46, one home and one farm, all located within the inundation area and within two-tenths of a mile of the dam. Black Tailings Dam mostly damage forest, but may affect ten mobile homes and one house. The community of Mineral Point is located in the inundation zone of Dresser #1 Dam and Dresser Ind. Old #1 dams. A breach of either dam could cause damage to numerous homes, businesses, the Washington County Headstart and the Potosi Correctional Facility. Lac Shayne Dam's inundation zone is restricted to predominately forested areas. One high risk dam is located in the vicinity of the City of Potosi, the largest community within the county. The Place Lake Dam is located approximately two miles south of Potosi. Based on available information and analysis, Potosi is within the inundation zone of Place Lake Dam. Several structures including homes, retail businesses, and governmental offices including the court house and city hall, library, Citadel State School, John Evans Middle School, Trojan Intermediate School and Potosi High School are located within areas that would likely be affected if the dam failed.

The center portion of the county is home to fifteen dams designated as high risk. Indian Creek Mine Dam-Upper damage would be restricted to forested land in the event of a dam breach. Rogue Creek Upper Dam, Something Green B Dam and Something Green A Dam comprise a three stage lake system. Rogue Creek Upper Dam if breached would flow directly into the lake contained by Something Green B Dam causing no damage. In the event Something Green B

Dam failed there is one structure in the inundation zone prior to discharging into Lake Four Winds which is contained by Something Green A Dam. In the event of Something Green A Dam failing there is one farm, one house, one business and Rogue Creek Road located directly below the dam in the inundation zone. Four Winds Way Dam is located adjacent to Something Green A Dam and would affect one home, one farm and Kingston Road. Arnault Branch Mine Dam does not appear to have any structures, only roads within the inundation zone. County Road 329 and Arnault Branch road would most likely be damaged. Luttrell Lake Upper Dam and Luttrell Lake Dam Lower comprise a two stage lake system. The upper dam if breached would flow directly into the lower lake. If Luttrell Lake Dam Lower breached the flow would spill directly into a natural waterway and channeled under a bridge of the Union Pacific Railroad. There are five homes within the first one mile of the waterway. Gun Club Lake Dam if breached would flow into a waterway at the base of the dam and be channeled northwest toward the Union Pacific Railroad approximately one mile away. No structures appear to be within the inundation zone. Gibson Memorial Dam and Sayersbrook Dam are located adjacent to one another, sharing a common inundation zone. Located within three-tenths of a mile of the dams are Sayersbrook Road, Sayersbrook Bison Ranch, and one home, one restaurant a swimming pool and tennis court. Forest Lake Dam impounds the waters of Hornsey Brothers Lake. Four homes and Highway AA are located within the inundation zone within four-tenths of a mile of the dam. Lakeview Dam contains the waters of Hornsey Lake. If breached, this dam will affect 24 homes, one farm and Highway 8. Pine Tree Lake East Dam and Pine Tree Lake West Dam contain two abutting lakes which share a single spillway. Within a tenth of a mile of the dams are ten homes, Old Highway 38 and Highway 8; all within the inundation zone of the dams.

Henpeck Hollow Dam is the only high risk dam identified in the west central portion of the county. The area surrounding the dam is remote and primarily forest. No structures were observed and it is assumed that damage would be minimal.

There are five high risk dams located in the south east portion of Washington County. Potosi Lake Dam drains one mile to a river. Damaged areas caused by a breach may include Green Acres Road, five homes and eight mobile homes. Belgrade Dam is located in a predominately undeveloped area. Damage will most likely be limited to forested areas. Lake Cherokee Dam if breached may damage ten homes, forest and pasture land, Scout Camp Road, Highway M and a portion of the Union Pacific Railroad. Lake Apache Dam is located west of Lake Cherokee Dam and shares a similar inundation zone which includes eight homes, forest and pasture land, Scout Camp Road, Highway M and a portion of the Union Pacific Railroad. Spring Glen Lake Dam is remotely located. If the dam is breached possible damage will be limited to one farm, unimproved roads and forest.

The south central portion of the county has eight dams identified as high risk. Damage caused by a breach of Russel Elsey Dam would predominately be to forested land, but two homes and Highway 8 may experience some damage. The failure of Dessieux Lake Dam would mostly cause damage to forested land but may have some effect on Highway P located about one and a half miles from the dam. Parole Mine Dam is in a predominately forested area but a dam breach may cause damage to Walker Road, Palmer Road and an unimproved road which are located within one mile of the dam. Also a church and cemetery located just over one mile from the dam may experience some damage depending on the severity of the breach. A breach of Howell Mine

Dam would cause damage primarily to forested areas, but may also cause damage to County Road 651A located a half mile from the dam. Palmer Mine Dam is remote. A breach would cause little to no damage except for forested land and one unimproved road located in the inundation zone. Podorski Lake Dam is located in a sparsely populated area and drains to a water way two-tenths of a mile from the dam. A dam failure may cause damage to one farm located three-tenths of a mile from the dam, and an unimproved road. Gudaitis Lake Dam is located in a heavily forested area with no structures observed. Damage would be limited to an electric transmission line located less than a tenth of a mile from the dam. If breached, damage from the Schnelle Lake Dam would be minimal, limited to pasture and forested areas.

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

A barite tailing pond dam in Washington County failed in 1975 and contaminated some tributaries to the Big River. There have since been no dam failures. About half of the county's dams hold old tailing ponds. If a dam failure were to occur in Washington County, the severity would likely be limited since very few people live near the tailing ponds, but could be critical due to potential contaminated water sources. Most of the tailing ponds are dry. 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 Irondale, Mineral Point and Potosi, portions of Washington County, Kingston K-14 School District, Potosi R-III School District and Richwoods R-VII School District- Limited (2) – 10 to 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 of the proximity of high hazard dams to all of these jurisdictions, and with some portion of each jurisdiction being either in or adjacent to estimated inundation zones, we have given these jurisdictions a higher rating than the rest of the jurisdictions. Roads, bridges, homes, school facilities and businesses could be damaged if a catastrophic dam failure occurred.

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. If a dam failure were to occur in Washington County, in most cases the severity would likely be limited since very few people would be affected by the failure of one of the county's dams. The threat is not negligible, however, because a flash flood would quickly follow a dam failure, threatening those living below the dam. Roads, bridges and homes could be demolished.

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 has not been a dam incident in the county since 1975, the probability of a future occurrence is not likely.

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 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

A dam failure in Washington County would likely 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. The exception might be if a dam failure occurred that would damage school facilities. This might result in a wider impact as it could affect school children from throughout a school district. Damage to highways and bridges could result in transportation problems that might take weeks or months to repair. Although the Taum Sauk Reservoir incident had a great impact on the local economy of that area, there are no dams in Washington County that are economically significant enough to have a similarly adverse economic impact.

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. Encourage jurisdictions to review and exercise plans for dam failures.

Hazard Summary – Dam Failure – Washington County, Cities of Irondale, Mineral Point, Potosi & School Districts of Kingston K-14, Potosi R-III & Richwoods R-VII

Calculated Priority Risk Index	Planning Priority
1.95	Low

Hazard Summary – Dam Failure – City of Caledonia, Valley R-VI School District

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:

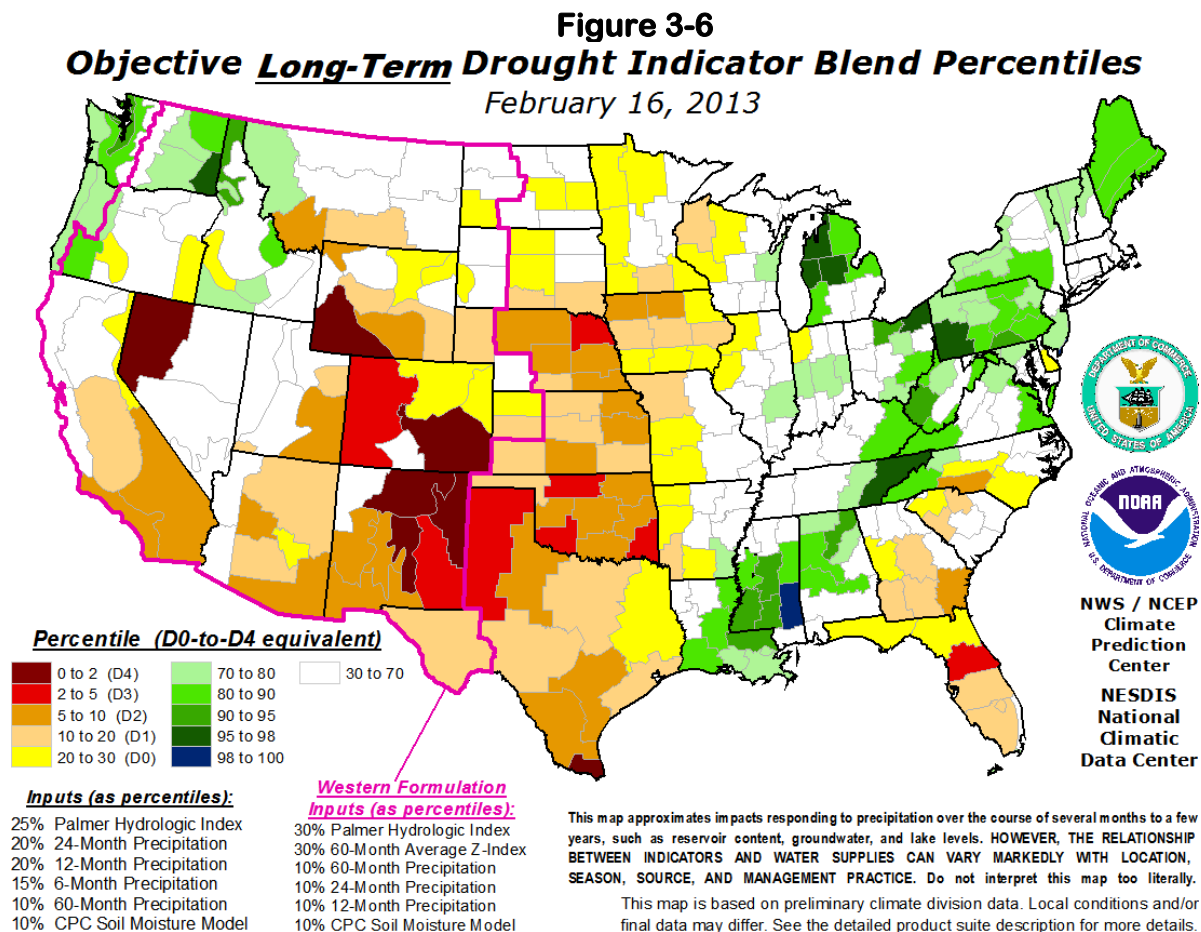
1. **Agricultural Drought**, defined by soil moisture deficiencies.
2. **Hydrological Drought**, defined by declining surface and groundwater supplies, and
3. **Meteorological Drought**, defined by precipitation deficiencies.

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."

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}

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.



Likely Locations

All areas of Washington 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 loss of yield in 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 six drought events reported for Washington 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. The third began in as a moderate drought in April 2012 and upgraded to severe drought in July of 2012 continuing into 2013.

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 Washington 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 Washington 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, Washington 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 Washington 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 Washington 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 Washington County will likely have no or little impact on the daily activities of Washington 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 Washington 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 volcanism (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. Sand blows 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

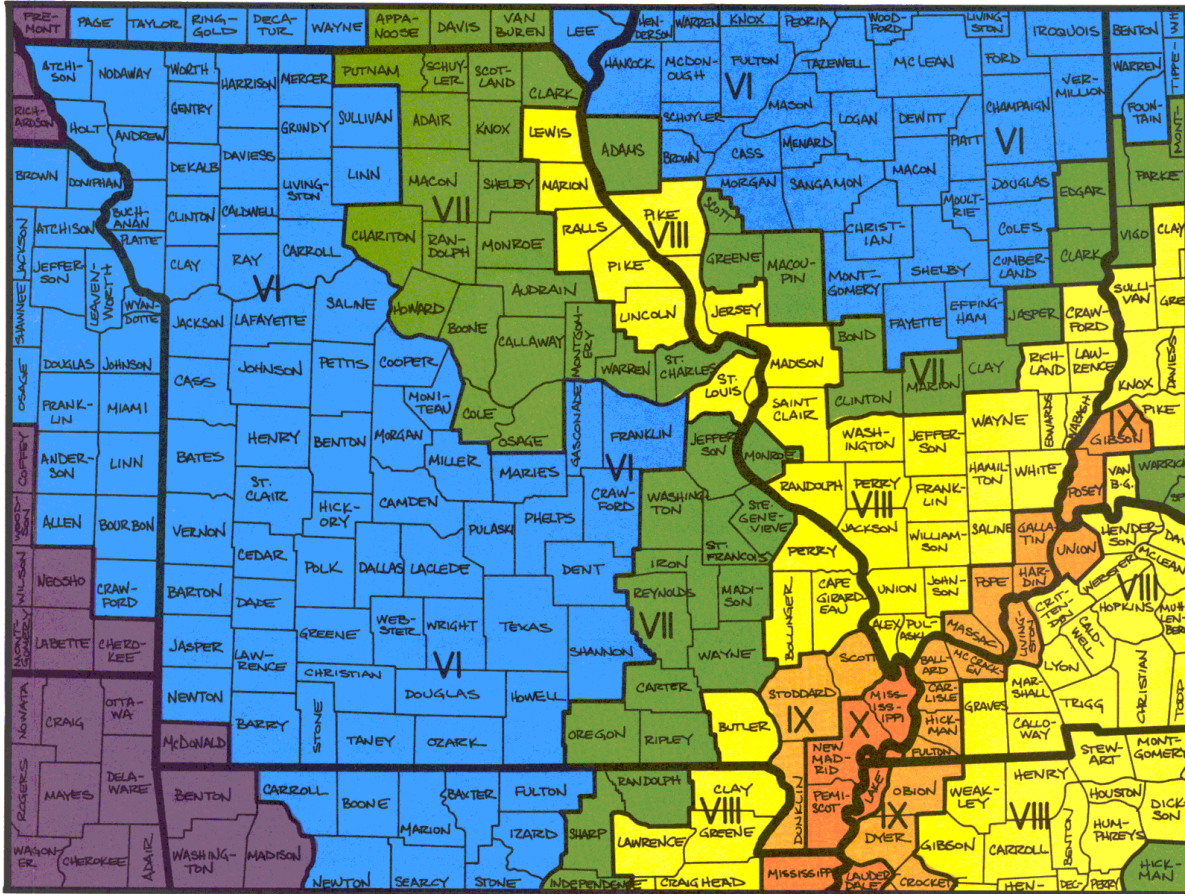
MMI	Felt Intensity
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. 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.

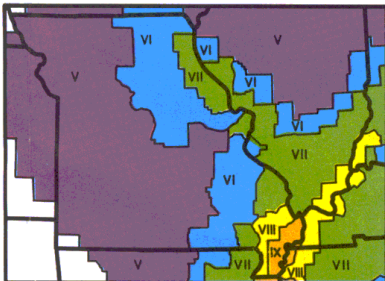
Hazard History

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.

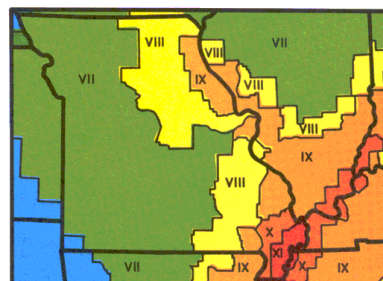
Figure 3-7
PROJECTED EARTHQUAKE INTENSITIES



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 Cuba in neighboring Crawford County. According to information from the USGS, a microearthquake happened about 5 miles northwest of Cuba 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 Washington County.

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.

Washington County is located in east central Missouri, less than 150 miles 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, in the event of a severe quake in southeast Missouri, Washington County could experience a range of damage from negligible damage in well-designed buildings; slight to moderate damage in well-built ordinary structures and considerable damage in poorly built or designed buildings, including broken brick work such as chimneys. However, after running the HAZUS scenario for

Washington County, the results showed that there would be no significant damage to structures or infrastructure, nor would functionality of critical systems be affected in any significant way. Additional 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

Based on HAZUS reports showing no damage to structures or infrastructure in Washington County, 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. Washington County is located in the south central part of the state and Figure 3-3 – Earthquake Intensity Map shows that the county, at a Mercalli rating of VII, could have various levels of damage based on the design and construction of buildings. However, scenarios run with HAZUS indicate that there will be no significant damage to structures, infrastructure or the functionality of critical systems in the county. The damage, comparatively speaking, would be much milder than what would occur in counties located closer to the New Madrid region. Another consideration is that if a catastrophic earthquake were to occur, Washington 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 Washington County is not in the New Madrid shock zone, it will most likely endure some damage from the earthquake to poorly constructed or designed buildings, utility disruption, environmental impacts and economic disruptions/losses. If a major earthquake should occur,

Washington 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 Washington 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

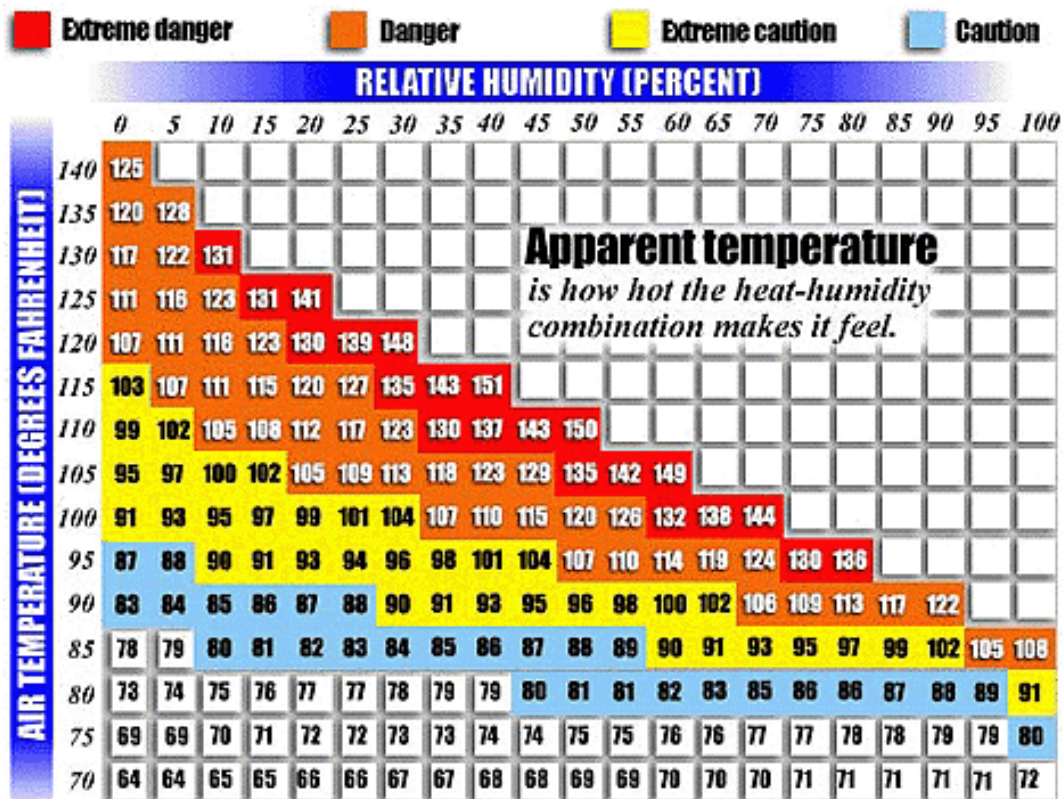
Heat can kill by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. 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 effects 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

Nineteen instances of excessive heat were recorded in Washington County between 1994 and 2001. A 1995 heat wave led to the death of a 93-year-old woman in a Potosi mobile home and 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 Washington 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 Washington County. The Washington 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

Critical – 25 -50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries resulting in permanent disability (3). Extreme heat has the potential for and has caused death in Washington County – and so could be classified as catastrophic. But historically, heat-related deaths have seldom occurred in Washington 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} Because Washington County has had heat related deaths in the past, has a high level of poverty, which increases vulnerability to this hazard, extreme heat is being ranked as Critical.

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 Washington 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 Washington County the impact will probably have a low impact on the community as a whole. However, due to Washington County’s high level of poverty, and the fact that the poor and elderly are at higher risk of injury and death from heat waves, the County needs to take steps to provide cooling shelters and similar mitigation actions to protect this segment of the population. 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 and may result in power outages or brownouts.

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 Washington 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 and if necessary set up cooling shelters.

Hazard Summary – Extreme Heat – All Jurisdictions in Washington County

Calculated Priority Risk Index	Planning Priority
3.15	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

Flooding in Washington County is typically mild and affects small areas of the county. However, flash flooding has been known to cause inconveniences in some cities. While the flooding mainly affects low water bridges on county-maintained roads, it has been known to flood some Potosi city streets. Drivers who travel on the county maintained roads have dealt with closed roads numerous times due to flash flooding. Flash flooding has also closed some state highways.

Typical damages caused by Washington 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.

Geographic Location

Of the five participating jurisdictions in the Washington County Hazard Mitigation Plan, four are members of the National Flood Insurance Program (NFIP). Those are Washington County and the cities of Irondale, Mineral Point and Potosi. The Village of Caledonia is not currently a member of the NFIP. According to FEMA, there are Flood Insurance Rate Maps (FIRMs) for the unincorporated areas of Washington County and for the cities of Caledonia, Irondale, Mineral Point and Potosi. Digitized FIRM data is currently not available for the county.

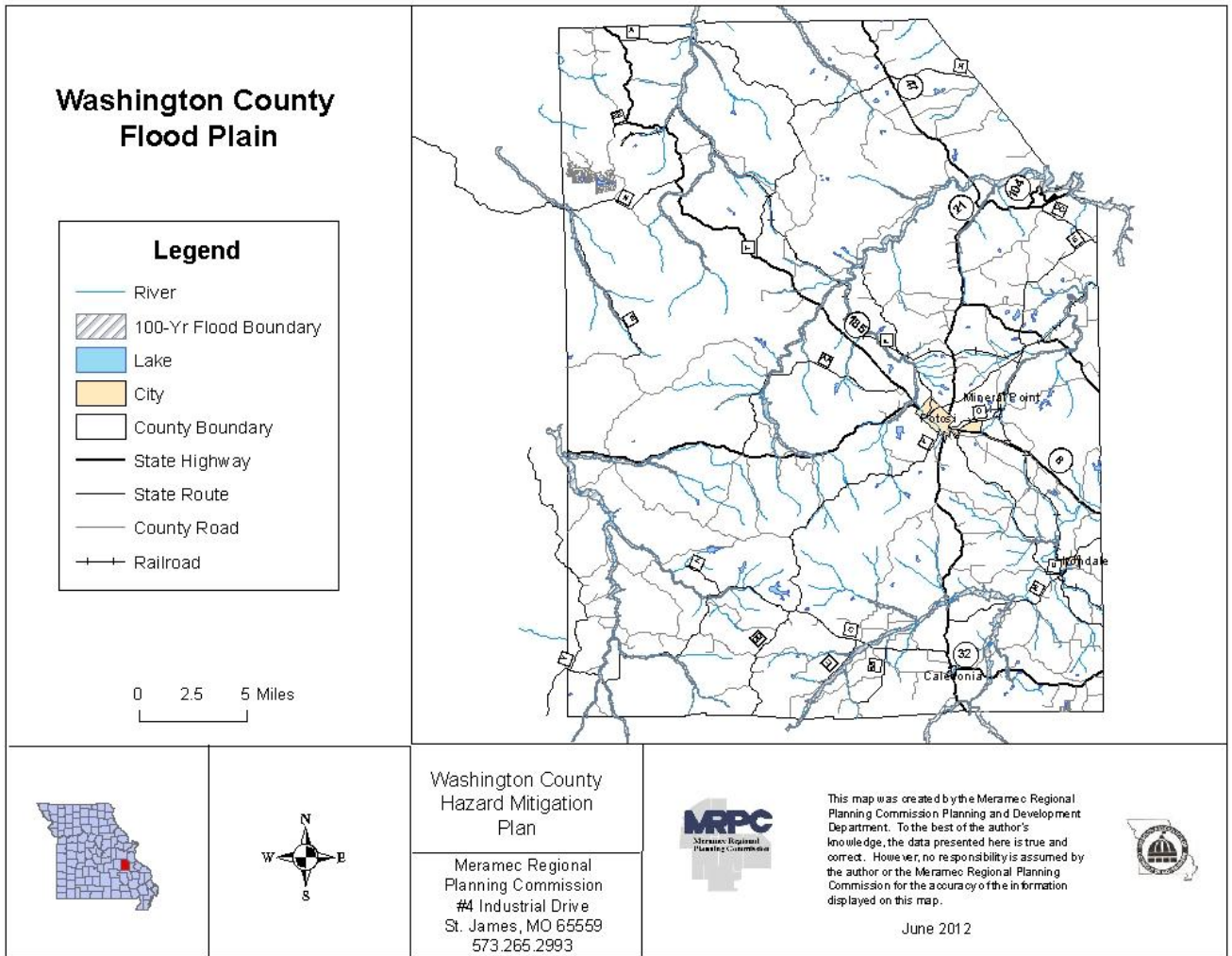
The Washington County Hazard Mitigation Plan contains maps created with FEMA's Hazards U.S. Multi-Hazard (HAZUS-MH) database. This software program is a nationally applicable standardized methodology for estimating potential losses from earthquakes, hurricane winds and floods. HAZUS-MH uses Geographic 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 section 3.3 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 three watersheds located in Washington County: the Meramec River watershed, the Big River watershed and the St. Francis watershed. The river with the potential to cause the most flood damage in the county is the Big River. The river has eight tributaries and flows northward for 138 miles until it reaches the Meramec River. The Meramec River watershed covers a

significant portion of Washington 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 floodplain map for the county.

Figure 3-9



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

Washington County has several rivers and small tributaries in both unincorporated and incorporated areas that are susceptible to flooding. Flash flooding is historically the county's only riverine disaster. The county, on average, experiences at least one flash flooding event

nearly every year, however most of these events cause little or no property or crop damages, nor loss of life. An exception was a flash flood in November 1993. The Washington County Sheriff's Department reported widespread flash flooding across the county with nearly five inches of rain. Several low water bridges were damaged from flash flooding. Although no evacuations were needed, low-lying areas were seriously flooded, especially near the Big River. This flash flood caused \$500,000 in damage.

A total of 14 floods and flash floods have affected the county since September 1993. Of the 14 reported events, six events caused property damage ranging from \$2,000 per event to \$5 million in April 1994. Eight of the 14 flood events caused no property damage or injuries. Table 3.9 illustrates flood events in the county from September 1993 to May 2009.

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

Location or County	Date	Type	Property Damage	Crop Damage
Washington County	9/23/1993	Flash Flood	\$5,000	0
Washington County	9/23/1993	Flash Flood	\$50,000	0
Washington County	11/14/1993	Flash Flood	\$500,000	0
Multiple County	4/11/1994	River Flood	\$5,000,000	\$5,000,000
Potosi	4/11/1994	Flash Flood	\$50,000	0
Richwoods	3/7/1995	Flash Flood	\$2,000	\$1,000
Washington County	4/19/1996	Flash Flood	0	0
Washington County	6/22/1997	Flash Flood	0	0
Washington County	5/12/2002	Flash Flood	0	0
Central Portion	4/21/2005	Flash Flood	0	0
Washington County	3/12/2006	Flash Flood	0	0
Potosi	1/13/2007	Flood	0	0
Springtown	2/5/2008	Flash Flood	0	0
Maryden	5/8/2009	Flash Flood	0	0

Source: National Climactic Data Center

Of the five local government jurisdictions participating in this plan, four are currently participating in the National Flood Insurance Program (NFIP): Washington County, the Village of Irondale, the Village of Mineral Point and the City of Potosi. The Village of Caledonia does not participate in the NFIP. According to repetitive loss data provided by SEMA, there is one property in Mineral Point that has had repetitive losses. It is a single-family dwelling and has flooded twice. Flooding occurred in 1993 and 1994. The property has not 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 September 1993 through May 2009, flood events have occurred in Washington County in every month of the year with the exceptions of July, August, 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 Washington 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. 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. The county is vulnerable to flooding from the Big River and tributaries of the Meramec and Big rivers. The rest of the jurisdictions –Caledonia, Irondale, Mineral Point, Potosi and all of the school districts are vulnerable to flash flooding, but not to 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 Washington County: 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 Caledonia, Irondale, Mineral Point, Potosi and the the Kingston K-14 School District, Potosi R-III School District, Richwoods R-VII School District and Valley R-VI School District: Probable 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 Washington 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 14 flood events reported, only one resulted in significant damage in Washington County. In November 1993, there was \$500,000 in damages reported for Washington County. In April 1994, a multiple county flood event also resulted in \$5,000,000 in property damage. There is one property listed by the NFIP that has had repetitive losses with the most recent loss in 1994. Based on the CPRI and historical information of flood events and flood damages in Washington 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. Loss of life and injuries are also typically limited. Historically, the most impacted areas have been in unincorporated areas of the county.

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 Washington County leads to the assessment that flooding will occur in the Meramec River basin and the Big 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, depending on weather conditions and precipitation. 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 Washington 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 some locations in Potosi that lie in or adjacent to flood prone areas, few building lie within the floodplain. Temporary road closures might affect some of the jurisdictions.

Recommendation

The county and all but one community have adopted a floodplain management ordinance concerning construction in the floodplain. The county and communities 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 – Washington County

Calculated Priority Risk Index	Planning Priority
3.0	High

Hazard Summary – Flood – Cities of Caledonia, Irondale, Mineral Point, Potosi & Kingston K-14, Potosi R-III, Richwoods R-VII and Valley R-VI 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.^{xxxiii}

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 tope 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 Washington 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 3-9 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 Washington County, they are unlikely.^{xxxix}

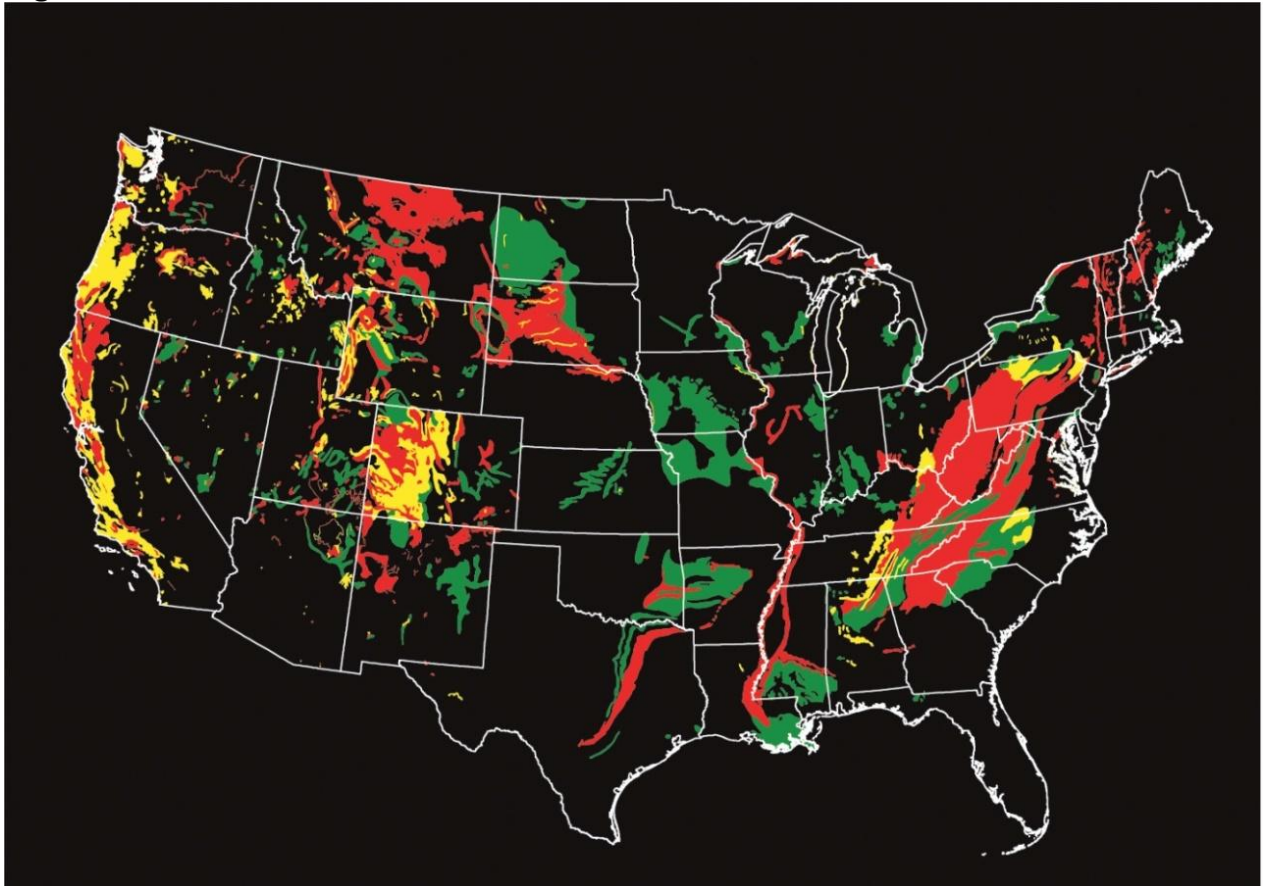
Type of Damage

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, Washington 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 highways 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 Probable Future 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 Washington 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 Washington 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

Washington 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 Washington County

Calculated Priority Risk Index	Planning Priority
1.45	Low

3.2.8 Land Subsidence/Sinkholes

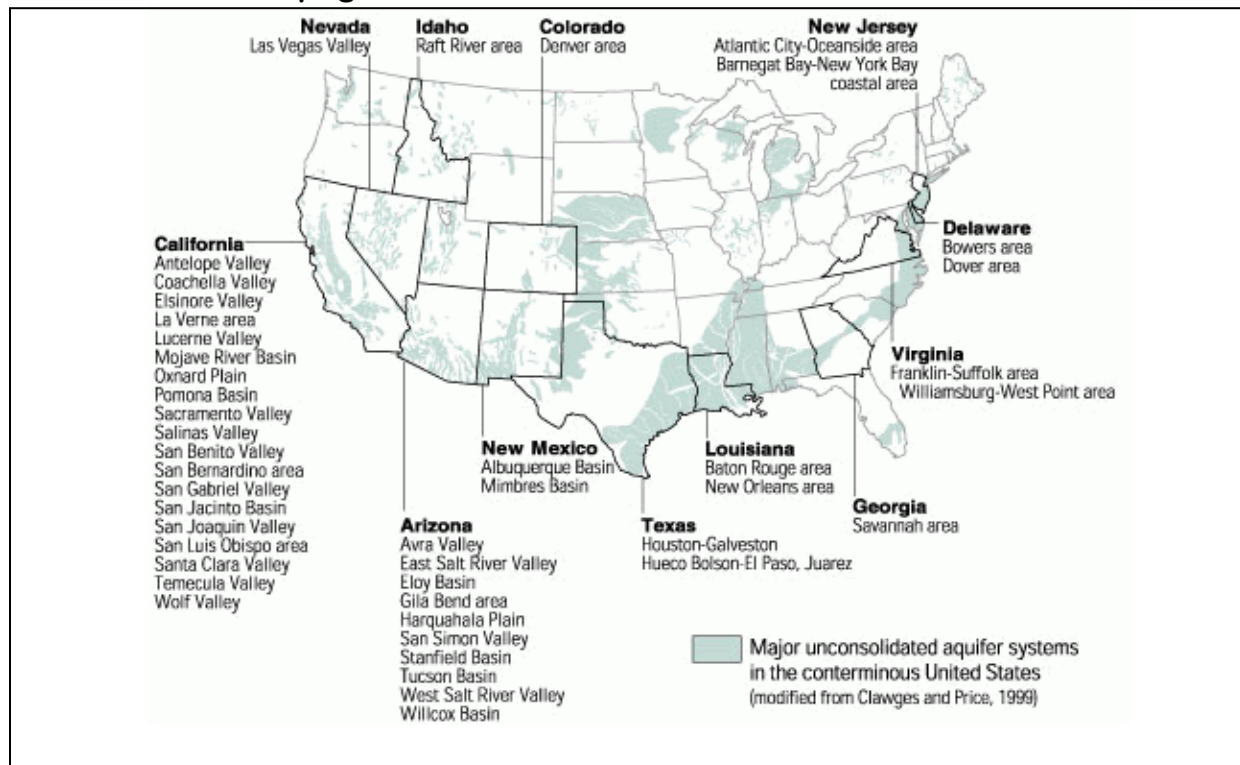
Description

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.

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>

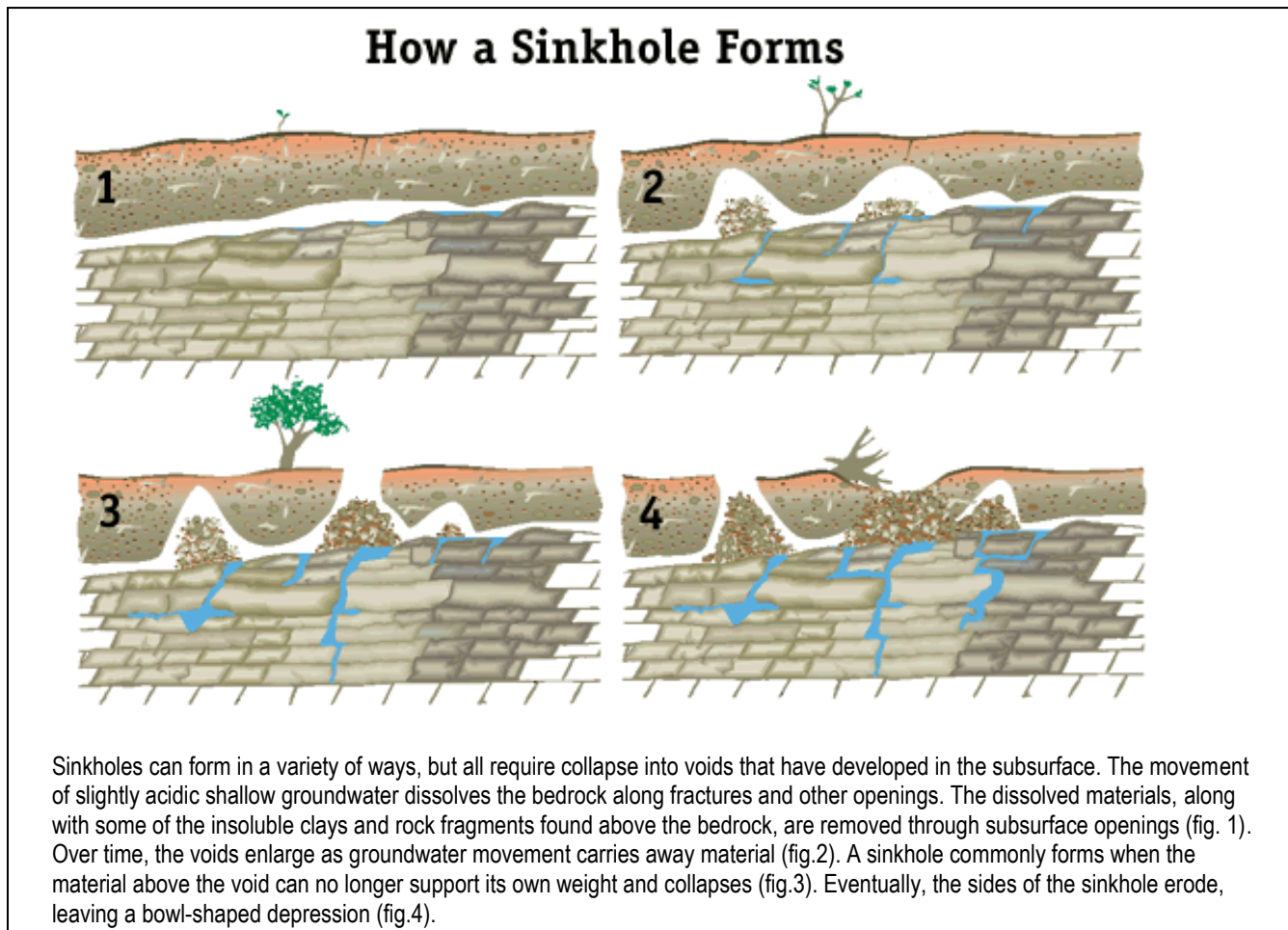
A sinkhole is a surface area usually formed when bedrock slowly dissolves, creating voids below ground that can cause depressions on the surface or even result in openings in the ground when the ceiling of an underlying cave collapses. Typically sinkholes appear as conical depressions in the ground. 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 Washington 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."¹ⁱ

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



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

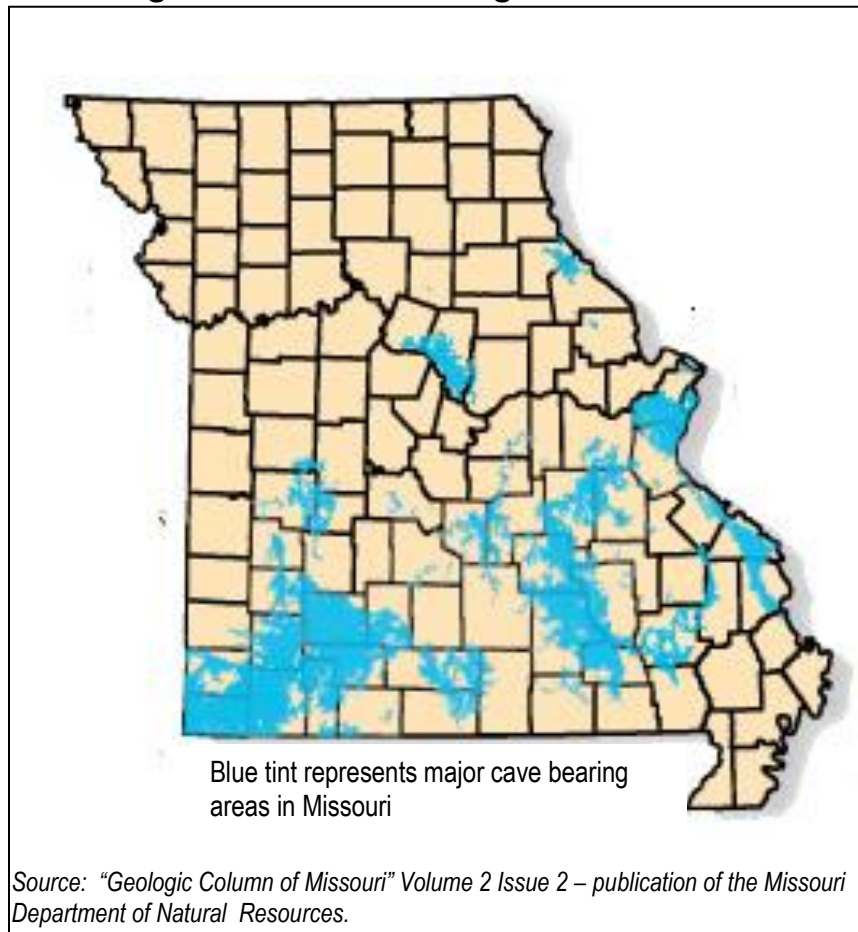
There have been a number of incidents in Missouri where sinkholes have formed and drained lakes. In the 1960s, a lake was built in northern Howell County near the Eleven Point River. A

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.

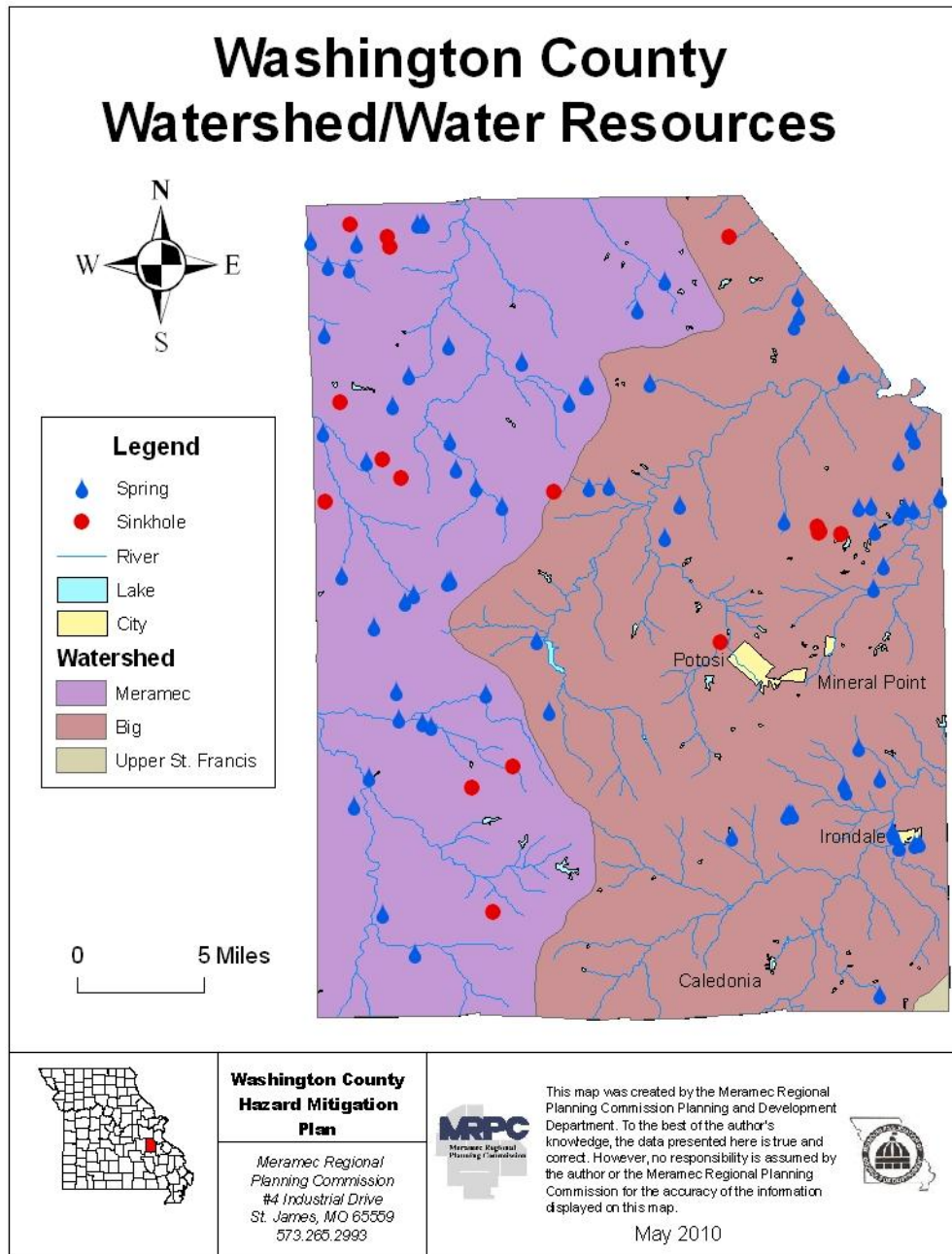
Figure 3-13 Cave Bearing Areas of Missouri



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.”^{iv} 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 3-14 is a map of Washington County water resources, including springs, lakes, rivers, streams, watersheds, and marked in red—sinkholes. As is evidenced by this map, there are several sinkholes in Washington County – 16 known sinkholes.

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 Washington County.

Hazard History

Although there are a few sinkholes and sinkhole areas in Washington 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 Washington County. Based on the map of sinkholes in Washington County, the incorporated 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 no 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 does not appear to have varying magnitude for the jurisdictions. Washington 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 and school district would also be negligible as there are no sinkholes located within or on the borders of these jurisdictions or their 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.

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

Calculated Priority Risk Index	Planning Priority
1.45	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

Washington County lies along the eastern edge of tornado alley and from 1950 to 2009 the county recorded 20 tornados from F0 to F4 in strength. Two tornado events caused damage in excess of \$25 million. Recorded tornados in Washington County since 1950 are shown in Table

3.13. Six people have died and 94 people have been injured in Washington County due to tornados.

Table 3.13 Tornado History – Washington County^{lxiv}

Date	Location	Magnitude	Number injured/killed	Property Damage
5/21/1957	Washington Co	F3	1 injured, 0 killed	\$25,000,000
5/22/1957	Washington Co	F1	0 injured, 0 killed	\$25,000
12/8/1966	Washington Co	F3	0 injured, 0 killed	\$250,000
12/8/1966	Washington Co	F3	2 injured, 0 killed	\$250,000
12/21/1967	Washington Co	F4	47 injured, 3 killed	\$2,500,000
6/22/1969	Washington Co	F4	22 injured, 2 killed	\$2,500,000
5/24/1971	Washington Co	F2	0 injured, 0 killed	\$250,000
12/15/1971	Washington Co	F1	2 injured, 0 killed	\$25,000
4/14/1974	Washington Co	F2	0 injured, 0 killed	\$0
11/9/1984	Washington Co	F2	15 injured, 1 killed	\$25,000,000
4/24/1993	Potosi	F1	0 injured, 0 killed	\$500,000
4/24/2002	Caledonia	F1	0 injured, 0 killed	\$0
5/12/2002	Hopewell	F0	0 injured, 0 killed	\$0
10/18/2004	Potosi	F1	7 injured, 0 killed	\$0
10/18/2004	Potosi	F0	0 injured, 0 killed	\$0
10/18/2004	Potosi	F0	0 injured, 0 killed	\$0
10/18/2004	Mineral Point	F0	0 injured, 0 killed	\$0
10/18/2004	Mineral Point	F0	0 injured, 0 killed	\$0
9/22/2006	Richwoods	F1	0 injured, 0 killed	\$0
9/22/2006	Richwoods	F1	0 injured, 0 killed	\$0
TOTALS			94 injured, 6 killed	\$56,300,000

Source: National Oceanic and Atmospheric Administration - <http://www4.ncdc.noaa.gov/cgi-win/wwcgl.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 Potosi, Caledonia, Hopewell, Mineral Point and Richwoods since 1950. Over the past 60 years, Washington County has had approximately \$56,300,000 in property damage attributed to tornados.

Thunderstorm winds, while not as powerful as tornados, are still a cause for concern in Washington 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 86 incidences of thunderstorms with high winds in Washington 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. Washington County has been fortunate that despite the large number of damaging windstorms, only three incidents resulted in reported property damage. Since 1950, the county has suffered \$504,000 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.

Hail is a fairly common weather activity in Washington County, having occurred 113 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 Washington County has been recorded as large as 2.75 inches in diameter in 2009, but typically hail stones are much smaller. While hail can be damaging, it has typically been mild in Washington County and only caused \$1,000 in property damages since 1950.^{lxvi}

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

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

Location	Date	Type	Magnitude	Property Damage
County	5/21/1957	Hail	1.50 in.	0
County	8/17/1974	Hail	1.75 in.	0
County	5/11/1975	Hail	1.00 in.	0
County	3/20/1976	Hail	2.25 in.	0
County	7/30/1976	Hail	1.00 in.	0
County	10/12/1978	Hail	1.00 in.	0
County	5/10/1980	Hail	0.75 in.	0
County	5/18/1981	Hail	1.75 in.	0
County	6/9/1985	Hail	1.00 in.	0
County	5/8/1988	Hail	1.75 in.	0
County	3/21/1991	Hail	1.00 in.	0
Leadwood	4/24/1993	Hail	1.00 in.	0
Racola	4/10/1994	Tstm Wind	0 kts.	\$1,000
Caledonia	4/15/1994	Tstm Wind	0 kts.	\$500,000
Potosi	4/27/1994	Hail	0.75 in.	0
Richwoods	4/16/1995	Hail	1.75 in.	\$1,000
Richwoods	5/13/1995	Hail	0.75 in.	0
Potosi	5/17/1995	Hail	1.00 in.	0
Richwoods	5/18/1995	Tstm Wind	0 kts.	\$3,000
Richwoods	5/18/1995	Hail	1.75 in.	0

Location	Date	Type	Magnitude	Property Damage
Ellington	7/8/1995	Hail	0.75 in.	0
Potosi	4/19/1996	Hail	1.00 in.	0
Potosi	4/19/1996	Hail	1.00 in.	0
Potosi	10/17/1996	Hail	0.75 in.	0
Irondale	5/17/1997	Hail	0.75 in.	0
Potosi	5/17/1997	Hail	0.75 in.	0
Potosi	5/17/1997	Hail	1.00 in.	0
Mineral Point	5/17/1997	Hail	1.75 in.	0
Richwoods	7/8/1997	Hail	0.75 in.	0
Potosi	4/13/1998	Hail	0.75 in.	0
Potosi	5/21/1998	Hail	1.75 in.	0
Potosi	5/21/1998	Hail	1.75 in.	0
Richwoods	10/29/1998	Hail	0.75 in.	0
Old Mines	2/27/1999	Hail	1.00 in.	0
Potosi	2/27/1999	Hail	1.00 in.	0
Potosi	2/27/1999	Hail	1.00 in.	0
Belgrade	5/16/1999	Hail	0.75 in.	0
Potosi	2/13/2000	Hail	0.75 in.	0
Cadet	4/9/2001	Hail	1.00 in.	0
Richwoods	4/9/2001	Hail	1.00 in.	0
Richwoods	5/17/2001	Hail	0.75 in.	0
Potosi	3/15/2002	Hail	1.75 in.	0
Potosi	5/12/2002	Hail	0.88 in.	0
Potosi	4/29/2003	Hail	0.75 in.	0
Potosi	5/4/2003	Hail	1.75 in.	0
Irondale	4/22/2004	Hail	0.75 in.	0
Old Mines	5/25/2004	Hail	1.75 in.	0
Old Mines	5/26/2004	Hail	0.88 in.	0
Potosi	5/26/2004	Hail	1.75 in.	0
Potosi	5/26/2004	Hail	1.00 in.	0
Potosi	5/26/2004	Hail	1.00 in.	0
Potosi	6/18/2004	Hail	0.88 in.	0
Potosi	8/17/2004	Hail	1.75 in.	0
Belgrade	8/17/2004	Hail	1.75 in.	0
Potosi	10/18/2004	Hail	1.00 in.	0
Old Mines	10/18/2004	Hail	1.75 in.	0
Potosi	4/21/2005	Hail	0.75 in.	0
Richwoods	4/21/2005	Hail	0.88 in.	0
Potosi	4/21/2005	Hail	0.75 in.	0
Potosi	4/21/2005	Hail	1.00 in.	0
Potosi	4/21/2005	Hail	0.88 in.	0
Potosi	5/11/2005	Hail	1.00 in.	0
Old Mines	5/11/2005	Hail	1.00 in.	0
Richwoods	5/11/2005	Hail	0.75 in.	0
Old Mines	11/5/2005	Hail	0.75 in.	0
Old Mines	2/16/2006	Hail	1.00 in.	0
Anthones Mill	3/11/2006	Hail	0.75 in.	0

Location	Date	Type	Magnitude	Property Damage
Aptus	3/11/2006	Hail	0.75 in.	0
Old Mines	3/11/2006	Hail	0.75 in.	0
Potosi	3/11/2006	Hail	0.75 in.	0
Belgrade	3/11/2006	Hail	1.75 in.	0
Potosi	3/11/2006	Hail	0.75 in.	0
Potosi	3/11/2006	Hail	1.00 in.	0
Potosi	3/11/2006	Hail	1.75 in.	0
Old Mines	3/12/2006	Hail	2.50 in.	0
Potosi	4/2/2006	Hail	1.25 in.	0
Potosi	4/2/2006	Hail	0.88 in.	0
Potosi	4/2/2006	Hail	0.88 in.	0
Richwoods	4/2/2006	Hail	1.00 in.	0
Potosi	4/2/2006	Hail	0.75 in.	0
Potosi	4/22/2006	Hail	0.75 in.	0
Potosi	4/22/2006	Hail	0.75 in.	0
Potosi	4/22/2006	Hail	1.25 in.	0
Belgrade	4/22/2006	Hail	0.75 in.	0
Potosi	4/23/2006	Hail	0.75 in.	0
Belgrade	5/1/2006	Hail	0.88 in.	0
Belgrade	5/1/2006	Hail	1.00 in.	0
Belgrade	5/1/2006	Hail	0.75 in.	0
Old Mines	6/28/2006	Hail	0.88 in.	0
Potosi	7/19/2006	Hail	0.75 in.	0
Caledonia	7/19/2006	Hail	1.00 in.	0
Pea Ridge	9/22/2006	Hail	0.88 in.	0
Richwoods	9/22/2006	Hail	2.00 in.	0
Richwoods	4/3/2007	Hail	0.75 in.	0
Old Mines	4/3/2007	Hail	1.00 in.	0
Potosi	4/3/2007	Hail	1.25 in.	0
Potosi	4/3/2007	Hail	1.00 in.	0
Potosi	4/3/2007	Hail	1.00 in.	0
Belgrade	5/10/2008	Hail	0.88 in.	0
Sunlight	6/21/2008	Hail	0.75 in.	0
Richwoods	6/22/2008	Hail	1.25 in.	0
Old Mines	6/22/2008	Hail	1.00 in.	0
Summit	6/22/2008	Hail	0.75 in.	0
Potosi	8/5/2008	Hail	0.88 in.	0
Old Mines	8/5/2008	Hail	0.88 in.	0
Richwoods	9/29/2008	Hail	0.75 in.	0
Baryties	9/29/2008	Hail	0.75 in.	0
Potosi	3/8/2009	Hail	0.88 in.	0
Springtown	4/5/2009	Hail	0.88 in.	0
Springtown	5/8/2009	Hail	2.75 in.	0
Potosi	6/7/2009	Hail	1.00 in.	0
Old Mines	6/8/2009	Hail	1.00 in.	0
Mineral Point	6/8/2009	Hail	0.88 in.	0
Old Mines	6/8/2009	Hail	1.75 in.	0

Location	Date	Type	Magnitude	Property Damage
Belgrade	7/11/2009	Hail	1.00 in.	0
Richwoods	7/16/2009	Hail	1.75 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 Potosi and the unincorporated town of Belgrade. Several radio stations in the area and television stations in the region provide updates when severe weather threatens Washington 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

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) 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 Washington County, there have been 94 injuries in 20 incidents and six deaths. Out of 20 tornados, two were rated as F4 tornados, three were F3 tornados and the rest were F2 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, in particular, the six deaths and 94 injuries, the probably magnitude of future events is rated as critical.

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 Washington 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 \$505,000 in property damage from thunder and hail storms.

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 for one to occur every two to three years. with tornados occurring in the county on an average of every two to three years. With a history of \$54.3 million dollars in losses over 59 years, the average damages are just under \$1 million per year.

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 Washington 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 Washington 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 \$56,300,000 in damages from 20 tornados. Two tornados, one in 1957 and the other in 1984, accounted for \$50 million of that total. Six lives were lost in the past 59 years from tornados. Mitigation activities may provide a more secure prediction that loss of life will be negligible in the future.

Recommendation

Early warnings and tornado safe rooms 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/tornado safe rooms 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. Efforts should be made to find ways of funding tornado safe rooms in schools and high population facilities such as large employers.

Hazard Summary – Tornado for all Jurisdictions in Washington County

Calculated Priority Risk Index	Planning Priority
3.15	High

Hazard Summary – Thunderstorm/High Wind/Hail for all Jurisdictions in Washington 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 Washington 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.

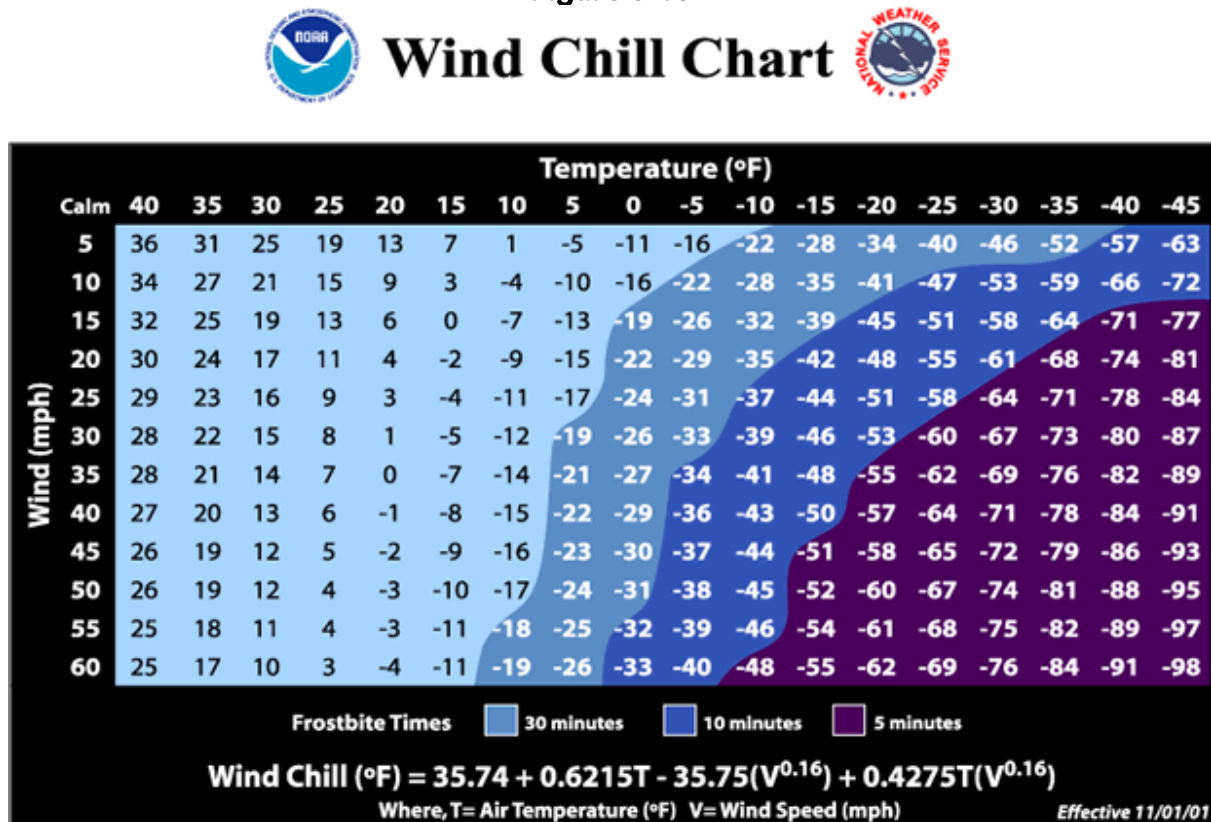
A new Wind Chill Temperature Index took effect on November 1, 2001, replacing the original wind chill index that was devised in 1945. To find the Wind Chill Temperature Index from the table that follows, find the air temperature along the top of the table and the wind speed along the left side. The point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

Hazard History

Severe winter weather typically strikes Missouri more than once every year. Washington 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 Washington County. However, icy conditions often make roads hazardous and automobile accidents are frequent occurrences.

Since 1994, more than \$10.3 million in property damage has been reported from winter storms and extreme cold weather that affected the southern half of the state, including Washington County. However, only a small portion of that overall damage can be attributed to Washington County.

Figure 3-15



Source: National Oceanic and Atmospheric Administration

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. Washington 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 34 extreme cold, snow or ice events reported in Washington 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 Washington County 1994-2011

Location	Date	Type	Magnitude	Property Damage
Multi-County	1/14/1994	Extreme Cold	0 Deaths, 15 Injuries	\$5,000,000
Multi-County	3/8/1994	Heavy Snow	0 Deaths, 0 Injuries	\$5,000,000
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	12/8/0995	Snow	0 Deaths, 0 Injuries	0
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	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
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	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	12/8/2005	Winter Storm	2 Deaths, 0 Injuries	0
Multi-County	12/1/2006	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	4/4/2007	Frost/Freeze	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	2/21/2008	Sleet	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
Multi-County	1/31/2011	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	2/1/2011	Winter Storm	0 Deaths, 0 Injuries	0
TOTALS			4 Deaths, 21 Injuries	\$10,300,000

Source: NOAA, National Climatic Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwcgui.dll?wwevent~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 Washington 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 Washington 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}

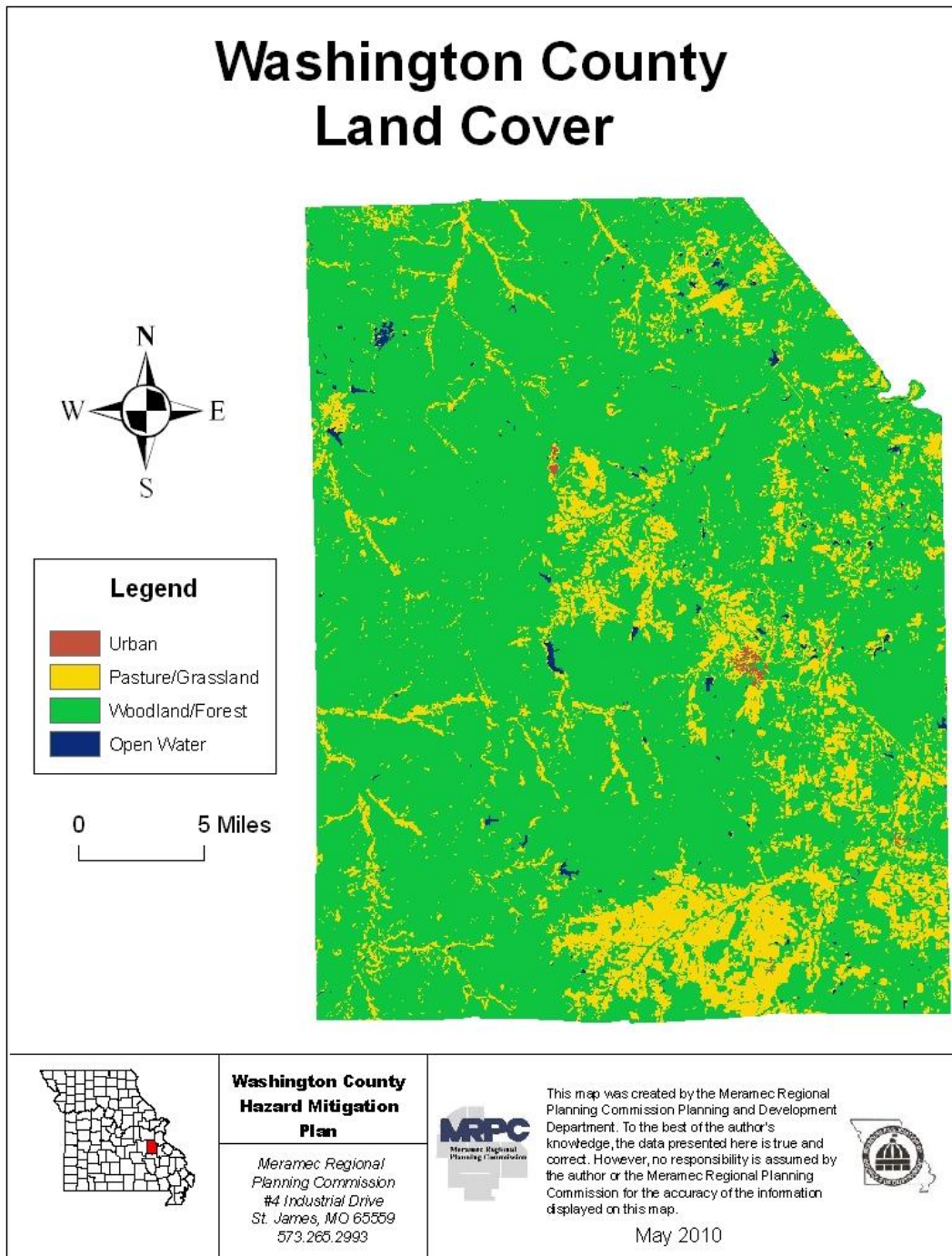
More and more people are making their homes in woodland settings in or near forests and rural areas. There, homeowners enjoy the beauty of the environment but they also face the very real danger of wildfire. Washington County is primarily comprised of wooded, rural areas and is also home to a sizeable portion of the Mark Twain National Forest. The southwest quarter of the county is part of the National Forest. The county is also home to Washington State Park, and other state owned parks and conservation areas. All of these tree-filled areas are significant possibilities for wildfire disasters. Figure 3-16 is a land cover map for Washington 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.

Figure 3.16



Hazard History

Because building structures exist anywhere people live and work, fires can occur at anytime 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 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}

According to the Missouri Department of Conservation Forest Fire Reporting, there have been 936 fires reported between January 1, 2000 and January 1, 2010. The total acreage burned from those incidents was 9,998.45 acres. Six residences and eight outbuildings were damaged. Ten residences and 18 outbuildings 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 Washington County is:

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

Statement of Probable Future Severity/Magnitude

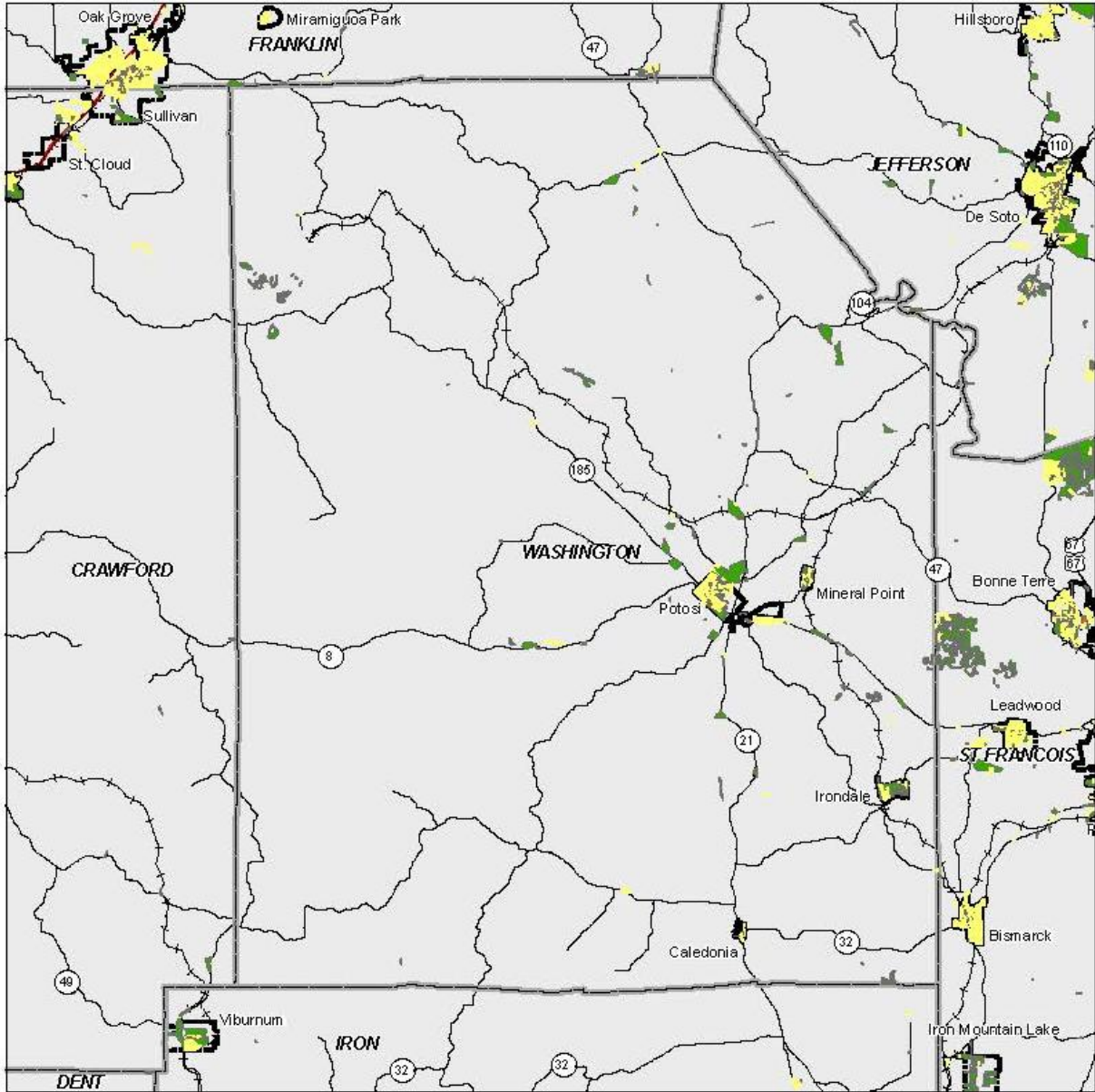
Negligible (1) - Injuries and/or illnesses are treatable with first aid; minor quality of life lost; shutdown of critical facilities and services for 24 hours or less; less than 10 percent of property is severely damaged. The severity of wildfire in Washington County and all of its jurisdictions should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

Statement of Probable Risk/Likelihood of Future Occurrence

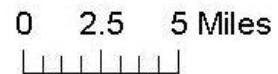
Wildfire is another hazard where there is a difference in the probability of occurrences in incorporated and unincorporated areas of the county. Although fires that erupt in rural areas may burn longer and damage more acreage, the risk to property is lower because of the lower density of homes and businesses. 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 Washington County. All of the communities in the county show a medium density interface with portions of Caledonia, Irondale, Mineral Point and Potosi 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 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.

Figure 3.17

Washington County Wildland Urban Interface



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



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

The likelihood of wildfire in unincorporated areas of Washington 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 Caledonia, Irondale, Mineral Point and Potosi is as follows:

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

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 probable risk/likeness for future occurrence would be less than that for communities in general. The probability of wildfire affecting the Kingston K-14, Potosi R-III, Richwoods R-VII and Valley R-VI, is as follows:

Unlikely (1) - An event is probable within the next ten 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 Washington 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 – Washington County

Calculated Priority Risk Index	Planning Priority
2.9	High

Hazard Summary – Wildfire – Caledonia, Irondale, Mineral Point and Potosi

Calculated Priority Risk Index	Planning Priority
2.45	Moderate

Hazard Summary – Wildfire – Kingston K-14, Potosi R-III, Richwoods R-VII, and Valley R-VI

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	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI
Dam Failure	Low	Low	Low	Low	Low	Low	Low	Low	Low
Drought	Low	Low	Low	Low	Low	Low	Low	Low	Low
Earthquake	Mod- erate	Mod- erate	Mod- erate	Mod- erate	Mod- erate	Mod- erate	Mod- erate	Mod- erate	Mod- erate
Extreme Heat	High	High	High	High	High	High	High	High	High
Flood	High	High	High	High	High	High	High	High	High
Landslide	Low	Low	Low	Low	Low	Low	Low	Low	Low
Land Subsidence/ Sinkhole	Low	Low	Low	Low	Low	Low	Low	Low	Low
Severe Storms Hail/Wind	High	High	High	High	High	High	High	High	High
Tornado	High	High	High	High	High	High	High	High	High
Severe Winter Weather	High	High	High	High	High	High	High	High	High
Wildfire	High	Mod- erate	Mod- erate	Mod- erate	Mod- erate	Low	Low	Low	Low

3.3 Vulnerability Assessment for Washington 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 – 10-24 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.

According to HAZUS-MH, there is a total building replacement value (excluding contents) of \$804,605,000 for Washington County. Residential housing makes up 88.3 percent of the total building value for Washington County, approximately \$686,131,000. Non-residential building stock is valued at \$118,474,000. Table 3.17 shows the breakout of type of buildings, exposure, and percentage of total building stock.

Table 3.17 Occupancy and Exposure of Overall Washington County Building Stock

Occupancy	Exposure	Percent of Total
Residential	\$686,131,000	85.3%
Commercial	\$65,751,000	8.0%
Industrial	\$15,282,000	2.0%
Agricultural	\$3,497,000	0.4%
Religion	\$26,533,000	3.3%
Government	\$5,496,000	0.7%
Education	\$1,915,000	0.3%
Total	\$804,605,000	100.0%

Source: HAZUS-MH

Table 3.18 Unincorporated Washington County Building Stock

Occupancy	Building Count	Percent of Total
Residential	9,236	97.3%
Commercial	158	1.7%
Industrial	42	0.4%
Agricultural	8	0.1%
Religion	29	0.3%
Government	12	0.1%
Education	8	0.1%
Total	9,493	100.0%

Source: HAZUS-MH

Table 3.19 Village of Caledonia Building Stock

Occupancy	Building Count	Percent of Total
Residential	101	90.2%
Commercial	4	3.5%
Industrial	3	2.7%
Agricultural	0	0%
Religion	1	0.9%
Government	2	1.8%
Education	1	0.9%
Total	112	100.0%

Source: HAZUS-MH

Table 3.20 City of Irondale Building Stock

Occupancy	Building Count	Percent of Total
Residential	230	93.9%
Commercial	8	3.3%
Industrial	2	0.8%
Agricultural	2	0.8%
Religion	2	0.8%
Government	1	0.4%
Education	0	0%
Total	245	100.0%

Source: HAZUS-MH

Table 3.21 Village of Mineral Point Building Stock

Occupancy	Building Count	Percent of Total
Residential	198	98.5%
Commercial	1	0.5%
Industrial	1	0.5%
Agricultural	0	0%
Religion	0	0%
Government	1	0.5%
Education	0	0%
Total	201	100.0%

Source: HAZUS-MH

Table 3.22 City of Potosi Building Stock

Occupancy	Building Count	Percent of Total
Residential	761	94%
Commercial	30	3.8%
Industrial	4	0.5%
Agricultural	1	0.1%
Religion	9	1.1%
Government	3	.3%
Education	2	0.2%
Total	810	100.0%

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 3.23 has a more comprehensive list of potential critical facilities. Not all of these examples may exist in Washington County.

Table 3.23 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 3.24 is an inventory of critical facilities and infrastructure in Washington 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 3.24 Critical Facilities and Infrastructure by Jurisdiction - Washington County

Facility	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Total
Airports	0	0	1	0	1	1
Bridges	24	0	0	0	0	24
Communications Centers	1	0	0	0	0	1
Dams	118	0	2	0	0	120
Daycare Centers ^{lxxiii}	2	2	0	2	10	16
Elder Care/ Long Term Care Facilities ^{lxxivlxxv}	0	0	0	2	2	4
Health Care Facility	0	0	0	0	1	1
Fire Stations	4	1	1	0	3	9
EMS Stations	1	0	0	0	1	2
Emergency Operations Centers	1	0	0	0	0	1
Government Facilities	12	2	1	1	0	16
Law Enforcement Facilities	1	0	1	0	1	3
Major Interstate Highways	0	0	0	0	0	0
Military Installations	0	0	0	0	0	0
Railroads	2	0	1	1	0	2
Pipelines	0	0	0	0	0	0
Schools ^{lxxvi}	7	2	0	0	5	14
Emergency Shelters ^{lxxvii}	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available
Wastewater Treatment Facilities	1	1	0	0	3	5
Public Wells	0	1	2	1	9	13

Source: Washington County Hazard Mitigation Planning Committee

There are 4 long term care facilities for the elderly and disabled in Washington County. They are located in Mineral Point and Potosi. Table 3.25 provides specific information on the long term care facilities in Washington County.

Table 3.25 Long Term Elder Care and Elder Day Care Centers in Washington County

Elder Care Facility Name	Location	Capacity	Level of Licensure
Chapel Ridge Living Center	Mineral Point	34	RCF
Georgian Gardens Nursing Center	Potosi	120	SNF
Potosi Manor	Potosi	90	SNF
South Haven Residential Care	Mineral Point	20	RCF

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 Washington County. Smaller daycares that do not have enough children to require licensing are not included as data is not available on these facilities. Table 3.26 provides information on the licensed daycare facilities in Washington County.

Table 3.26 Licensed Child Care Facilities in Washington County

Facility Name	Location	Facility Type
Barbara Coleman	Caledonia	Family Home
Covenant Grace of God Church	Mineral Point	License Exempt Program
Dena Wilson	Potosi	Family Home
Donna Littrell	Potosi	Group Home
Donna M. Yates	Blackwell	Family Home
East Missouri Action Agency	Mineral Point	Child Care Center
Kay Randall	Potosi	Group Home
Kids Zone	Potosi	License Exempt Program
Kimberly K. Martin	Caledonia	Family Home
Kimberly Bequette	Potosi	Family Home
Little Learners Academy	Potosi	Child Care Center
Little Steps Childcare	Blackwell	Child Care Center
Patricia Dickey Daycare	Potosi	Family Home
Phyllis Smith	Potosi	Family Home
Tammy Benson	Potosi	Group Home
Tammy's Tiny Tots Too	Potosi	Child Care Center

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. Washington 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 Washington County:

- Endangered, threatened, species of concern: Indiana bat, gray bat, cerulean warbler and Central Missouri Cave amphipod.
- Historic and Cultural Resources: Caledonia Historic District in Caledonia, Cresswell Petroglyph Archaeological Site, address restricted, George Cresswell Furnace, in the vicinity of Potosi, Land Archaeological Site, address restricted, Lost Creek Pictograph Archaeological Site, address restricted, Palmer Historic Mining District in the vicinity of Potosi, Harrison Queen House in the vicinity of Caledonia, Susan Cave, address restricted, Washington County Courthouse in Potosi, Washington State Park CCC Historic District in the vicinity of Potosi and Washington State Park Petroglyph Archaeological Site in the vicinity of Fertile, Missouri.
- Economic Resources: Sure Seal, Inc. in Mineral Point and Wal-Mart, Potosi Correctional Center, Washington County Memorial Hospital, Potosi School District, YMCA of the Ozarks, Purcell Tire and Rubber Company, Red Wing Shoe Company, Washington County Government, Deaconess Long Term Care of Missouri Inc. and Reed Lumber all located in Potosi.
- Natural Resources: there are eight state public use areas and conservation areas in Washington County; one state park; 82 springs; three watersheds; and portions of the 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 3.27 Specific Community Assets in Washington County by Jurisdiction

Name of Asset	Replacement Value (\$)	Occupancy/Capacity
Unincorporated Area (Including County Government Assets)		
County buildings (including courthouse, jail and road sheds, offices) (8)	\$6,014,416.00	N/A
Generator Building (1)	\$11,550.00	N/A
Airport (1)	\$354,551.00	N/A
County Highway Department (1)	\$253,918.00	N/A
Communications Centers (1)	\$7,658.00	N/A
Dams (118)	Information not available	N/A
Washington County Extension Office (1)	\$127,629.00	N/A

Name of Asset	Replacement Value (\$)	Occupancy/Capacity
Caledonia		
Government Buildings including waste water and public well buildings (16)	\$262,950.00	N/A
Rural Fire Department	Information not available	N/A
Waste Water Facility (1)	\$3,000.00	N/A
City Wells (1)	\$45,938.00	N/A
Irondale		
Government Buildings – includes city hall, park buildings, public works building, animal control, storage sheds (17)	\$499,989.00	N/A
Administration (2)	\$68,906.00	N/A
Dams (2)	Information not available	N/A
Parks (5)	\$133,680.00	N/A
Water and Sewer (10)	\$297,403.00	N/A
Mineral Point		
Government Buildings -including city hall, storage sheds, and waste water and public well buildings (4)	\$180,065.00	N/A
City Well (1)	Information not available	N/A
Potosi		
Government Buildings (including city hall, recreation building, storage sheds, and park buildings) (10)	\$1,348,411.00	N/A
Police (1)	\$731,188.00	N/A
Waste Water Plant and buildings (3)	\$1,484,855.00	N/A
City Wells and buildings (6)	\$2,001,448.00	N/A
Kingston K-14 School District – Assessed Valuation \$26,545,976		
Kingston Primary		191
Kingston Elementary		177
Kingston Middle School		159
Kingston High School		217
Potosi R-III School District – Assessed Valuation \$81,804,829		
Potosi Elementary School		765
Trojan Intermediate School		553
John A. Evans Middle School		395
Potosi High School		663
Richwoods R-VII School District – Assessed Valuation \$13,306,399		
Richwoods Elementary School		175
Valley R-VI School District – Assessed Valuation \$21,155,124		
Belgrade Elementary School		83
Caledonia Elementary School		110
Valley High School		182

3.3.3 Vulnerability by Hazard

This section describes the overall vulnerability of Washington 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 these 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 Washington County and Jurisdictions

Overview

Planning Significance: High. Overall vulnerability to flooding is highest in developed areas of the floodplains of the Big River and its tributaries. Based on the vulnerability analysis and the loss estimates provided in Table 3.28, the unincorporated areas of the county 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 Washington County. Digital Flood Insurance Rate Map (DFIRM) is not yet available for Washington 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 Washington County. HAZUS estimated that 19 residential structures would be affected by this size flood event. Ten of those structures would sustain one to ten percent damage, and nine structures would not sustain any measurable damage. None would sustain substantial damage. Figure 3-18 is a HAZUS generated map showing the 100 year flood boundary and the direct building losses for the county.

According to HAZUS data, 85.3 percent of the structures in Washington County are residential. Eight percent of structures are commercial buildings. Two percent are industrial buildings. The remainder are agricultural (.4 percent); religious (3.3 percent); government (.7 percent); and education (.3 percent). The total financial exposure for structures in the county is an estimated \$804,605,000.

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 3.28 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 3.28 is based on the data provided and may

have some insufficiencies. Based on the data available and analysis, the unincorporated portions of Washington County are the most vulnerable to flood losses. It should be noted that the HAZUS data indicated that in a 100 year flood, no government buildings would be damaged – only residential structures.

Table 3.28 Estimated Flood Losses by Jurisdiction

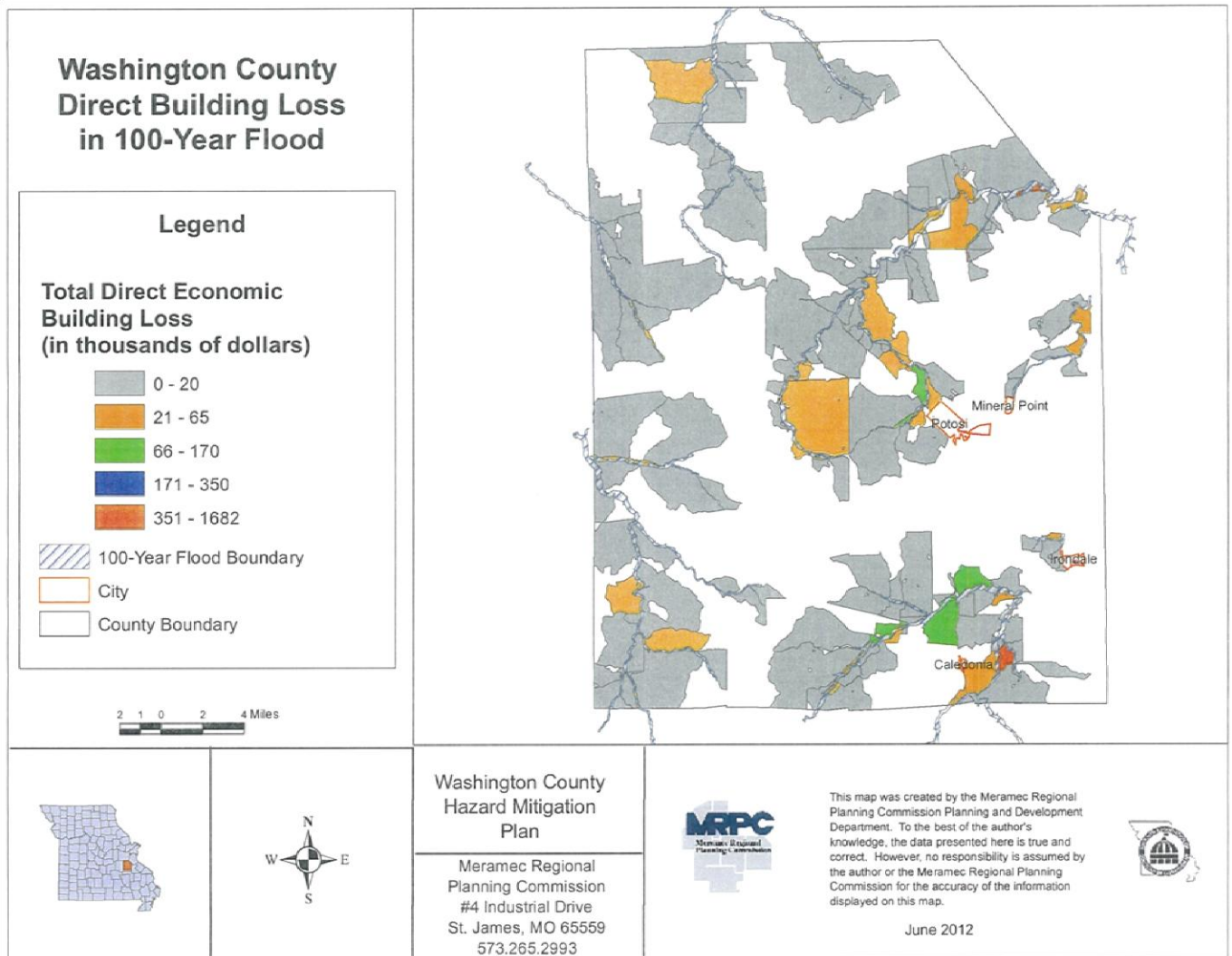
Jurisdiction	Building Damage	Contents Damage	Inventory Damage	Relocation Loss	Income Related Loss	Rental Income Loss	Wage Loss	Total	% of Total
Unincorp. Washington Co	\$2,523,000	\$1,806,000	\$38,000	\$4,000	\$158,000	\$1,000	\$744,000	\$1,038,000	100%
Caledonia	-0-	-0-	-0-	-0-	-0-	-0-	-0-	\$61,000	-0-
Irondale	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Mineral Point	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Potosi	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL	\$2,523,000	\$1,806,000	\$38,000	\$4,000	\$158,000	\$1,000	\$744,000	\$1,038,000	100%

Source: HAZUS-MH MR3

Total economic losses for Washington County in the 100 year flood scenario are estimated at \$5.274 million. The total building related losses were \$4.368 million (building damage, contents damage, inventory damage and rental income loss) –.54 percent of the total value of the county’s structures.

Figure 3-18 maps the estimated potential building losses in the county.

Figure 3-18



Tables 3.29 through 3.33 show the estimated number of buildings that could be damaged should a flood occur in 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.

Table 3.29 Estimated Damaged Building Count for Caledonia - Flood

Occupancy	Total Building Count	Number of Buildings in the 100-Year Floodplain	Estimated Number of Buildings Damaged
Residential	101	0	0
Commercial	4	0	0
Industrial	3	0	0
Agricultural	0	0	0
Religion	1	0	0
Government	2	0	0
Education	1	0	0
Total	112	0	0

Source: HAZUS-MH

Table 3.30 Estimated Damaged Building Count for Irondale - Flood

Occupancy	Total Building Count	Number of Buildings in the 100-Year Floodplain	Estimated Number of Buildings Damaged
Residential	230	0	0
Commercial	8	0	0
Industrial	2	0	0
Agricultural	2	0	0
Religion	2	0	0
Government	1	0	0
Education	0	0	0
Total	245	0	0

Source: HAZUS-MH

Table 3.31 Estimated Damaged Building Count for Mineral Point - Flood

Occupancy	Total Building Count	Number of Buildings in the 100-Year Floodplain	Estimated Number of Buildings Damaged
Residential	198	0	0
Commercial	1	0	0
Industrial	1	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	201	0	0

Source: HAZUS-MH

Table 3.32 Estimated Damaged Building Count for Potosi - Flood

Occupancy	Total Building Count	Number of Buildings in the 100-Year Floodplain	Estimated Number of Buildings Damaged
Residential	761	0	0
Commercial	30	0	0
Industrial	4	0	0
Agricultural	1	0	0
Religion	9	0	0
Government	0	0	0
Education	2	0	0
Total	807	0	0

Source: HAZUS-MH

Table 3.33 Estimated Damaged Building Count for Washington County

Occupancy	Total Building Count	Estimated Number of Buildings Damaged IN 100-Year Flood
Residential	9,236	212
Commercial	158	4
Industrial	42	1
Agricultural	8	0
Religion	29	0
Government	12	0
Education	8	0
Total	9,493	217

Source: HAZUS-MH

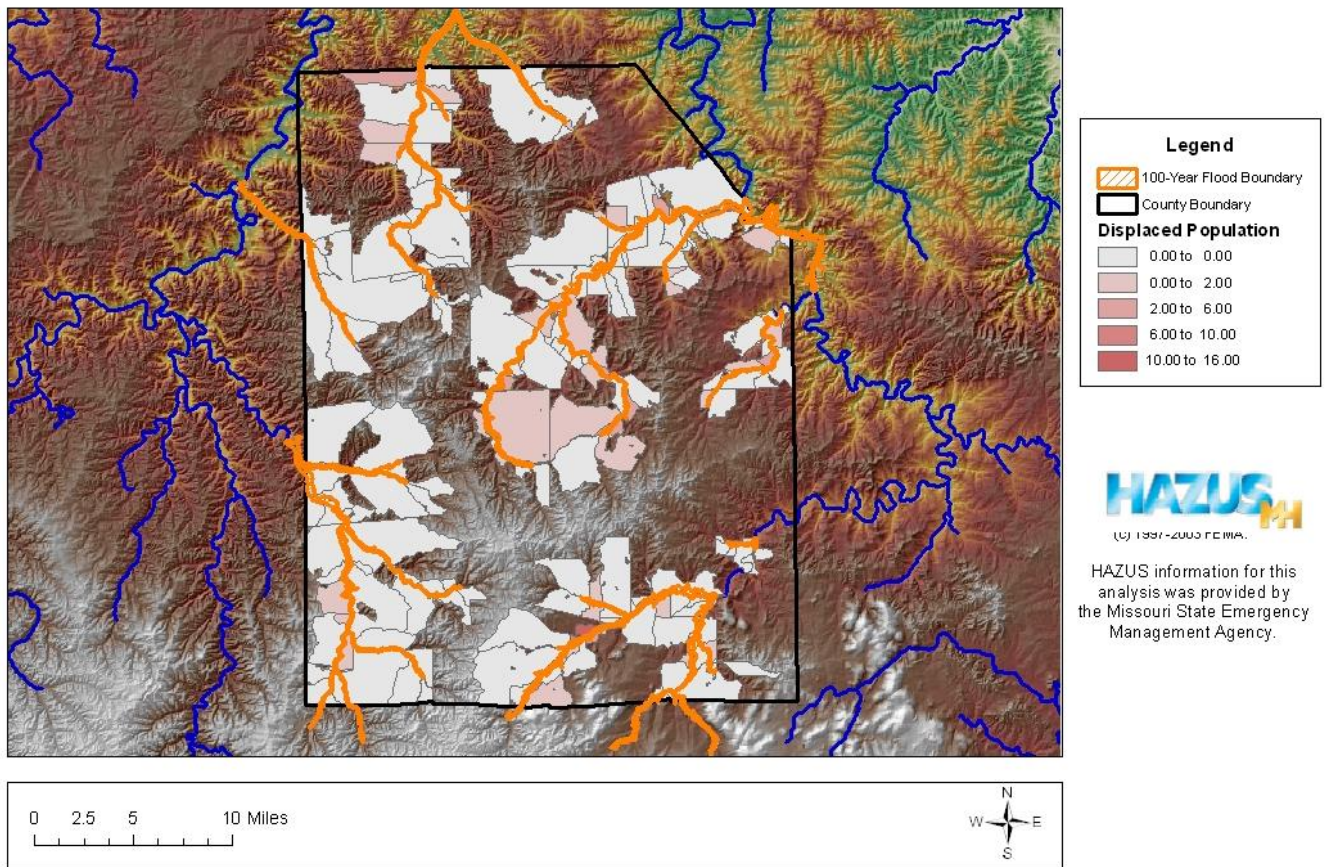
Flood Vulnerability: Potential Population Displaced

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 25,076, approximately 213 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 13 will seek temporary shelter in public shelters.

Figure 3-19 classifies areas of Washington 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 Cities of Potosi and Mineral Point; and scattered throughout the unincorporated areas of the county along the Meramec River and the Big River watersheds. There is little risk to people or property for other incorporated cities in Washington County.

Figure 3-19

Washington County Displaced Population in 100-Year Flood



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 Washington 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.

Flood Vulnerability: Critical Facility Locations by City

Figures 3-23 and 3-24 map the locations of critical facilities in relation to the 100-year floodplain for the incorporated cities of Washington County. Based on HAZUS-MH data, there are no critical facilities located in or immediately adjacent to the 100-year floodplain in any of the incorporated cities. However, there are a few structures in the unincorporated areas of the

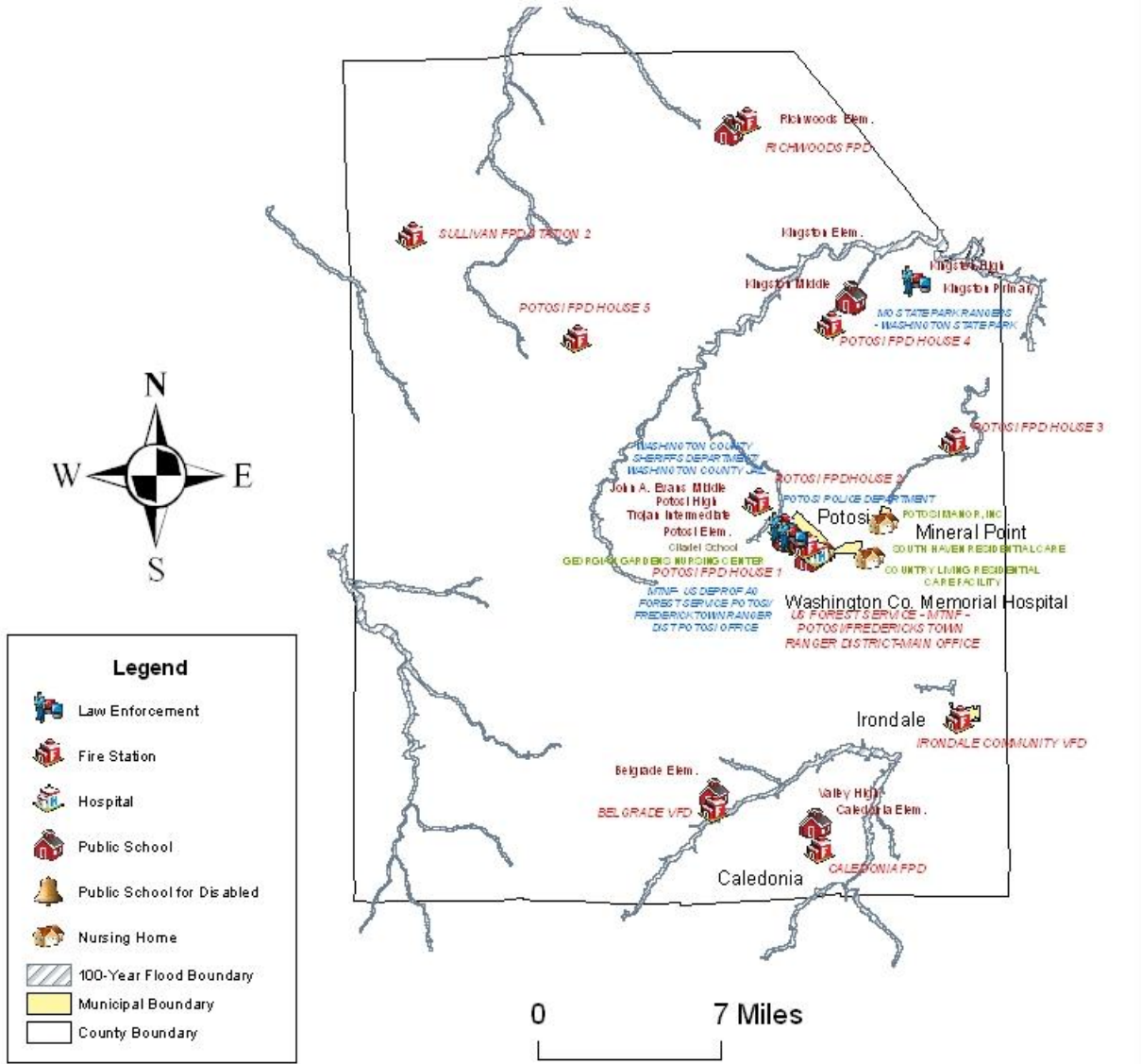
county that appear to be located adjacent to a floodplain, including: Potosi Fire Protection District House 4, Kingston School buildings, and the Belgrade Volunteer Fire Department.

National Flood Insurance Program and Repetitive Loss Properties

Of the five local government jurisdictions participating in this plan, four are currently participating in the National Flood Insurance Program (NFIP): Washington County, the Village of Irondale, the Village of Mineral Point and the City of Potosi. The Village of Caledonia does not participate in the NFIP. According to repetitive loss data provided by SEMA, there is one property in Mineral Point that has had repetitive losses. It is a single-family dwelling and has flooded twice. Flooding occurred in 1993 and 1994. The property has not been mitigated.

Figure 3-20

Washington County Critical Facilities and the 100-Year Flood



Washington County Hazard Mitigation Plan

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



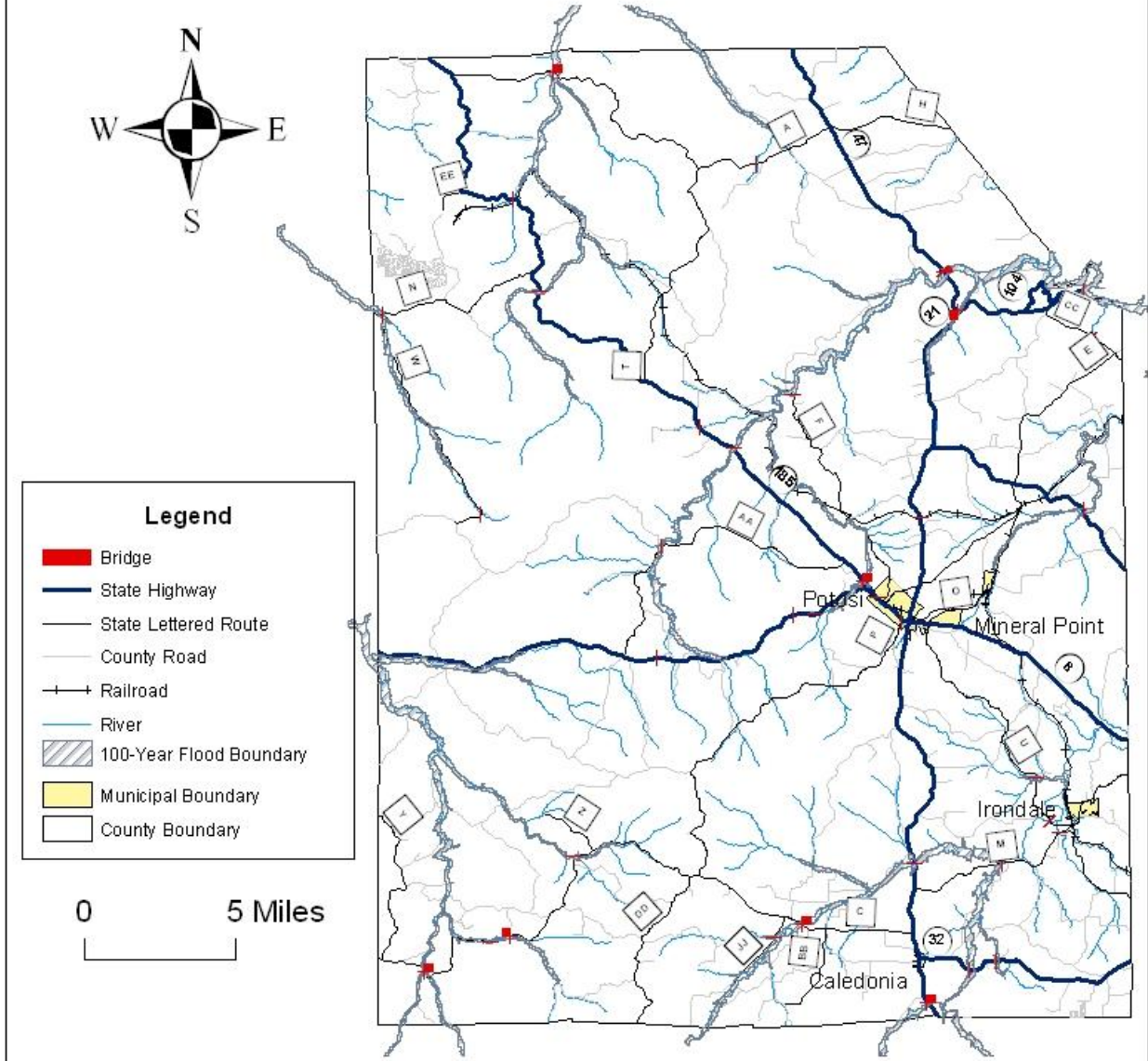
This map was created by the Meramec Regional Planning Commission Planning and Development Department. To the best of the author's knowledge, the data presented here is true and correct. However, no responsibility is assumed by the author or the Meramec Regional Planning Commission for the accuracy of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



May 2010

Figure 3-21

Washington County Transportation Critical Facilities and the 100-Year Flood



**Washington County
Hazard Mitigation
Plan**

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



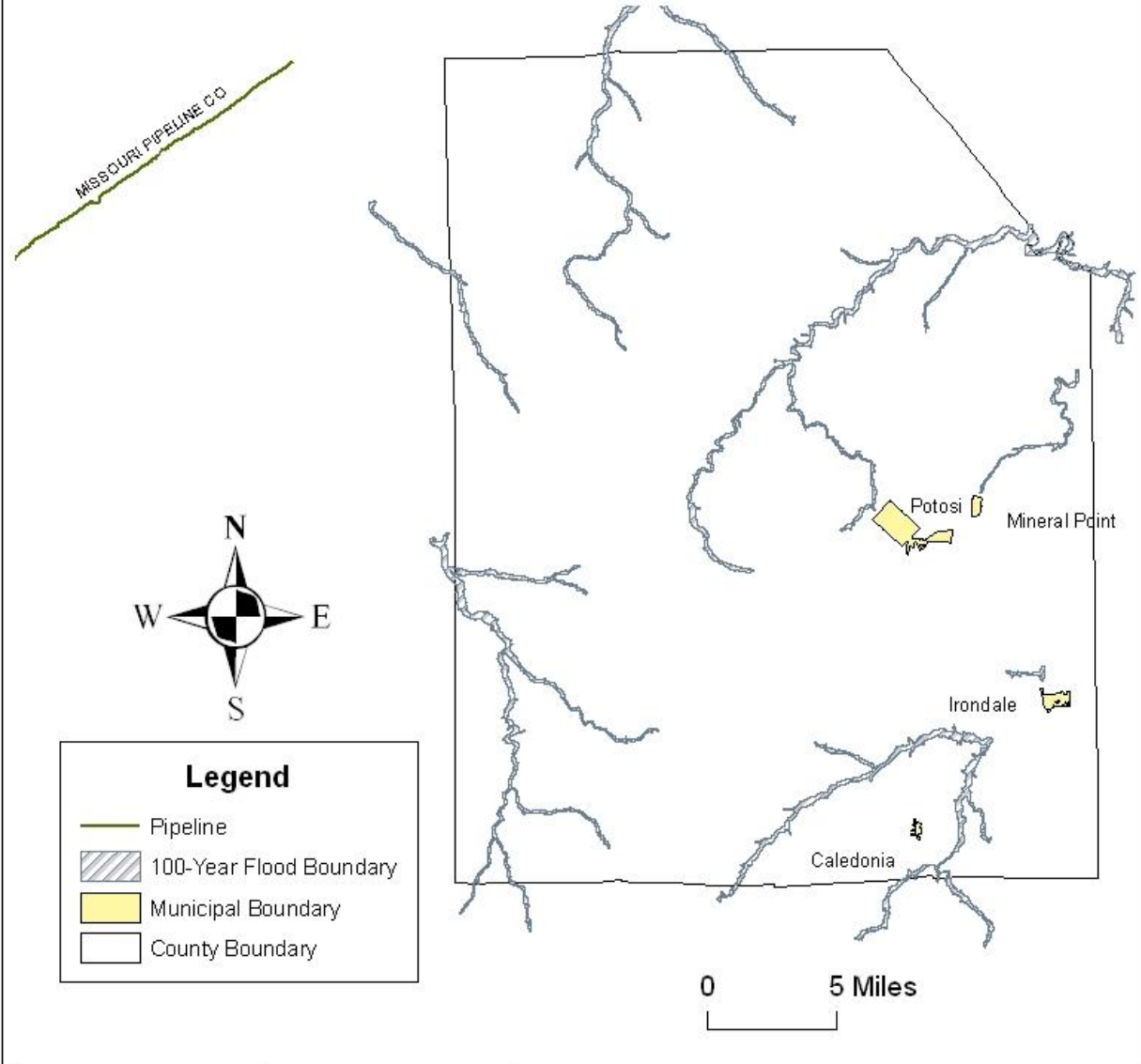
This map was created by the Meramec Regional Planning Commission Planning and Development Department. To the best of the author's knowledge, the data presented here is true and correct. However, no responsibility is assumed by the author or the Meramec Regional Planning Commission for the accuracy of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



May 2010

Figure 3-22

Washington County Pipelines and the 100-Year Flood



**Washington 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.



May 2010

Figure 3-23

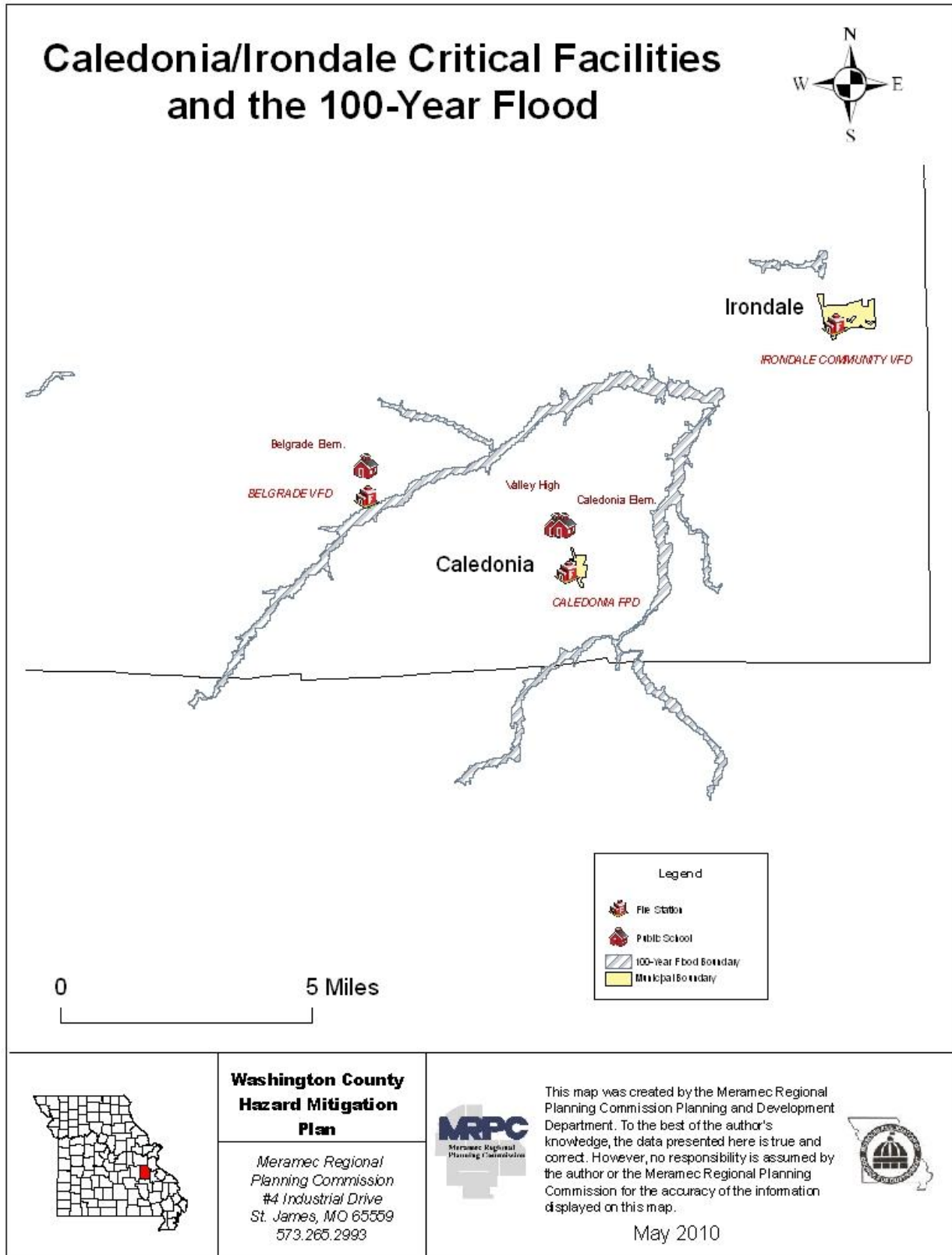
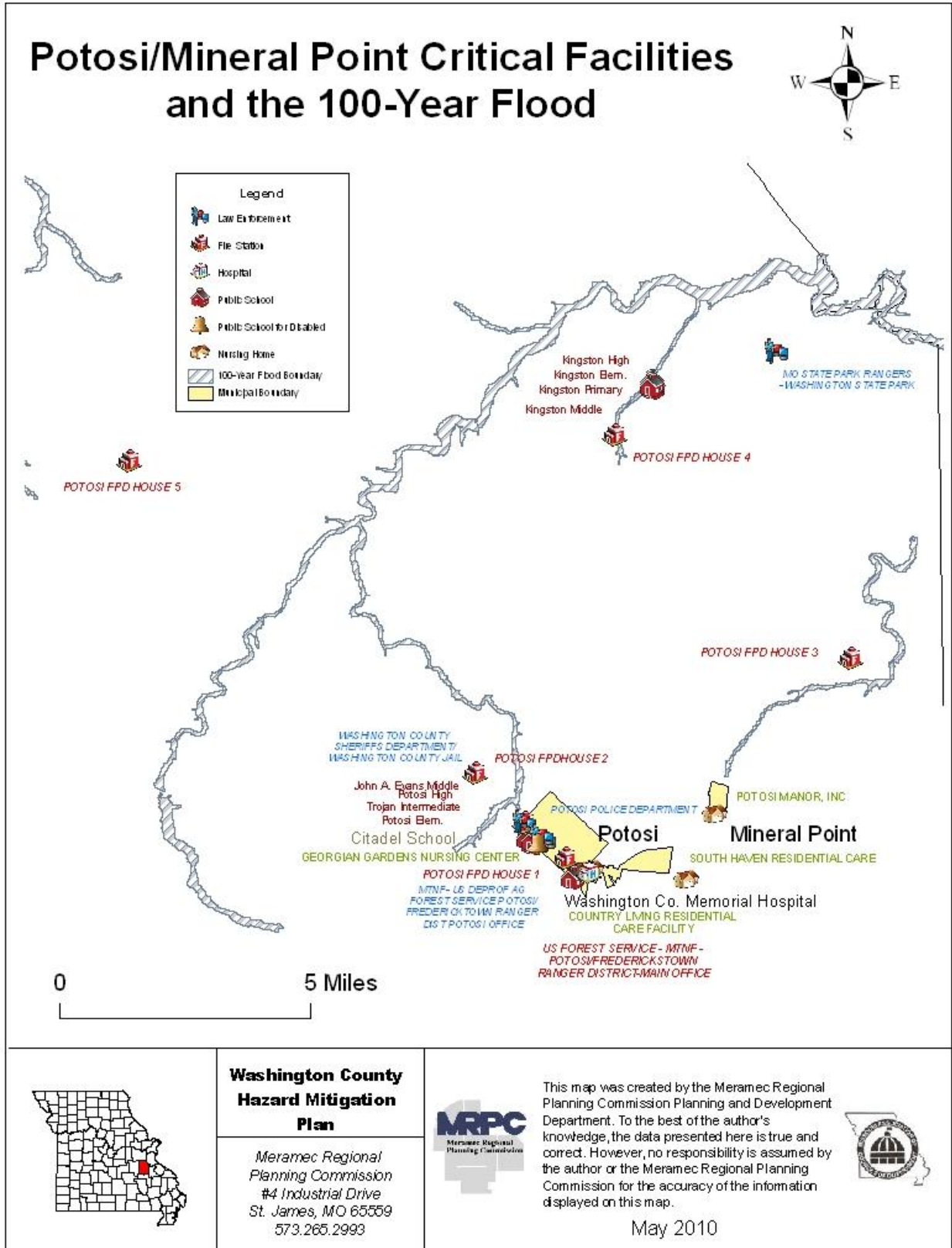


Figure 3-24



Dam Failure Vulnerability of Washington 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 jurisdictions – with Washington County, the cities of Irondale, Mineral Point and Potosi, and the school districts of Kingston K-14, Potosi R-III and Richwoods R-VII having a numerical risk score slightly higher than the remaining two jurisdictions. This rating was arrived at even though there are 49 dams in Washington County that are rated as High hazard by the Missouri Department of Natural Resources. Due to the fact that there has been only one incident of dam failure in the county in 60 years that did not result in any injuries or property damage, 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 Irondale, Mineral Point and Potosi, as well as the school districts of Kingston K-14, Potosi R-III and Richwoods R-VII were more vulnerable to this hazard. There are two high hazard dams that if compromised could cause damage to Irondale; three high hazard dams located near Mineral Point; four high hazard dams that could cause damage in Potosi and potentially Potosi R-III schools; two near Richwoods R-VII; and four high hazard dams near Kingston K-14. Failure of any of these dams could cause damage to streets, residences and/or businesses. But although the CPRI score was higher for these jurisdictions, they still ranked as being at a low risk. There has been only one incident of dam failure in the county when in 1975, a tailing dam failed and allowed barite tailings to leak into a nearby waterway. There have been no incidents of injuries or property damage. Washington County has an unusually high number of dams for the region, but the majority of 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 Washington 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 Potosi and Irondale 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 or just outside of those communities.

Drought Vulnerability of Washington 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 Washington County or the jurisdictions located in the county. 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 Washington 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 HAZUS scenarios support this and show that there will be no damage to structures or infrastructure and no effect on the functionality of critical services. 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 Washington County. According to the Modified Mercalli Scale, the earthquake would likely be felt by all residents and the area may experience damage to poorly designed or constructed buildings. However, 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 Washington County.

Future Development

It is anticipated that the threat of earthquake would have no effect on future development in Washington County, although it would benefit local governments to include earthquake resilience in building codes if they are not already incorporated.

Extreme Heat Vulnerability of Washington 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 2010 U.S. Census and the 2007 – 2011 American Community Survey, five year estimates shown in Table 3.34 compares the percentage of persons over age 65 and the percentage of persons below the federal poverty line living in Washington County and its jurisdictions to averages for Missouri and the United States.

Table 3.34 Washington County Demographic and Economic Characteristics (2011)

Jurisdiction	2010 Population*	Age 65 and Over (%)*	Individuals Below the Poverty Level (%)**
United States	308,745,538	13.0	13.8
Missouri	5,988,927	14.0	14.0
Washington County	25,195	13.4	20.7
Caledonia	130	21.5	49.1
Irondale	445	12.4	65.8
Mineral Point	351	9.4	44.3
Potosi	2,660	18.7	33.9

*Source: 2010 U. S. Census

**Source: U.S. Census Bureau, 2006-2010 American Community Survey 5-yr Estimates

The City of Caledonia has a higher than average percentage of people over the age of 65. All the cities and county have a higher than average percentage of individuals living below the poverty level. Both of these populations are vulnerable to the effects of heat waves. The power grid in Washington 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 3.25 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 Potosi. It is anticipated that growth will continue at a slow but steady level into the future.

Landslide Vulnerability of Washington 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 Washington 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 Washington County.

Land Subsidence/Sinkhole Vulnerability of Washington 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 some sinkholes in Washington County, there are no recorded incidents of sinkhole collapse that caused injury or property damage. All of the sinkholes are located in rural areas of the county. 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 Washington County.

Severe Storms Hail/Wind Vulnerability of Washington 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 Washington 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, Washington County reported a total of \$504,000 in property damage from severe storm winds. There was \$1,000 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 determine magnitude of impact, which includes percentages for damage, we can estimate 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 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 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 3.35 Estimated Damaged Building Count for Caledonia - Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	101	9	1
Commercial	4	0	0
Industrial	3	0	0
Agricultural	0	0	0
Religion	1	0	0
Government	2	0	0
Education	1	0	0
Total	112	9	1

Source: HAZUS-MH

Table 3.36 Estimated Damaged Building Count for Irondale - Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	230	21	2
Commercial	8	1	0
Industrial	2	0	0
Agricultural	2	0	0
Religion	2	0	0
Government	1	0	0
Education	0	0	0
Total	245	21	2

Source: HAZUS-MH

Table 3.37 Estimated Damaged Building Count for Mineral Point - Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	198	18	2
Commercial	1	0	0
Industrial	1	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	201	18	2

Source: HAZUS-MH

Table 3.38 Estimated Damaged Building Count for Potosi - Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	761	68	8
Commercial	30	3	0
Industrial	4	0	0
Agricultural	1	0	0
Religion	9	1	0
Government	3	0	0
Education	2	0	0
Total	810	72	8

Source: HAZUS-MH

Table 3.39 Estimated Damaged Building Count for Washington County - Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	9,236	831	92
Commercial	158	14	2
Industrial	42	4	0
Agricultural	8	1	0
Religion	29	3	0
Government	12	1	0
Education	8	1	0
Total	9,493	855	94

Source: HAZUS-MH

Table 3.40 Estimated Damaged Building Count for Kingston K-14 School District - Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
4	.36	.04

Source: www.dese.mo.gov/directory

Table 3.41 Estimated Damaged Building Count for Potosi R-III School District - Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
4	.36	.04

Source: www.dese.mo.gov/directory

Table 3.42 Estimated Damaged Building Count for Richwoods R-VII School District - Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
1	.09	.01

Source: www.dese.mo.gov/directory

Table 3.43 Estimated Damaged Building Count for Valley R-VI School District - Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged with 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
3	.27	.03

Source: www.dese.mo.gov/directory

Future Development

Development trends in Washington County are not likely to increase vulnerability to this type of hazard.

Severe Winter Storm Vulnerability of Washington County and Jurisdictions

Overview

Planning Significance: High. All of Washington 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 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 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 3.44 Estimated Damaged Building Count for Caledonia – Winter Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	101	9	1
Commercial	4	0	0
Industrial	3	0	0
Agricultural	0	0	0
Religion	1	0	0
Government	2	0	0
Education	1	0	0
Total	112	9	1

Source: HAZUS-MH

Table 3.45 Estimated Damaged Building Count for Irondale – Winter Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	230	21	2
Commercial	8	1	0
Industrial	2	0	0
Agricultural	2	0	0
Religion	2	0	0
Government	1	0	0
Education	0	0	0
Total	245	21	2

Source: HAZUS-MH

Table 3.46 Estimated Damaged Building Count for Mineral Point – Winter Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	198	18	2
Commercial	1	0	0
Industrial	1	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	201	18	2

Source: HAZUS-MH

Table 3.47 Estimated Damaged Building Count for Potosi – Winter Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	761	68	8
Commercial	30	3	0
Industrial	4	0	0
Agricultural	1	0	0
Religion	9	1	0
Government	3	0	0
Education	2	0	0
Total	810	72	8

Source: HAZUS-MH

Table 3.48 Estimated Damaged Building Count for Washington County – Winter Storms

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	9,236	831	92
Commercial	158	14	2
Industrial	42	4	0
Agricultural	8	1	0
Religion	29	3	0
Government	12	1	0
Education	8	1	0
Total	9,493	855	94

Source: HAZUS-MH

Table 3.49 Estimated Damaged Building Count for Kingston K-14 School District – Winter Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
4	.36	.04

Source: www.dese.mo.gov/directory

Table 3.50 Estimated Damaged Building Count for Potosi R-III School District – Winter Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
4	.36	.04

Source: www.dese.mo.gov/directory

Table 3.51 Estimated Damaged Building Count for Richwoods R-VII School District – Winter Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
1	.09	.01

Source: www.dese.mo.gov/directory

Table 3.52 Estimated Damaged Building Count for Valley R-VI School District – Winter Storms

Total Building Count	Estimated Number/Percentage of Buildings Damaged with 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
3	.27	.03

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 Washington County and Jurisdictions

Overview

Planning Significance: High. Based on the history of frequency and severity of tornados in Washington County, this hazard was ranked as a high risk due to the historic frequency, cost and casualties in loss of life and injuries. 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 20 tornados have occurred in Washington County between 1950 and 2009. Total damages were \$56.3 million during the 59 year period. Of that total, \$50 million was caused by two tornado event. A total of six people have been killed and 94 people have been injured in tornados in the county.

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 Washington 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

Washington County has had two tornados of magnitude F4. Three other tornados were magnitude F3, and all other tornados that have occurred since 1950 have been F2 or smaller.

Historical data supports the possibility of a large tornado occurring, and safe rooms/storm shelters should be constructed to provide protection during the most severe of tornados. Of the 20 recorded events, ten resulted in damages costing from \$25,000 to \$25 million. If the total losses are averaged over the 59 year period, the annual cost of tornados in Washington County is \$954,237.

Based on CPRI scores and the rating system used 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 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 tornados as limited – 25-50 percent of property severely damaged. All damage estimates have been figured using 50 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 50 percent and 25 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 Caledonia - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 50% Worst Case Damage	Estimated Number of Buildings Damaged With 25% Minimal Damage
Residential	101	50	25
Commercial	4	2	1
Industrial	3	2	1
Agricultural	0	0	0
Religion	1	1	0
Government	2	1	1
Education	1	1	0
Total	112	57	28

Source: HAZUS-MH

Table 3.54 Estimated Damaged Building Count for Irondale - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged With 10% Minimal Damage
Residential	230	58	58
Commercial	8	4	2
Industrial	2	1	1
Agricultural	2	1	1
Religion	2	1	1
Government	1	1	0
Education	0	0	0
Total	245	66	63

Source: HAZUS-MH

Table 3.55 Estimated Damaged Building Count for Mineral Point - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged With 10% Minimal Damage
Residential	198	99	50
Commercial	1	1	0
Industrial	1	1	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	1	0
Education	0	0	0
Total	201	102	50

Source: HAZUS-MH

Table 3.56 Estimated Damaged Building Count for Potosi - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged With 10% Minimal Damage
Residential	761	381	190
Commercial	30	15	8
Industrial	4	2	1
Agricultural	1	1	0
Religion	9	5	2
Government	3	2	1
Education	2	1	1
Total	807	407	203

Source: HAZUS-MH

Table 3.57 Estimated Damaged Building Count for Washington County - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged With 10% Minimal Damage
Residential	9,236	4,618	2,309
Commercial	158	79	49
Industrial	42	21	11
Agricultural	8	4	2
Religion	29	15	7
Government	12	6	3
Education	8	4	2
Total	9,493	4,747	2,383

Source: HAZUS-MH

Table 3.58 Estimated Damaged Building Count for Kingston K-14 School District - Tornado

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 25% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 10% Minimal Damage
4	2	1

Source: www.dese.mo.gov/directory

Table 3.59 Estimated Damaged Building Count for Potosi R-III School District - Tornado

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged With 10% Minimal Damage
4	2	1

Source: www.dese.mo.gov/directory

Table 3.60 Estimated Damaged Building Count for Richwoods R-VII School District - Tornado

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 25% Worst Case Damage	Estimated Number of Buildings Damaged With 10% Minimal Damage
1	.5	.25

Source: www.dese.mo.gov/directory

Table 3.61 Estimated Damaged Building Count for Valley R-VI School District - Tornado

Total Building Count	Estimated Number/Percentage of Buildings Damaged with 25% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 10% Minimal Damage
3	1.5	1

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 Washington County and Jurisdictions

Overview

Planning significance: High for unincorporated areas of Washington County; Moderate for all cities; and Low for all school districts. As discussed under the past history and magnitude sections of the profile for this hazard (Section 3.2.10), historically there have been 936 fires reported between January 1, 2000 and January 1, 2010. The total acreage burned from those incidents was 9,998.45 acres. Six residences and eight outbuildings were damaged. Ten residences and 18 outbuildings were destroyed during the course of these fires. Fortunately there were no reported deaths or injuries from these fires. Due to the rural nature of the county and the sizeable expanse of public land (Mark Twain National Forest, Missouri Department of Conservation lands, Washington State Park) this hazard should be considered a high priority. For the cities in the county, the risk is somewhat lower. 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. As the school districts have their buildings located in populated areas, in or adjacent to communities, and because the schools have relatively small number of buildings, the risk to school districts was considered to be Low.

Potential Losses to Existing Development

In a rural, wooded region like Washington 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, Washington 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 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 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 24 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 – 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 3.62 Estimated Damaged Building Count for Caledonia – Wildfire

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	101	9	1
Commercial	4	0	0
Industrial	3	0	0
Agricultural	0	0	0
Religion	1	0	0
Government	2	0	0
Education	1	0	0
Total	112	9	1

Source: HAZUS-MH

Table 3.63 Estimated Damaged Building Count for Irondale – Wildfire

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	230	21	2
Commercial	8	1	0
Industrial	2	0	0
Agricultural	2	0	0
Religion	2	0	0
Government	1	0	0
Education	0	0	0
Total	245	21	2

Source: HAZUS-MH

Table 3.64 Estimated Damaged Building Count for Mineral Point – Wildfire

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	198	18	2
Commercial	1	0	0
Industrial	1	0	0
Agricultural	0	0	0
Religion	0	0	0
Government	1	0	0
Education	0	0	0
Total	201	18	2

Source: HAZUS-MH

Table 3.65 Estimated Damaged Building Count for Potosi – Wildfire

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	761	68	8
Commercial	30	3	0
Industrial	4	0	0
Agricultural	1	0	0
Religion	9	1	0
Government	3	0	0
Education	2	0	0
Total	810	72	8

Source: HAZUS-MH

Table 3.66 Estimated Damaged Building Count for Washington County – Wildfire

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	9,236	831	92
Commercial	158	14	2
Industrial	42	4	0
Agricultural	8	1	0
Religion	29	3	0
Government	12	1	0
Education	8	1	0
Total	9,493	855	94

Source: HAZUS-MH

Table 3.67 Estimated Damaged Building Count for Kingston K-14 School District – Wildfire

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
4	.36	.04

Source: www.dese.mo.gov/directory

Table 3.68 Estimated Damaged Building Count for Potosi R-III School District – Wildfire

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
4	.36	.04

Source: www.dese.mo.gov/directory

Table 3.69 Estimated Damaged Building Count for Richwoods R-VII School District – Wildfire

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
1	.09	.01

Source: www.dese.mo.gov/directory

Table 3.70 Estimated Damaged Building Count for Valley R-VI School District – Wildfire

Total Building Count	Estimated Number/Percentage of Buildings Damaged with 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
3	.27	.03

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 3.71 shows the changes in population for Washington County and its jurisdictions.

Table 3.71 Historic Population Trends for Washington County and Jurisdictions

Jurisdiction	Washington County	Caledonia	Irondale	Mineral Point	Potosi
2010 Population	25,195	130	445	351	2,660
% Change	7.9	-17.7	1.8	-3.3	-0.1
2000 Population	23,344	158	437	363	2,662
% Change	14.5	11.3	-7.8	-5.5	-0.8
1990 Population	20,380	142	474	384	2,683
% Change	13.3	-12.4	35.8	7.3	6.1
1980 Population	17,983	162	349	358	2,528
% Change	19.2	43.3	9.4	-3.0	-8.4
1970 Population	15,086	113	319	369	2,761
% Change	5.2	-5.0	-4.8	11.1	-1.6
1960 Population	14,346	119	335	332	2,805
% Change	-2.3	-16.8	-24.3	9.2	17.6
1950 Population	14,689	143	443	304	2,359
% Change	-16.0	2.8	-0.7	-12.6	17.0

Source: U.S. Census Bureau

According to the Missouri Office of Administration, Division of Budget and Planning, the population for Washington County is projected to grow slightly over the next 20 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 2000 and 2010, Washington County experienced the fourth highest growth rate of all the counties in the Meramec region – 7.9 percent following Pulaski, Phelps and Crawford Counties respectively.^{lxxviii} Only one incorporated community in the county; Irondale showed growth during this same period of 1.8 percent. The remaining three incorporated communities showed a loss in population –Potosi -0.1 percent, Mineral Point -3.3 percent and Caledonia -17.7 percent.

The incorporated communities will likely continue to loose population unless more job opportunities become available for the populations youth who are currently leaving home in search of better employment.

3.3.5 Summary of Key Issues

Table 3.26 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 3.72 Washington County Hazard Ranking High to Low Planning Significance

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Dam Failure - Caledonia Valley R-VI -Washington Co. Irondale Mineral Point Potosi Kingston K-14 Potosi R-III Richwoods R-VII	1	1	4	3	1.65	Low
Drought	1	1	1	4	1.3	Low
Earthquake	2	1	4	4	2.05	Moderate
Extreme Heat	4	3	1	3	3.15	High
Flood -Washington Co. -Caledonia Irondale Mineral Point Potosi Kingston K-14 Potosi R-III Richwoods R-VII Valley R-VI	4	1	4	3	3.0	High
Landslide	1	1	4	1	1.45	Low
Land Subsidence/ Sinkholes	1	1	4	3	1.45	Low
Severe Storm (Hail storm/Wind storm)	4	1	4	1	3	High
Tornado	2	3	4	1	3.15	High
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: Washington 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.
- 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 likely a number of vulnerable properties in the Big River watershed, and at least one property in Mineral Point 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 Washington County is not located in an area that will likely 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 Washington County have a higher than average percentage of people over the age of 65 and 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

- Washington County has had several people injured or killed by tornados and averages almost \$1 million in property damage per year from tornado events.
- 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

- Washington County has frequent wildfires and is considered high risk.
- Caledonia, Irondale, Mineral Point and Potosi are 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://mcs.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.

^{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>

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- 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.
- 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
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- lx Missouri Hazard Analysis, State Emergency Management Agency, August 1999.
- lxi National Disaster Education Coalition. <http://www.disastercenter.com/guide/thunder.html>
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<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 Washington 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 Washington 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.

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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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.

44 CFR Requirement 201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts and changes in priorities.

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. When the initial plan was written, the planning committee created a list of needs and then developed goals, objectives and action items based on those needs. During the plan update, the planning committee reviewed the list of needs, goals, objectives and action items that were established in the initial plan. No changes were made to the overarching goals established in 2004. During the revision process it was determined that several listed issues needed to be revised or had been addressed and were no longer considered a need. Minor changes were made to existing action items to reflect needs that have been partially or fully addressed. Some action items were added and are listed after Table 4.1.

The mitigation actions identified in the original plan document were divided into four categories and are defined as follows:

- Completed – actions have been completed
- Retained – actions have not been completed but are deemed important and appropriate for the updated plan – or – the actions are on-going mitigation activities
- Modified – actions were in the original plan document, but the focus or language has been modified to some degree to better define the action item
- Deleted – actions were deemed unrealistic or inappropriate or no longer applicable for the jurisdictions involved

The review and categorization of the original plan’s action items are listed in Table 4.1.

Table 4.1 – Review & Assessment of 2004 Plan Action Items

Action Item Number	Mitigation Action	Assessment for Update
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.	Retained – County has two CERT trainers and has CERT information posted on the Washington County Health Department website – www.washingtoncountyhealthdepartment.org . The website also has links to Ready-in-3 information.
2	Educate residents about siren meanings.	Completed – Addressed.

Action Item Number	Mitigation Action	Assessment for Update
3	Educate residents about precautions that should be taken during severe heat.	Modified – “Continue to educate residents about precautions that should be taken during severe heat.” The county health department and SEMA provide instructional press releases and information that are distributed prior to and during severe heat incidents.
4	Promote the development of emergency plans by businesses.	Modified and combined with 13 – “Continue to promote the development of emergency plans by businesses/government/ schools.” Local fire department in Potosi has provided assistance to local businesses such as Redwing Shoes, Belgrade Bank, Purcell Tire and Walmart in this area. “Are You Prepared” brochure has been distributed.
5	Encourage cities to obtain early warning systems and improved communications systems.	Modified – “Continue to encourage cities to obtain early warning systems and improved communications systems.” County agencies have received a number of communications upgrades through Homeland Security Grant programs.
6	Promote the use of weather radios by local residents and schools to ensure advanced warning about threatening weather.	Modified– “Continue to promote the use of weather radios by local residents to ensure advanced warning about threatening weather.” All schools in Washington County now have NOAA weather radios.
7	Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.	Retained – County EMD works with local stations KTJJ and KREI.
8	Place water height gauges and signs near low water crossings.	Retained.
9	Encourage the county’s tree trimming programs that reduce damages during high winds and severe winter storms while also encouraging dead tree removal.	Modified – “Continue to encourage tree trimming and dead tree removal by cities, counties and utility companies.” Tree trimming programs have become much more aggressive – this is an on-going activity.
10	Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.	Modified – “Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.” The county has completed several projects including raising Kingston Bridge; raising the road and making bridge improvements on Settles Hollow Road, Villmer Road; Racloa Road and Arnold Branch; raised Ebo Hollow Road. The county is also involved in a project to assess and prioritize bridge and low water crossing projects.
11	Establish cooling centers where residents can go during extreme heat or power outages.	Modified – “continue to provide cooling shelters for residents during extreme heat or power outage events and publicize location and availability.” The county health department has established cooling

Action Item Number	Mitigation Action	Assessment for Update
		centers during times of extreme heat as well as during power outages in Potosi, Richwoods and Belgrade in churches, senior centers, Lions Club hall and Washington County Handicap Center.
12	Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.	Modified – “continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.”
13	Encourage businesses to develop emergency plans.	Deleted and combined with #4.
14	Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.	Retained – Since the initial plan was developed, Washington County has joined the NFIP. The county and all city jurisdictions are members of NFIP.
15	Encourage minimum standards for building codes in all cities.	Retained. Irondale, Mineral Point and Potosi all have building codes. Washington County does not have the authority to enact. Caledonia does not have building codes or ordinances in place.
16	Encourage local governments to develop and implement regulations for the securing of hazardous materials tank and mobile homes to reduce hazards during flooding and high winds.	Retained.
17	Encourage the Mark Twain National Forest to levy stricter fines for persons causing fire hazards.	Retained.
18	Distribute SEMA brochures at public facilities and events.	Modified – “Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.” On-going activity at local festivals and fairs.
19	Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.	Retained. The county EMD and health department, as well as SEMA distribute press releases and public service announcements on hazards and preparedness.
20	Encourage local residents to purchase weather radios through press releases and brochures.	Retained. The county EMD has this as an on-going activity.
21	Ask SEMA mitigation specialists to present information to city councils, county commission and local planning organizations.	Modified – combined with Action Item 30. “Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.” County EMD has this as an on-going activity.
22	Re-evaluate the hazard mitigation plan, merge with other community planning.	Modified – merged with Action Items 29 & 32. “Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and

Action Item Number	Mitigation Action	Assessment for Update
		integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures." As other planning documents (LEOP, comprehensive plans, CEDS, etc.) are reviewed and updated, hazard mitigation action items are being included where applicable.
23	Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.	Retained. Ongoing activity.
24	Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).	Retained. Ongoing activity.
25	Publicize county or citywide drills.	Retained – county EMD publicizes drills, works with schools and other agencies.
26	Encourage joint meetings of different organizations/agencies for mitigation planning.	Modified – "Continue to encourage joint meetings of different organizations/agencies for mitigation planning." County EMD currently holds monthly meetings where a variety of issues are discussed including hazard mitigation. Other meetings include MREPC & homeland security Region C HSOC.
27	Joint training (or drills) between agencies, public and private entities (including schools and businesses).	Modified – "Continue to encourage joint training (or drills) between agencies, public and private entities (including schools and businesses). " An ongoing activity. The county has held drills with local schools, emergency response agencies, MREPC, etc.
28	Pool different agency resources to achieve widespread mitigation results.	Retained – ongoing activity. County is part of statewide mutual aid, Region C HSOC, MREPC, etc.
29	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.	Deleted – combined with Action Item 22.
30	Encourage communities to budget for enhanced warning systems.	Retained.
31	Encourage all communities to develop storm water management plans.	Retained. Currently Potosi is the only community with a storm water management plan.
32	Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	Deleted – merged with Action Item 22.
33	Encourage cities to require contractor storm water management pans in all new development –both residential and commercial properties.	Retained.

Action Item Number	Mitigation Action	Assessment for Update
34	Encourage county to become a member of the National Flood Insurance Program (NFIP).	Completed – Washington County is now a member of the NFIP.
35	Encourage local government to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.	Retained.
36	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.	Retained.
37	Work with SEMA Region C area coordinator to learn about new mitigation funding opportunities	Deleted and merged with Action Item 21.
38	Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.	Retained.
39	Work with state/local/federal agencies to include mitigation in all economic and community development projects.	Retained. On –going activity.
40	Encourage local governments to budget for mitigation projects.	Retained. On-going activity.
41	Encourage cities and counties to implement cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.	Retained. On-going activity – county and city of Potosi both have cost-share programs for installing culverts.
42	Implement public awareness program about the benefits of hazard mitigation projects, both public and private.	Retained.
43	Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.	Retained.

The following mitigation actions were added for the update of the plan:

- Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- Continue to evaluate and update emergency operation plans.
- Continue to conduct emergency preparedness exercises periodically.
- Continue to provide CERT training and encourage the development of CERT teams.
- Regularly review and update school emergency plans.
- Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
- Schools need to continue to conduct emergency preparedness exercises on a regular basis.

- Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.
- Encourage the designation of storm shelters and construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).
- Monitor developments in data availability concerning the impact of levee failure, dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies.

4.2.1 Mitigation Goals, Objectives and Actions

A list of the mitigation goals, objectives and action items for the Washington County Multi-Hazard Mitigation Plan (2013) follows. Actions which address reducing the effects of hazards on new and/or existing buildings and infrastructure are indicated in parentheses following the actions (New, Existing, Both).

This list of goals, objectives and actions is followed by an overview of the mitigation actions with the hazards each action is addressing and the participating jurisdiction(s) to which it applies (Figure 4.2). More information on the implementation and administration of the specific mitigation actions for each participating jurisdiction is included in Section 4.3.2.

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.
 - 1.1.1 **Action Item:** 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. (Existing)
 - 1.1.2 **Action Item:** Continue to educate residents about precautions that should be taken during severe heat.
 - 1.1.3 **Action Item:** Promote the development of emergency plans by businesses/government/schools.
 - 1.1.4 **Action Item:** Continue to provide CERT training and encourage the development of CERT teams.
 - 1.1.5 **Action Item:** Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
 - 1.1.6 **Action Item:** Schools need to continue to conduct emergency preparedness exercises on a regular basis.
- 1.2 Use the latest technology to provide adequate warning, communication, and mitigation of hazard events.

- 1.2.1 Action Item:** Continue to encourage cities to obtain early warning systems and improved communications systems
- 1.2.2 Action Item:** Continue to promote the use of weather radios by local residents to ensure advanced warning about threatening weather
- 1.2.3 Action Item:** Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.
- 1.2.4 Action Item:** Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.

1.3 Reduce the danger to, and enhance protection of, dangerous areas during hazard events.

- 1.3.1 Action Item:** Place water height gauges and signs near low water crossings.
- 1.3.2 Action Item:** Continue to encourage tree trimming and dead tree removal by utility companies and local government. (Both)
- 1.3.3 Action Item:** Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property. (Both)
- 1.3.4 Action Item:** Establish cooling centers where residents can go during extreme heat or power outages.
- 1.3.5 Action Item:** Regularly review and update school emergency plans.
- 1.3.6 Action Item:** Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.
- 1.3.7 Action Item:** Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as 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.
 - 2.1.1 Action Item:** Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant. (Existing)
 - 2.1.2 Action Item:** Encourage businesses/government/schools to develop emergency plans. (Both)
 - 2.1.3 Action Item:** Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Both)
 - 2.1.4 Action Item:** Continue to evaluate and update emergency operation plans. (Both)

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.

2.2.1 Action Item: Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program. (Both)

2.2.2 Action Item: Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

2.3 Use regulations to ensure that development will not put people in harm's way or increase threats to existing properties.

2.3.1 Action Item: Encourage minimum standards for building codes in all cities. (New)

2.3.2 Action Item: Encourage local governments to develop and implement regulations for the securing of hazardous materials tank and mobile homes to reduce hazards during flooding and high winds. (Both)

2.3.3 Action Item: Encourage the Mark Twain National Forest to levy stricter fines for persons causing fire hazards. (Both)

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. (Both)

3.1.1 Action Item: Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events. (Both)

3.1.2 Action Item: Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate. (Both)

3.2 Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

3.2.1 Action Item: Encourage local residents to purchase weather radios through press releases and brochures.

3.2.2 Action Item: Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects. (Both)

3.3 Publicize and encourage the adoption of appropriate hazard mitigation measures by county and city governments.

3.3.1 Action Item: Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Both)

3.3.2 Action Item: Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations. (Both)

3.4 Educate the public on actions they can take to prevent or reduce the loss of life or property from all natural hazards.

3.4.1 Action Item: Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).

3.4.2 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.

4.1.1 Action Item: Continue to encourage joint meetings of different organizations/agencies for mitigation planning.

4.1.2 Action Item: Continue to encourage joint training (or drills) between agencies, public and private entities (including schools and businesses).

4.1.3 Action Item: Pool different agency resources to achieve widespread mitigation results. (Both)

4.2 Encourage active participation and responsibility of chief elected officials in mitigation planning and activities.

4.2.1 Action Item: Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Both)

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.

- 5.1.1 Action Item:** Encourage communities to budget for enhanced warning systems.
- 5.1.2 Action Item:** Encourage all communities to develop storm water management plans. (Both)
- 5.1.3 Action Item:** Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Both)
- 5.1.4 Action Item:** Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties. (New)

5.2 Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

5.2.1 Action Item: Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area. (Existing)

5.2.2 Action Item: Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space. (Existing)

Goal 6: Secure resources for investment in hazard mitigation

Objectives

6.1 Research the use of local and outside sources of funding

6.1.1 Action Item: Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.

6.1.2 Action Item: Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met. (Both)

6.1.3 Action Item: Work with state/local/federal agencies to include mitigation in all economic and community development projects. (Both)

6.1.4 Action Item: Encourage local jurisdictions to budget for mitigation projects. (Both)

6.2 Encourage participation of property owners in investing in hazard mitigation projects on their own property.

6.2.1 Action Item: Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the jurisdiction as a whole. (Both)

6.2.2 Action Item: Implement public awareness program about the benefits of hazard mitigation projects, both public and private. (Both)

6.3 In the event of a disaster declaration, be prepared to apply for hazard mitigation grants for prioritized projects.

6.3.1 Action Item: Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property. (Both)

Table 4.2 Mitigation Actions Hazards Addressed, Applicable Jurisdictions

Action No.	Mitigation Action Item	Jurisdictions																			
		Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Landslide	Land Subsidence/Sinkholes	Severe Storm (Hail/Wind)	Tornado	Severe Winter Weather	Wildfire	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI
1.1.1	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.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.2	Continue to educate residents about precautions that should be taken during severe heat.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.3	Promote the development of emergency plans by businesses/government/schools.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.4	Continue to provide CERT training and encourage the development of CERT teams.	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.5	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.	X		X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.6	Schools need to continue to conduct emergency preparedness exercises on a regular basis.	X		X	X	X			X	X	X	X	X					X	X	X	X
1.2.1	Continue to encourage cities to obtain early warning systems and improved communications systems					X			X	X	X		X	X	X	X	X				
1.2.2	Continue to promote the use of weather radios by local residents to ensure advanced warning about threatening weather								X	X	x		X	X	X	X	X				
1.2.3	Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.	X			X	X			X	X	X	X	X								

		Jurisdictions																				
Action No.	Mitigation Action Item	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Landslide	Land Subsidence/Sinkholes	Severe Storm (Hail/Wind)	Tornado	Severe Winter Weather	Wildfire	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI	
1.2.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.	X						X	X		X	X										
1.3.1	Place water height gauges and signs near low water crossings.					X							X									
1.3.2	Continue to encourage tree trimming and dead tree removal by utility companies and local government.								X	X	X		X	X	X	X	X					
1.3.3	Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.					X							X				X					
1.3.4	Establish cooling centers where residents can go during extreme heat or power outages.				X								X	X	X	X	X					
1.3.5	Regularly review and update school emergency plans.	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X
1.3.6	Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.								X	X			X					X	X	X	X	X
1.3.7	Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).								X	X			X	X	X	X	X					
2.1.1	Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.			X									X	X	X	X	X	X	X	X	X	X
2.1.2	Encourage businesses/government/schools to develop emergency plans.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

		Jurisdictions																				
Action No.	Mitigation Action Item	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Landslide	Land Subsidence/Sinkholes	Severe Storm (Hail/Wind)	Tornado	Severe Winter Weather	Wildfire	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI	
2.1.3	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.	X						X	X		X	X										
2.1.4	Continue to evaluate and update emergency operation plans.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.2.1	Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.					X							X		X	X	X					
2.2.2	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.					X							X		X	X	X			X	X	
2.3.1	Encourage minimum standards for building codes in all cities.			X	X				X	X	X			X								
2.3.2	Encourage local governments to develop and implement regulations for the securing of hazardous materials tank and mobile homes to reduce hazards during flooding and high winds.					X			X	X			X	X	X	X	X					
2.3.3	Encourage the Mark Twain National Forest to levy stricter fines for persons causing fire hazards.											X	X									
3.1.1	Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
3.1.2	Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
3.2.1	Encourage local residents to purchase weather radios through press releases and brochures.				X	X			X	X	X		X									
3.2.2	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning,	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

		Jurisdictions																			
Action No.	Mitigation Action Item	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Landslide	Land Subsidence/Sinkholes	Severe Storm (Hail/Wind)	Tornado	Severe Winter Weather	Wildfire	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI
	implementation and budgeting for mitigation projects.																				
3.3.1	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.3.2	Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
3.4.1	Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions	X	X	X	X	X	X	X	X	X	X	X									
3.4.2	Publicize county or citywide drills.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.1.1	Continue to encourage joint meetings of different organizations/agencies for mitigation related planning.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.1.2	Continue to encourage joint training (and drills) between agencies, public and private entities (including schools and businesses).	X		X		X			X	X	X	X	X	X	X	X	X	X	X	X	X
4.1.3	Pool different agency resources to achieve widespread mitigation results.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.2.1	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

		Jurisdictions																				
Action No.	Mitigation Action Item	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Landslide	Land Subsidence/Sinkholes	Severe Storm (Hail/Wind)	Tornado	Severe Winter Weather	Wildfire	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI	
5.1.1	Encourage communities to budget for enhanced warning systems.					X			X	X	X		X		X	X						
5.1.2	Encourage all communities to develop storm water management plans.					X			X		X			X	X	X	X					
5.1.3	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.1.4	Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.					X			X		X		X	X	X	X	X					
5.2.1	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.					X							X		X	X	X					
5.2.2	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.					X									X	X	X					
6.1.1	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.1.2	Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.	X		X		X							X	X	X	X	X					
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
6.1.4	Encourage local jurisdictions to budget for mitigation projects.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

		Jurisdictions																				
Action No.	Mitigation Action Item	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Landslide	Land Subsidence/Sinkholes	Severe Storm (Hail/Wind)	Tornado	Severe Winter Weather	Wildfire	Washington County	Caledonia	Irondale	Mineral Point	Potosi	Kingston K-14	Potosi R-III	Richwoods R-VII	Valley R-VI	
6.2.1	Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the jurisdiction as a whole.	X		X		X	X	X	X	X	X	X	X	X	X	X	X					
6.2.2	Implement public awareness program about the benefits of hazard mitigation projects, both public and private through press releases and brochures.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.3.1	Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

4.3 NFIP Participation and Action Items Supporting NFIP

44 CFR Requirement 201.61(3)(ii): [The mitigation strategy] must also address the jurisdiction’s participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Details of NFIP participation and current flood maps have been included in the Flood Profile in Chapter 3. The NFIP participation status of jurisdictions is shown again in Figure 4.3.

Table 4.3 Washington County Jurisdictions Participation in NFIP

Jurisdictions Participating in NFIP
Washington County
Irondale
Mineral Point
Potosi
Jurisdiction NOT Participating in NFIP
Caledonia

Source: SEMA

Washington County, Irondale, Mineral Point and Potosi are all members of the NFIP. The presiding commissioner serves as the floodplain manager for the county. The fire chief serves as floodplain manager for the City of Irondale. The city treasurer serves as floodplain manager for the City of Mineral Point. The city of Potosi contracts out floodplain manager duties. The following mitigation actions pertain to continued compliance with the NFIP for all member jurisdictions:

2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.

2.2.2 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

2.3.2 Encourage local governments to develop and implement regulations for the securing of hazardous materials tank and mobile homes to reduce hazards during flooding and high winds.

3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.

5.2.1 Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.

5.2.2 Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.

4.4 Prioritization of Hazard Mitigation Action Items

[The mitigation strategy section shall include] an action plan describing how the actions identified in section I(3)(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 benefit review of the proposed projects and their associated costs.

4.4.1 STAPLEE and Benefit/Cost Review Scoring

After the list of mitigation actions for all jurisdictions in Washington County had been developed, as recommended by FEMA, a STAPLEE review and Benefit/Cost review was completed on the action items. 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?
- **Administrative:** 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?

Each question was scored based on a 0 to 3 point value system:

- 3 = Definitely YES
- 2 = Maybe YES
- 1 = Probably NO
- 0 = Definitely NO

For the Benefit/Cost Review portion of the prioritization process, these two aspects were scored as follows:

Benefit – two (2) points were added for each of the following avoided damages (8 points maximum = highest benefit)

- Injuries and/or casualties
- Property damages
- Loss-of-function/displacement impacts

- Emergency management costs/community costs

Cost – points were subtracted according to the following cost scale (-5 points maximum = highest cost)

- (-1) = Minimal – little cost to the jurisdiction involved
- (-3) = Moderate – definite cost involved but could likely be worked into operating budget
- (-5) = Significant – cost above and beyond most operating budgets; would require extra appropriations to finance or to meet matching funds for a grant

Note: For the Benefit/Cost Review, the benefit and cost of actions which used the word “encourage” were evaluated as if the action or strategy being encouraged was actually to be carried out.

Total Score – The scores for the STAPLEE Review and Benefit/Cost Review were added to determine a Total Score for each action.

Priority Scale – To achieve an understanding of how a Total Score might be translated into a Priority Rating, a sample matrix was filled out for the possible range of ratings an action might receive on both the STAPLEE and Benefit/Cost Review. The possible ratings tested ranged between:

- A hypothetical action with “Half probably NO and half maybe YES” answers on STAPLEE (i.e. poor STAPLEE score) and Low Benefit/High Cost: Total Score = 7
- A hypothetical action with “All definitely YES” on STAPLEE and High Benefit/Little Cost: Total Score = 28

An inspection of the possible scores within this range led to the development of the following Priority Scale based on the Total Score in the STAPLEE- Benefit/Cost Review process:

20 – 28 points = High Priority
 14-19 points = Medium Priority
 13 points and below = Low Priority

It should be noted that most of the actions attained a High priority rating: this is reflective of the fact that many actions which would have scored poorly on the STAPLEE review were deleted for the update during the initial discussion/review of the actions in the original plan (see Table 4.1). Also, many of the actions are ongoing and already in place but remain high priorities for the jurisdictions.

The STAPLEE review, Benefit/Cost review and Final Priority for each of the mitigation actions is shown in Table 4.4.

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES		1 = Prob NO											
		2 = Maybe YES		0 = Def NO											
Action No.	Mitigation Actions	S	T	A	P	L	E	E	STAPLEE Total	Losses Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
1.1.1	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.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
1.1.2	Continue to educate residents about precautions that should be taken during severe heat.	3	3	3	3	3	2	3	20	IC, LF, EMCC	6	-1	5	25	H
1.1.3	Promote development of emergency plans by businesses/government/schools.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
1.1.4	Continue to provide CERT training and encourage the development of CERT teams.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
1.1.5	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
1.1.6	Schools need to continue to conduct emergency preparedness exercises on a regular basis.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
1.2.1	Continue to encourage cities to obtain early warning systems and improved communications systems.	3	3	2	3	3	1	3	18	IC, PD, LF, EMCC	8	-3	5	23	H
1.2.2	Continue to promote use of weather radios by local residents to insure advanced warning about threatening weather.	3	3	3	3	3	3	3	21	IC, EMCC	4	-1	3	24	H
1.2.3	Partner with local radio stations to ensure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.	3	3	3	3	3	3	3	21	IC, EMCC	4	-1	3	24	H
1.2.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
1.3.1	Place water height gauges and signs near low water crossings	3	3	2	3	3	2	3	19	IC	2	-1	1	20	H
1.3.2	Continue to encourage tree trimming and dead tree removal programs by utility companies and local government.	3	3	3	3	3	2	2	19	IC, PD, LF, EMCC	8	-3	5	24	H
1.3.3	Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.	3	3	2	3	3	2	2	18	IC, PD, LF, EMCC	8	-1	7	25	H

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES		1 = Prob NO											
		2 = Maybe YES		0 = Def NO											
Action No.	Mitigation Actions	S	T	A	P	L	E	E	STAPLEE Total	Losses Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
1.3.4	Establish cooling centers where residents can go during extreme heat or power outages.	3	3	3	3	3	3	3	21	IC, LF, EMCC	6	-1	5	26	H
1.3.5	Regularly review and update school emergency plans	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
1.3.6	Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.	3	3	3	3	3	1	3	19	IC, EMCC	4	-5	-1	18	M
1.3.7	Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).	3 3	3	3	3	3	1	3	19	IC, EMCC	4	-5	-1	18	M
2.1.1	Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.	3	2	2	3	3	1	3	17	IC, PD, LF, EMCC	8	-5	3	20	H
2.1.2	Continue to encourage businesses/government/schools to develop emergency plans.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-3	5	26	H
2.1.3	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
2.1.4	Continue to evaluate and update emergency operation plans.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
2.2.1	Educate residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program.	2	3	3	2	3	2	3	18	IC, PD, LF, EMCC	8	-1	7	25	H
2.2.2	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	2	3	3	2	3	2	3	18	IC, PD, LF, EMCC	8	-3	5	23	H
2.3.1	Encourage minimum standards for building codes in all cities.	2	2	2	2	3	1	2	14	PD, LF, EMCC	6	-3	3	17	M
2.3.2	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.	2	2	2	1	2	2	2	13	IC, PD	4	-1	3	16	M

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES		1 = Prob NO											
		2 = Maybe YES		0 = Def NO											
Action No.	Mitigation Actions	S	T	A	P	L	E	E	STAPLEE Total	Losses Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
2.3.3	Encourage the Mark Twain National Forest to levy stricter fines for persons causing fire hazards.	2	2	2	2	3	2	3	16	IC, PD, LF, EMCC	8	-1	7	23	H
3.1.1	Distribute SEMA brochures on natural disasters, preparedness and NFIP at public facilities and events.	3	3	2	3	3	3	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
3.1.2	Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparedness and how to mitigate.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
3.2.1	Encourage local residents to purchase weather radios through press releases and brochures.	3	3	3	3	3	2	3	20	IC, EMCC	4	-1	3	23	H
3.2.2	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.	3	3	3	2	3	2	3	19	IC, PD, LF, EMCC	8	-1	7	26	H
3.3.1	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	3	2	2	2	3	1	3	16	IC, PD, LF, EMCC	8	-3	5	21	H
3.3.2	Distribute press releases by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.	3	3	2	3	3	2	3	19	IC, PD, LF, EMCC	8	-1	7	26	H
3.4.1	Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought, heat wave)	3	3	2	3	3	2	3	19	IC, PD, LF, EMCC	8	-1	7	26	H
3.4.2	Publicize county or citywide drills.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
4.1.1	Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
4.1.2	Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).	3	2	2	3	3	2	3	18	IC, PD, LF, EMCC	8	-1	7	25	H
4.1.3	Pool different agency resources to achieve widespread mitigation planning results.	3	2	2	2	3	2	3	17	IC, PD, LF, EMCC	8	-1	7	24	H

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES		1 = Prob NO											
		2 = Maybe YES		0 = Def NO											
Action No.	Mitigation Actions	S	T	A	P	L	E	F	STAPLEE Total	Loss Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
4.2.1	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	3	2	2	2	3	1	3	16	IC, PD, LF, EMCC	8	-3	5	21	H
5.1.1	Encourage communities to budget for enhanced warning systems.	3	2	2	3	3	2	3	18	IC, LF, EMCC	6	-3	3	21	H
5.1.2	Encourage all communities to develop stormwater management plans.	2	2	1	1	3	1	3	13	PD	2	-5	-3	10	L
5.1.3	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	3	2	2	2	3	1	3	16	IC, PD, LF, EMCC	8	-3	5	21	H
5.1.4	Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.	2	2	2	2	3	2	3	16	PD	2	-3	-1	15	M
5.2.1	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.	1	2	2	1	2	1	3	12	PD, EMCC	4	-5	-1	11	L
5.2.2	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.	2	2	2	1	2	1	3	13	PD, EMCC	4	-1	3	16	M
6.1.1	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
6.1.2	Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.	3	2	2	2	3	2	3	17	IC, PD, LF, EMCC	8	-1	7	24	H
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.	3	2	2	2	3	2	2	16	IC, PD, LF, EMCC	8	-1	7	23	H
6.1.4	Encourage local jurisdictions to budget for mitigation projects.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-5	3	23	H
6.2.1	Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.	2	1	1	1	2	2	2	11	IC, PD, LF, EMCC	8	-5	3	14	M
6.2.2	Implement public awareness program about the benefits of hazard mitigation projects, both public and private through press releases and brochures.	3	3	2	3	3	2	3	19	IC, PD, LF, EMCC	8	-1	7	26	H

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES		1 = Prob NO		2 = Maybe YES		0 = Def NO							
Action No.	Mitigation Actions	S	T	A	P	L	E	E	STAPLEE Total	Loss Avoided (2 pts. Each)	Benefit	Cost	B/C Total	Total	Priority
6.3.1	Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.	3	3	2	2	3	2	3	18	IC, PD, LF, EMCC	8	-1	7	25	H

Requirement 201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

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.

4.4.2 Implementation and Administration in Participating Jurisdictions

After completion of the STAPLEE and Benefit/Cost Reviews and prioritization of the mitigation action items, the action items were assigned to specific jurisdictions and plans were developed for implementation and administration.

The mitigation actions for each participating jurisdiction are shown in the following pages. The implementation and administration of each action item is listed in the section for the jurisdiction which is serving as the lead for the action. A description of the method for integrating the hazard mitigation plan action items into other planning processes in the jurisdiction is included after the actions.

Washington County

The following are mitigation actions for which Washington County is the lead. It should be noted that the County is the lead for many actions which mitigate for hazards in multiple jurisdictions in the planning area. [Note: some action items are listed under multiple goals – these have been combined where possible and noted by action number in Table 4.5.]

The tables that follow indicate the jurisdictions(s) for which the county is leading the action. Actions lead by the County for other jurisdictions are repeated in list form under each participating jurisdiction to which they apply.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.5 Action Items Assigned to Washington County

Action 1.1.1	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.
Priority	High
Plan for Implementation & Administration	Public education/awareness efforts on the subject of personal emergency preparedness will be continued by providing a variety of printed materials (brochures, press releases, etc.) on the topic to the public at public buildings such as the courthouse, city halls, etc., and at public events such as fairs and festivals. In addition, some information will be posted on the Washington County Health Department website – www.washingtoncountyhealthdepartment.org
Lead	County Commission, County EMD, County Health Department
Partners	City governments, emergency response agencies, schools
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
Action 1.1.2	Continue to educate residents about precautions that should be taken during severe heat.
Priority	High
Plan for Implementation & Administration	Information on extreme heat hazards, precautions and preparedness will be continued by providing a variety of printed materials (brochures, press releases, etc.) on the topic to the public at public buildings such as the courthouse, city halls, etc., and at public events such as fairs and festivals. In addition, the information will continue to be posted on the Washington County Health Department website – www.washingtoncountyhealthdepartment.org
Lead	County Commission, County EMD, County Health Department
Partners	City governments
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Extreme Heat
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, LF, EMCC
1.1.3	Promote development of emergency plans by businesses/governments/schools.
Priority	High
Plan for Implementation & Administration	Information on and samples of emergency plans and continuity plans for businesses will be made available through the EMD office. .
Lead	County EMD, County Commission
Partners	City governments, emergency response agencies, county health department
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC

1.1.4	Continue to provide CERT training and encourage the development of CERT teams.
Priority	High
Plan for Implementation & Administration	County EMD will assist in coordinating periodic CERT trainings in the county. Citizens will be notified through local media. The EMD will work to generate interest in the classes and encourage the development of teams.
Lead	County EMD, County Commission
Partners	City governments, schools
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.2.1	Continue to encourage cities to obtain early warning systems and improved communications systems.
Priority	High
Plan for Implementation & Administration	County EMD and County Commission will continue to review changing technologies and existing systems (sirens, Reverse 9-1-1, AlertFM, etc.) and work with county 9-1-1 board to find ways to improve the county's current warning systems. This will be part of the annual review of the county LEOP.
Lead	County EMD, County Commission
Partners	City governments, schools, 9-1-1
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Severe storm, tornado, severe winter weather, wildfire
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.2.2	Continue to promote use of weather radios by local residents to insure advanced warning about threatening weather.
Priority	High
Plan for Implementation & Administration	County EMD will continue to promote and educate the public on weather radios. This will be accomplished through press releases to local media.
Lead	County EMD, County Commission
Partners	City governments, schools
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Severe storm, tornado, severe winter weather, wildfire
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, EMCC
1.2.3	Partner with local radio stations to ensure that appropriate warning of impending disasters is provided to residents in the countywide listening area.
Priority	High
Plan for Implementation & Administration	County EMD will continue to cultivate relationships with local radio stations and work with them to ensure that appropriate warnings are provided by making regular contact.
Lead	County EMD, County Commission
Partners	Local radio stations
Projected Cost/Funding	Minimal/operating budget

Criterion for Completion	Ongoing
Hazards Addressed	Severe storm, tornado, severe winter weather
Applicable Jurisdictions	Washington County
Benefits (Losses Avoided)	IC, EMCC
1.2.4, 2.1.3	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.
Priority	High
Plan for Implementation & Administration	County EMD and County Commission will continue to monitor developments in data availability on impacts of dam failure, tornados, sinkholes, land subsidence & wildfire. This will be done in cooperation with SEMA, FEMA, MDC, MDNR & MRPC. As additional information becomes available, the County EMD will incorporate information into the hazard mitigation plan to improve future planning efforts.
Lead	County EMD, County Commission, County Health Department
Partners	SEMA, FEMA, MRPC, MDC, MDNR
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Dam failure, tornados, sinkholes, land subsidence, wildfire
Applicable Jurisdictions	Washington County
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.1	Place water height gauges and signs near low water crossings.
Priority	High
Plan for Implementation & Administration	County Commission will review low water crossings in county and determine which are in need of gauges and signs and assign installation to appropriate road crews.
Lead	County Commission
Partners	County road crews
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Installations complete by 2015
Hazards Addressed	Flood
Applicable Jurisdictions	Washington County
Benefits (Losses Avoided)	IC
1.3.3	Continue to review and consider potential road and bridge upgrades to improve drainage, reduce flooding and the risk to residents and property.
Priority	High
Plan for Implementation & Administration	County Commission will periodically review roads and bridges and determine which bridges, low water crossings and sections of road are potential hazard mitigation projects. The list will be prioritized for the purpose of having a list of projects to search for potential funding.
Lead	County Commission
Partners	Local governments, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC

1.3.4	Establish cooling centers where residents can go during extreme heat or power outages.
Priority	High
Plan for Implementation & Administration	County Health Department and EMD will continue to establish and publicize cooling centers in the county when necessary.
Lead	County Health Department, EMD
Partners	Local governments, schools, churches
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Severe Heat
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, LF, EMCC
1.3.7	Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).
Priority	Medium
Plan for Implementation & Administration	County and city EMDs will periodically review the need for tornado safe rooms/storm shelters in high population facilities and areas and work with potential locations for the designation of storm shelter or the construction of safe rooms.
Lead	County EMD, County Commission
Partners	Local governments, schools, large employers
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Tornados, Severe Storms
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, EMCC
2.1.1	Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
Priority	High
Plan for Implementation & Administration	County EMD will encourage a self-inspection program through monthly EMD meetings and provide resources from SEMA and FEMA.
Lead	County EMD, County Commission
Partners	Local businesses, local government, schools
Projected Cost/Funding	High/grants
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.1.2	Encourage businesses/government/schools to develop emergency plans.
Priority	High
Plan for Implementation & Administration	County EMD, with assistance from local emergency response agencies, city EMDs and County Health Department will encourage the development and implementation of emergency plans at EMD monthly meetings, trainings and drills.
Lead	County EMD, County Commission
Partners	County Health Department, local emergency response agencies, SEMA
Projected Cost/Funding	Moderate/operating budget

Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.1.4	Continue to evaluate and update emergency operation plans.
Priority	High
Plan for Implementation & Administration	City and County EMDs are responsible for periodically reviewing and updating the Washington County LEOP which includes all of the communities.
Lead	County and City EMDs, County Commission
Partners	Local government, schools, emergency response agencies
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.2.1	Educate and raise awareness of residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program.
Priority	High
Plan for Implementation & Administration	Floodplain managers throughout the county need to work together to provide press releases in local papers and NFIP brochures in public buildings.
Lead	County Commission, county floodplain managers
Partners	SEMA, FEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Washington County, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.2.2	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Plan for Implementation & Administration	County floodplain managers need to take floodplain training on a regular basis, review local floodplain management ordinances and make sure local elected officials understand their responsibilities under NFIP.
Lead	County Commission, local floodplain managers
Partners	SEMA, FEMA
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Washington County, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.3.2	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.
Priority	Medium
Plan for Implementation &	County EMD currently enforces regulations in the floodplain in regards to securing

Administration	tanks and mobile homes and will encourage communities to extend those requirements beyond the floodplain in order to address hazards during high winds as well as floods.
Lead	County EMD, County Commission, Floodplain Managers
Partners	Local governments
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood, Tornado, Severe Storm/Wind
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD
2.3.3	Encourage the Mark Twain National Forest to levy stricter fines for persons causing fire hazards.
Priority	High
Plan for Implementation & Administration	County Commission and EMD will visit with MTNF staff to explore the possibility of stricter fines.
Lead	County Commission
Partners	MTNF, MDC, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Initial meetings completed by 12/2014
Hazards Addressed	Wildfire
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.1.1	Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
Priority	High
Plan for Implementation & Administration	County EMD will continue to distribute information through local media in press releases and brochures at events and in public facilities, and through the Washington County Department of Health website – www.washingtoncountyhealthdepartment.org
Lead	County EMD, County Commission, County Health Department
Partners	Local governments, emergency response agencies
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.1.2	Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.
Priority	High
Plan for Implementation & Administration	County EMD will provide press releases to local media on hazard information and means of mitigating hazards as well as whenever possible, post information on the county health department website – www.washingtoncountyhealthdepartment.org and coordinate these efforts with SEMA's statewide drills, awareness activities.
Lead	County EMD, County Commission
Partners	SEMA, city EMDs, local emergency response agencies
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi

Benefits (Losses Avoided)	IC, PD, LF EMCC
3.2.1	Encourage local residents to purchase weather radios through press releases and brochures.
Priority	High
Plan for Implementation & Administration	County EMD will promote the purchase of weather radios through periodic press releases to local media.
Lead	County EMD, County Commission
Partners	NOAA, SEMA, cities
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Extreme Heat, Flood, Severe Storm, Tornado, Severe Winter Storm
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, EMCC
3.2.2	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
Priority	High
Plan for Implementation & Administration	County EMD will work with various local governments, MREPC and MRPC to coordinate opportunities for SEMA hazard mitigation specialists to present information on mitigation programs, projects and potential funding.
Lead	County EMD, County Commission
Partners	Local government, SEMA, MREPC, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.3.1, 4.2.1, 5.1.3	Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.
Priority	High
Plan for Implementation & Administration	County EMD will work with other jurisdictions to review the hazard mitigation plan on a regular basis – annually or whenever disasters occur in the county. In addition, all jurisdictions will be encouraged to merge the hazard mitigation action items with other community plans and planning activities.
Lead	County EMD, County Commission
Partners	Local Jurisdictions, SEMA, MRPC
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.3.2	Distribute press releases by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
Priority	High
Plan for Implementation &	County Floodplain Manager will provide updates on mitigation activities in the county to

Administration	local media to keep the public informed. Changes in regulations, particularly in floodplain management will also be publicized through media.
Lead	County Floodplain, County Commission
Partners	Local jurisdictions, SEMA, FEMA, city floodplain managers
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.4.1	Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought, heat wave)
Priority	High
Plan for Implementation & Administration	County EMD will work with county health department, SEMA and local media to launch publicity/information campaigns to educate residents on what they can do to reduce their risks during threatening conditions such as drought and heat waves. This will include press releases and public service announcements.
Lead	County EMD, County Commission, County Health Department
Partners	SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.4.2	Publicize county or citywide drills.
Priority	High
Plan for Implementation & Administration	County EMD will work with local governments, agencies and emergency response agencies to publicize and encourage participation in drills being conducted in any of the jurisdictions. Publicizing will include emails, press releases and postings on county health department website – www.washingtoncountyhealthdepartment.org
Lead	County EMD, County Commission
Partners	Local jurisdictions, SEMA, emergency response agencies, county health department
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing – as needed
Hazards Addressed	All Hazards
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
4.1.1	Continue to encourage joint meetings of different organizations/agencies for mitigation related planning.
Priority	High
Plan for Implementation & Administration	County EMD will incorporate mitigation planning into existing meetings currently being held for training and emergency planning.
Lead	County EMD, County Commission
Partners	Local jurisdictions, emergency response agencies, SEMA, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing

Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
4.1.2	Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
Priority	High
Plan for Implementation & Administration	County EMD will work with all jurisdictions and emergency response agencies to coordinate trainings, drills and exercises that area inclusive of both public and private entities such as schools and businesses.
Lead	County EMD, County Commission
Partners	Local Jurisdictions, SEMA, MREPC, MRPC, emergency response agencies
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
4.1.3	Pool different agency resources to achieve widespread mitigation planning results.
Priority	High
Plan for Implementation & Administration	County EMD and County Commission will make contact with other jurisdictions, emergency response agencies, county health department, SEMA, Region C HSOC, MRPC, MREPC and find ways to work together to identify, prioritize, fund and implement mitigation projects throughout the county, as well as incorporate mitigation into all planning activities.
Lead	County EMD, County Commission
Partners	All Jurisdictions, local emergency response agencies, county health department, SEMA, MRPC, Region C HSOC, MREPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF EMCC
5.2.1	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Priority	Low
Plan for Implementation & Administration	Following flood events that result in property damage, the County Floodplain Manager will review the options available for floodplain buyouts, look for opportunities to purchase repetitive loss properties in flood prone areas and encourage other floodplain managers in the county to do the same. After flood damage has occurred, and before repairs have been made is the best time to contact property owners and make buyout offers.
Lead	County Floodplain Manager, County Commission
Partners	Washington County Commission, Irondale, Mineral Point, Potosi
Projected Cost/Funding	High/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Washington County, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	PD, EMCC

6.1.1	Encourage meetings between EMD, city/county officials, schools and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
Priority	High
Plan for Implementation & Administration	County EMD will stay in contact with and work with local jurisdictions, SEMA and FEMA to stay current on funding opportunities for mitigation projects throughout the county.
Lead	County EMD, County Commission
Partners	Local Jurisdictions, SEMA, FEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
6.1.2	Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
Priority	High
Plan for Implementation & Administration	Washington County Commission will include hazard mitigation issues in grant applications for upgrades to or replacements of roads and bridges. The county is currently involved in a regional project to identify and prioritize bridges and low water crossings that need to be mitigated to reduce risk during flood events. Once this project is completed, the county will receive a report which should be reviewed and considered before any future upgrades are initiated.
Lead	Washington County Commission
Partners	Road and Bridge Department, city government where applicable, MRPC, SEMA, FEMA
Projected Cost/Funding	Minimal/Operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
6.1.4	Encourage local jurisdictions to budget for mitigation projects.
Priority	High
Plan for Implementation & Administration	County EMD will include discussions on budgeting for mitigation projects with all local jurisdictions at various flood plain management, mitigation planning and emergency management meetings.
Lead	County EMD, County Commission
Partners	All Local Jurisdictions
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
6.2.1	Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the jurisdiction as a whole.
Priority	Medium
Plan for Implementation &	County EMD will include discussions on these types of programs with all jurisdictions at

Administration	meetings held on related issues (floodplain, emergency planning, etc.)
Lead	County EMD, County Commission
Partners	All communities, SEMA, FEMA
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Dam Failure, Earthquake, Flood, Landslide, Land Subsidence/Sinkhole, Severe Storm, Tornado, Severe Winter Weather, Wildfire
Applicable Jurisdictions	Washington County, Caledonia, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
6.2.2	Implement public awareness program about the benefits of hazard mitigation projects, both public and private through press releases and brochures.
Priority	High
Plan for Implementation & Administration	County EMD, with assistance from all jurisdictions and partner agencies will develop press releases on the benefits of hazard mitigation projects, but for public infrastructure as well as on the part of private property owners. The information will be distributed through local media.
Lead	County EMD, County Commission
Partners	All jurisdictions, SEMA, FEMA, MRPC
Projected Cost/Funding	Minimal/Operating Budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
6.3.1	Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.
Priority	High
Plan for Implementation & Administration	County EMD will ask jurisdictions to complete this action periodically and provide results to the EMD.
Lead	County EMD, County Commission
Partners	All Jurisdictions
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2015, repeat in 2017
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC

Integration of Hazard Mitigation Actions into Current Planning Processes

The mitigation actions in this plan will be integrated into the work plans of the departments leading the actions; many of the actions are already integrated into the activities of county personnel. Any funding required for mitigation will be considered during the annual budgeting process in the County.

The local emergency operations plan (LEOP) covers all aspects of emergency preparedness in Washington County, including all jurisdictions listed in this plan. The LEOP is an inclusive

document with a broad range of information concerning all the facets of emergency management and planning. The mitigation actions in the Washington County Hazard Mitigation Plan will be integrated into the LEOP as applicable.

Caledonia

Mitigation actions for Caledonia are shown in the following table and subsequent list. The actions in the table are those for which Caledonia itself will take the lead. Those listed at the end of the table are mitigation actions which Washington County will lead on behalf of numerous jurisdictions, including Caledonia.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.6 Action Items Assigned to Village of Caledonia

2.3.1	Encourage minimum standards for building codes in all cities.
Priority	Medium
Plan for Implementation & Administration	County EMD will encourage the adoption of building codes at monthly EMD meetings and provide information on how building codes mean more disaster resistant buildings and less damage in disasters.
Lead	County Commission, County EMD
Partners	City EMDs, local fire departments
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	Caledonia, Irondale, Mineral Point
Benefits (Losses Avoided)	PD
5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Plan for Implementation & Administration	City EMDs should meet with and encourage village trustees and county 9-1-1 board to investigate ways of improving warning systems within the community and searching for the means of funding such improvements.
Lead	City EMD, Board of Trustees
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
Benefits (Losses Avoided)	IC, LF, EMCC
5.1.2	Encourage all communities to develop storm water management plans.
Priority	Low
Plan for Implementation &	The water superintendent, maintenance/sewer operator and village trustees need to

Administration	consider the benefits of developing a storm water management plan and look into methods of developing and funding the project.
Lead	Water Superintendent, Maintenance/Sewer Operator, Board of Trustees
Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.1.4	Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.
Priority	Medium
Plan for Implementation & Administration	The water superintendent, maintenance/sewer operator and village trustees need to consider the benefits of requiring storm water management plans for all new development and explore ways to put these requirements into place.
Lead	Water Superintendent, Maintenance/Sewer Operator, Board of Trustees
Partners	Local builders associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.
Priority	High
Plan for Implementation & Administration	Village Trustees need to work with SEMA, FEMA, MRPC and other economic development agencies to include community mitigation projects and programs in all economic and community development projects planned for Caledonia.
Lead	Village Trustees
Partners	SEMA, FEMA, MRPC, DED, RD
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC

In addition to the above mitigation actions for which the Village of Caledonia is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the Village of Caledonia:

- 1.1.1 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.
- 1.1.2 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.

- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 1.2.3 Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.
- 1.2.4 Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Also 2.1.3)
- 1.3.1 Place water gauges and signs near low water crossings.
- 1.3.2 Continue to encourage continuation of tree trimming and dead tree removal programs by utilities and local governments.
- 1.3.3 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.
- 1.3.4 Establish cooling centers where residents can go during extreme heat or power outages.
- 1.3.7 Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.
- 2.2.2 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.

- 2.3.2 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.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.1.2 Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.3.2 Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
- 3.4.1 Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).
- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.1 Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.

6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private

6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Hazard Mitigation Actions into Current Planning Processes

The Village of Caledonia is a very small community of fewer than 150 people. The community has a very minimal budget with which to work and little or no funding for planning activities. Decision making in the village is typically done on an “as needed” basis. Planning that does occur in the village is carried out by the Board of Trustees with recommendations from city employees/volunteers or as part of larger, county planning activities. The hazard mitigation actions will be carried out on a volunteer basis by the Board of Trustees and where applicable, the Water Superintendent and Maintenance/Sewer Operator.

Irondale

Mitigation actions for Irondale are shown in the following table and subsequent list. The actions in the table are those for which Irondale itself will take the lead. Those listed at the end of the table are mitigation actions which Washington County will lead on behalf of numerous jurisdictions, including Irondale.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.7 Action Items Assigned to City of Irondale

5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Plan for Implementation & Administration	City EMD should meet with and encourage board of aldermen and county 9-1-1 board to investigate ways of improving warning systems within the community and searching for the means of funding such improvements.
Lead	City EMD, Board of Aldermen
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
Benefits (Losses Avoided)	IC, LF, EMCC

5.1.2	Encourage all communities to develop storm water management plans.
Priority	Low
Plan for Implementation & Administration	The water/sewer manager and board of aldermen need to consider the benefits of developing a storm water management plan and look into methods of developing and funding the project.
Lead	Water/Street/Waste Superintendent, Board of Aldermen
Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.1.4	Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.
Priority	Medium
Plan for Implementation & Administration	Board of Aldermen need to work with the Water/Street/Waste Superintendent to consider the benefits of requiring storm water management plans for all new development and explore ways to put these requirements into place.
Lead	Board of Aldermen
Partners	Local builder associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.2.2	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.
Priority	Medium
Plan for Implementation & Administration	Board of Aldermen and city floodplain manager need to review zoning in the community and where applicable, rezone areas prone to flooding.
Lead	Board of Aldermen
Partners	City floodplain manager
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD, EMCC
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.
Priority	High
Plan for Implementation & Administration	Board of Aldermen need to work with SEMA, FEMA, MRPC and other economic development agencies to include community mitigation projects and programs in all economic and community development projects planned for Irondale.
Lead	Board of Aldermen
Partners	SEMA, FEMA, MRPC, DED, RD
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing

Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC

In addition to the above mitigation actions for which the City of Irondale is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the City of Irondale:

- 1.1.3 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.
- 1.1.4 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 1.2.3 Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.
- 1.2.4 Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Also 2.1.3)
- 1.3.1 Place water gauges and signs near low water crossings.
- 1.3.2 Continue to encourage continuation of tree trimming and dead tree removal programs by utilities and local governments.
- 1.3.3 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.
- 1.3.4 Establish cooling centers where residents can go during extreme heat or power outages.
- 1.3.7 Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.

- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.
- 2.2.2 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- 2.3.2 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.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.1.2 Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.3.2 Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
- 3.4.1 Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).
- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).

- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 5.2.1 Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.1 Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Hazard Mitigation Actions into Current Planning Processes

The City of Irondale is a small community of fewer than 450 people. The community has a small budget with which to work and little funding for planning activities. Planning that occurs in the city is carried out by the Board of Aldermen with recommendations from city employees or as part of larger, county planning activities. The hazard mitigation actions will be carried out on a volunteer basis by the Board of Aldermen and where applicable, the Water/Street/Waste Superintendent and Floodplain Manager. Any funding needed for mitigation projects and programs will be considered by the Board of Aldermen during the annual budgeting process.

Mineral Point

Mitigation actions for Mineral Point are shown in the following table and subsequent list. The actions in the table are those for which Mineral Point itself will take the lead. Those listed at the end of the table are mitigation actions which Washington County will lead on behalf of numerous jurisdictions, including Mineral Point.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages

- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.8 Action Items Assigned to Village of Mineral Point

5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Plan for Implementation & Administration	City EMD should meet with and encourage board of trustees and county 9-1-1 board to investigate ways of improving warning systems within the community and searching for the means of funding such improvements.
Lead	City EMD, Board of Trustees
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
Benefits (Losses Avoided)	IC, LF, EMCC
5.1.2	Encourage all communities to develop storm water management plans.
Priority	Low
Plan for Implementation & Administration	The water/sewer manager and board of trustees need to consider the benefits of developing a storm water management plan and look into methods of developing and funding the project.
Lead	Water/Sewer Manager, Board of Trustees
Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.1.4	Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.
Priority	Medium
Plan for Implementation & Administration	Board of Trustees need to work with the Water/Sewer Manager to consider the benefits of requiring storm water management plans for all new development and explore ways to put these requirements into place.
Lead	Board of Trustees
Partners	Local builder associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.2.2	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.
Priority	Medium
Plan for Implementation & Administration	Board of Trustees and city floodplain manager need to review zoning in the community and where applicable, rezone areas prone to flooding.

Lead	Board of Trustees
Partners	City floodplain manager
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD, EMCC
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.
Priority	High
Plan for Implementation & Administration	Board of Trustees need to work with SEMA, FEMA, MRPC and other economic development agencies to include community mitigation projects and programs in all economic and community development projects planned for Irondale.
Lead	Board of Trustees
Partners	SEMA, FEMA, MRPC, DED, RD
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC

In addition to the above mitigation actions for which the Village of Mineral Point is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the Village of Mineral Point:

- 1.1.5 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.
- 1.1.6 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 1.2.3 Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.
- 1.2.4 Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all

jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Also 2.1.3)

- 1.3.1 Place water gauges and signs near low water crossings.
- 1.3.2 Continue to encourage continuation of tree trimming and dead tree removal programs by utilities and local governments.
- 1.3.3 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.
- 1.3.4 Establish cooling centers where residents can go during extreme heat or power outages.
- 1.3.7 Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.
- 2.2.2 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- 2.3.2 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.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.1.2 Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.

- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.3.2 Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
- 3.4.1 Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).
- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 5.2.1 Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.1 Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Hazard Mitigation Actions into Current Planning Processes

The Village of Mineral Point is a small community of fewer than 400 people. The community has a small budget with which to work and little funding for planning activities. Planning that occurs in the city is carried out by the Board of Trustees with recommendations from city employees or as part of larger, county planning activities. The hazard mitigation actions will be carried out on a volunteer basis by the Board of Trustees and where applicable, the Water/Sewer Manager and Floodplain Manager. Any funding needed for mitigation projects and programs will be considered by the Board of Trustees during the annual budgeting process.

Potosi

Mitigation actions for Potosi are shown in the following table and subsequent list. The actions in the table are those for which Potosi itself will take the lead. Those listed at the end of the table are mitigation actions which Washington County will lead on behalf of numerous jurisdictions, including Irondale.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.9 Action Items Assigned to City of Potosi

5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Plan for Implementation & Administration	City EMD should meet with and encourage board of aldermen and county 9-1-1 board to investigate ways of improving warning systems within the community and searching for the means of funding such improvements.
Lead	City EMD, Board of Aldermen
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
Benefits (Losses Avoided)	IC, LF, EMCC
5.1.2	Encourage all communities to develop storm water management plans.
Priority	Low
Plan for Implementation & Administration	The public works director and board of aldermen need to consider the benefits of developing a storm water management plan and look into methods of developing and funding the project.
Lead	Public Works Director, Board of Aldermen
Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing

Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.1.4	Encourage cities to require contractor storm water management plans in all new development –both residential and commercial properties.
Priority	Medium
Plan for Implementation & Administration	Board of Aldermen need to work with the Public Works Director to consider the benefits of requiring storm water management plans for all new development and explore ways to put these requirements into place.
Lead	Board of Aldermen
Partners	Local builder associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.2.2	Encourage communities to discuss zoning repetitive loss properties in the floodplain as open space.
Priority	Medium
Plan for Implementation & Administration	Board of Aldermen and city floodplain manager need to review zoning in the community and where applicable, rezone areas prone to flooding.
Lead	Board of Aldermen
Partners	City floodplain manager
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD, EMCC
6.1.3	Work with state/local/federal agencies to include mitigation in all economic and community development projects.
Priority	High
Plan for Implementation & Administration	Board of Aldermen need to work with SEMA, FEMA, MRPC and other economic development agencies to include community mitigation projects and programs in all economic and community development projects planned for Potosi.
Lead	Board of Aldermen
Partners	SEMA, FEMA, MRPC, DED, RD
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC

In addition to the above mitigation actions for which the City of Potosi is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the City of Potosi:

- 1.1.7 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.
- 1.1.8 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 1.2.3 Partner with local radio stations to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area.
- 1.2.4 Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Washington County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Also 2.1.3)
- 1.3.1 Place water gauges and signs near low water crossings.
- 1.3.2 Continue to encourage continuation of tree trimming and dead tree removal programs by utilities and local governments.
- 1.3.3 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.
- 1.3.4 Establish cooling centers where residents can go during extreme heat or power outages.
- 1.3.7 Encourage the designation of storm shelters and the construction of tornado safe rooms in any facility that typically has large numbers of people present (such as large employers).
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.

- 2.2.1 Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program.
- 2.2.2 Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- 2.3.2 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.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.1.2 Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency, preparation and how to mitigate.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.3.2 Distribute press release by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
- 3.4.1 Encourage county health department to use publicity campaigns that make residents aware of proper measures to take during times of threatening conditions (e.g. drought or heat wave).
- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 5.2.1 Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.

- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.1 Encourage cities and counties to consider implementing cost-share programs with private property owners for hazard mitigation projects that benefit the community as a whole.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Hazard Mitigation Actions into Current Planning Processes

Planning in the City of Potosi is carried out by the mayor and Board of Aldermen with recommendations from city departments. The hazard mitigation actions will be integrated into the work plans of the appropriate department where ever possible. Any funding needed for mitigation projects and programs will be considered by the Board of Aldermen during the annual budgeting process.

Kingston K-14 School District

Mitigation actions for the Kingston K-14 School District are shown in Table 4.10 and following list. The action items in the table are those for which the school district itself will take the lead. Those listed at the end of the table are mitigation actions which the County will lead on behalf of numerous jurisdictions, including the Kingston K-14 School District.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.10 Action Items Assigned to Kingston K-14 School District

1.1.5	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
Priority	High
Plan for Implementation & Administration	School administration will provide training to all school staff on the school emergency plan either on an annual basis or as part of new employee orientation.
Lead	Superintendent, School Board
Partners	Local emergency response agencies, EMDs
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and as needed after
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.1.6	Schools need to continue to conduct emergency preparedness exercises on a regular basis.
Priority	High
Plan for Implementation & Administration	School administration and school board will coordinate regular exercises and/or drills to exercise the school emergency plan in order to insure that all staff are familiar with their responsibilities during a disaster incident and that the plan meets school needs.
Lead	Superintendent, School Board
Partners	School staff, local emergency response agencies and EMDs, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and annually thereafter
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.5	Regularly review and update school emergency plan.
Priority	High
Plan for Implementation & Administration	The school superintendent, school board and other key school district personnel should annually review and update the school emergency plan as part of regular administrative activities.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA
Projected Cost/Funding	Low/operating budget
Criterion for Completion	Annually
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.6	Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.
Priority	Medium
Plan for Implementation & Administration	The school superintendent and school board should search for ways to fund construction of tornado safe rooms to serve each school – either as construction projects on their own or incorporate tornado safe rooms into planned future construction projects.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA, FEMA,
Projected Cost/Funding	Significant/Grants
Criterion for Completion	2018

Hazards Addressed	Tornado
Benefits (Losses Avoided)	IC, EMCC

In addition to the above mitigation actions for which Kingston K-14 School District is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the school district.

- 1.1.1 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.
- 1.1.2 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.4.2 Publicize county or citywide drills.

- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Actions into Current Planning Processes

Current facility needs, staff training needs and emergency plans are reviewed and updated as needed on an annual basis.

The school district, both the school district superintendent and school board, will work together to insure that school district planning documents will be updated and revised to include the mitigation actions in the Washington County Natural Hazard Mitigation Plan. The school district will communicate with the County EMD, local elected officials and emergency response agencies to make sure that all organizations involved stay informed of school district activities in regard to hazard mitigation.

Potosi R-III School District

Mitigation actions for the Potosi R-III School District are shown in Table 4.11 and following list. The action items in the table are those for which the school district itself will take the lead. Those listed at the end of the table are mitigation actions which the County will lead on behalf of numerous jurisdictions, including the Potosi R-III School District.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts

- EMCC – Emergency Management/Community Costs

Table 4.11 Action Items Assigned to Potosi R-III School District

1.1.5	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
Priority	High
Plan for Implementation & Administration	School administration will provide training to all school staff on the school emergency plan either on an annual basis or as part of new employee orientation.
Lead	Superintendent, School Board
Partners	Local emergency response agencies, EMDs
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and as needed after
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.1.6	Schools need to continue to conduct emergency preparedness exercises on a regular basis.
Priority	High
Plan for Implementation & Administration	School administration and school board will coordinate regular exercises and/or drills to exercise the school emergency plan in order to insure that all staff are familiar with their responsibilities during a disaster incident and that the plan meets school needs.
Lead	Superintendent, School Board
Partners	School staff, local emergency response agencies and EMDs, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and annually thereafter
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.5	Regularly review and update school emergency plan.
Priority	High
Plan for Implementation & Administration	The school superintendent, school board and other key school district personnel should annually review and update the school emergency plan as part of regular administrative activities.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA
Projected Cost/Funding	Low/operating budget
Criterion for Completion	Annually
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.6	Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.
Priority	Medium
Plan for Implementation & Administration	The school superintendent and school board should search for ways to fund construction of tornado safe rooms to serve each school – either as construction projects on their own or incorporate tornado safe rooms into planned future construction projects.
Lead	School Superintendent, School Board

Partners	County EMD, SEMA, FEMA,
Projected Cost/Funding	Significant/Grants
Criterion for Completion	2018
Hazards Addressed	Tornado
Benefits (Losses Avoided)	IC, EMCC

In addition to the above mitigation actions for which Potosi R-III School District is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the school district.

- 1.1.3 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.
- 1.1.4 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)

- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Actions into Current Planning Processes

Current facility needs, staff training needs and emergency plans are reviewed and updated as needed on an annual basis.

The school district, both the school district superintendent and school board, will work together to insure that school district planning documents will be updated and revised to include the mitigation actions in the Washington County Natural Hazard Mitigation Plan. The school district will communicate with the City EMD, local elected officials and emergency response agencies to make sure that all organizations involved stay informed of school district activities in regard to hazard mitigation.

Richwoods R-VII School District

Mitigation actions for the Richwoods R-VII School District are shown in Table 4.10 and following list. The action items in the table are those for which the school district itself will take the lead. Those listed at the end of the table are mitigation actions which the County will lead on behalf of numerous jurisdictions, including the Richwoods R-VII School District.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties

- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.12 Action Items Assigned to Richwoods R-VII School District

1.1.5	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
Priority	High
Plan for Implementation & Administration	School administration will provide training to all school staff on the school emergency plan either on an annual basis or as part of new employee orientation.
Lead	Superintendent, School Board
Partners	Local emergency response agencies, EMDs
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and as needed after
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.1.6	Schools need to continue to conduct emergency preparedness exercises on a regular basis.
Priority	High
Plan for Implementation & Administration	School administration and school board will coordinate regular exercises and/or drills to exercise the school emergency plan in order to insure that all staff are familiar with their responsibilities during a disaster incident and that the plan meets school needs.
Lead	Superintendent, School Board
Partners	School staff, local emergency response agencies and EMDs, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and annually thereafter
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.5	Regularly review and update school emergency plan.
Priority	High
Plan for Implementation & Administration	The school superintendent, school board and other key school district personnel should annually review and update the school emergency plan as part of regular administrative activities.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA
Projected Cost/Funding	Low/operating budget
Criterion for Completion	Annually
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.6	Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.
Priority	Medium
Plan for Implementation & Administration	The school superintendent and school board should search for ways to fund construction of tornado safe rooms to serve each school – either as construction projects on their own or incorporate tornado safe rooms into planned future construction

	projects.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA, FEMA,
Projected Cost/Funding	Significant/Grants
Criterion for Completion	2018
Hazards Addressed	Tornado
Benefits (Losses Avoided)	IC, EMCC

In addition to the above mitigation actions for which Richwoods R-VII School District is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the school district.

- 1.1.5 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.
- 1.1.6 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.
- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.

- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Actions into Current Planning Processes

Current facility needs, staff training needs and emergency plans are reviewed and updated as needed on an annual basis.

The school district, both the school district superintendent and school board, will work together to insure that school district planning documents will be updated and revised to include the mitigation actions in the Washington County Natural Hazard Mitigation Plan. The school district will communicate with the County EMD, local elected officials and emergency response agencies to make sure that all organizations involved stay informed of school district activities in regard to hazard mitigation.

Valley R-VI School District

Mitigation actions for the Valley R-VI School District are shown in Table 4.10 and following list. The action items in the table are those for which the school district itself will take the lead.

Those listed at the end of the table are mitigation actions which the County will lead on behalf of numerous jurisdictions, including the Valley R-VI School District.

The benefits (losses avoided) key for the charts is as follows:

- I/C – Injuries or Casualties
- PD – Property Damages
- LF – Loss of function/displacement impacts
- EMCC – Emergency Management/Community Costs

Table 4.13 Action Items Assigned to Kingston K-14 School District

1.1.5	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
Priority	High
Plan for Implementation & Administration	School administration will provide training to all school staff on the school emergency plan either on an annual basis or as part of new employee orientation.
Lead	Superintendent, School Board
Partners	Local emergency response agencies, EMDs
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and as needed after
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.1.6	Schools need to continue to conduct emergency preparedness exercises on a regular basis.
Priority	High
Plan for Implementation & Administration	School administration and school board will coordinate regular exercises and/or drills to exercise the school emergency plan in order to insure that all staff are familiar with their responsibilities during a disaster incident and that the plan meets school needs.
Lead	Superintendent, School Board
Partners	School staff, local emergency response agencies and EMDs, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2014 and annually thereafter
Hazards Addressed	All hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.5	Regularly review and update school emergency plan.
Priority	High
Plan for Implementation & Administration	The school superintendent, school board and other key school district personnel should annually review and update the school emergency plan as part of regular administrative activities.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA
Projected Cost/Funding	Low/operating budget
Criterion for Completion	Annually
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, PD, LF, EMCC

1.3.6	Encourage the designation of storm shelters and the construction of tornado safe rooms in every school that does not have one.
Priority	Medium
Plan for Implementation & Administration	The school superintendent and school board should search for ways to fund construction of tornado safe rooms to serve each school – either as construction projects on their own or incorporate tornado safe rooms into planned future construction projects.
Lead	School Superintendent, School Board
Partners	County EMD, SEMA, FEMA,
Projected Cost/Funding	Significant/Grants
Criterion for Completion	2018
Hazards Addressed	Tornado
Benefits (Losses Avoided)	IC, EMCC

In addition to the above mitigation actions for which Valley R-VI School District is the lead, Washington County will be the lead on the following actions which also serve as mitigation actions for the school district.

- 1.1.7 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.
- 1.1.8 Continue to educate residents about precautions that should be taken during severe heat.
- 1.1.3 Promote the development of emergency plans by businesses/government/schools.
- 1.1.4 Continue to provide CERT training and encourage the development of CERT teams.
- 1.2.1 Continue to encourage cities to obtain early warning systems and improved communications systems.
- 1.2.2 Continue to promote the use of weather radios by local residents to insure advanced warning about threatening weather.
- 2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.
- 2.1.2 Continue to encourage businesses/government/schools to develop and implement emergency plans.
- 2.1.4 Continue to evaluate and update emergency operation plans.
- 3.1.1 Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
- 3.2.1 Encourage residents to purchase weather radios through press releases and brochures.

- 3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 3.3.1 Re-evaluate the hazard mitigation plan, merge with other community planning and coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures. (Also 4.2.1 and 5.1.3)
- 3.4.2 Publicize county or citywide drills.
- 4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.
- 4.1.2 Continue to encourage joint training (and drills) between agencies, public and private entities (including schools/businesses).
- 4.1.3 Pool different agency resources to achieve widespread mitigation planning results.
- 6.1.1 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects.
- 6.1.4 Encourage local jurisdictions to budget for mitigation projects.
- 6.2.2 Implement public awareness program about the benefits of hazard mitigation projects, both public and private
- 6.3.1 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

Information on the implementation and administration of these actions is described under Washington County in this section.

Integration of Actions into Current Planning Processes

Current facility needs, staff training needs and emergency plans are reviewed and updated as needed on an annual basis.

The school district, both the school district superintendent and school board, will work together to insure that school district planning documents will be updated and revised to include the mitigation actions in the Washington County Natural Hazard Mitigation Plan. The school district will communicate with the County EMD, local elected officials and emergency response agencies to make sure that all organizations involved stay informed of school district activities in regard to hazard mitigation.

4.5 Funding Sources

There are a number of ways in which local hazard mitigation projects can be funded. A list and description of funding sources follows.

4.5.1 Local Funds

Local funding sources are primarily generated from property and sales tax revenues. These funds are generally allocated directly to schools, public works and other essential government functions. In rural areas and small communities there is likely little room in local government budgets for mitigation related activities. However, in those situations where mitigation is part of essential government functions, it may be possible to incorporate a mitigation project and use local funds. For example, if a bridge is scheduled for repair or replacement, the project could be engineered to make the bridge safer and less vulnerable to overtopping. It may also be possible to use local funds to leverage additional funds from other sources. For instance using local general revenue funds to match a hazard mitigation grant from state or federal sources to build a tornado safe room at a local school.

4.5.2 Non-Governmental Funds

Other sources of local funds could include private donations of funds or of goods and services. These could come from local charities, churches, Red Cross chapters, hospitals, businesses or other local not-for-profit groups. Local grant funds from sources such as community foundations are another potential source of funding for mitigation projects.

4.5.3 Federal Funds

The majority of federal dollars available for hazard mitigation projects is funneled through the FEMA Mitigation Grant program. Another possible source would be Community Development Block Grants (CDBG) after a Presidential Disaster Declaration.

FEMA Mitigation Grant Program – Jurisdictions which have adopted an up-to-date FEMA approved hazard mitigation plan are eligible for hazard mitigation funding through FEMA grant programs. These programs include the following:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM) -
- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

HMGP is funding provided following a Presidential Disaster Declaration. PDM, FMA, RFC and SRL are grant programs funded through a yearly appropriation from Congress. The funding cycles vary, but the following are approximate times for when grant rounds are open:

- June/July – FEMA publishes the “Unified Guidance” for these grant programs.

- Notices of Interest (NOI) for possible mitigation projects are due to SEMA as soon as possible following the publication of “Unified Guidance”.
- Mid-October – Grant applications are due to SEMA.
- December – SEMA forwards applications to FEMA

Eligibility of mitigation activities vary between grant programs. The type of project and eligible grant programs is illustrated in Table 4.14. Any projects submitted for funding must match the goals and objectives of the Washington County Hazard Mitigation Plan in order to be eligible for funding.

Table 4.14 Eligible Activities for FEMA Mitigation Grant Programs

Activity	HMGP	PDM	FMA	RFC	SRL
1. Mitigation Projects	X	X	X	X	X
Property Acquisition and Structure Demolition or Relocation	X	X	X	X	X
Structure Elevation	X	X	X	X	X
Mitigation Reconstruction					X
Dry Flood-proofing of Historic Residential Structures	X	X	X	X	X
Dry Flood-proofing of non-residential Structures	X	X	X	X	X
Minor Localized Flood Reduction Projects	X	X	X	X	
Structural Retrofitting of Existing Buildings	X	X			
Non-Structural Retrofitting of Existing Buildings and Facilities	X	X			
Safe Room Construction	X	X			
Infrastructure Retrofit	X	X			
Soil Stabilization	X	X			
Wildfire Mitigation	X	X			
Post-Disaster Code Enforcement	X				
5% Initiative Projects	X				
2. Hazard Mitigation Planning	X	X	X		
3. Management Costs	X	X	X	X	X

Source: www.fema.gov/library/viewRecord.do?id=3648

Application and Cost Share Requirements

The application process for the FEMA Mitigation Grant programs includes a Benefit Cost Analysis (BCA). A potential project must have a Benefit Cost Ratio (BCR) of at least 1.0 to be considered for funding; a ratio of 1.0 indicates at least \$1 benefit for each \$1 spent on the project. A BCA is the first step in determining if a project can potentially be funded.

Cost share requirements and the application format for these five programs are illustrated in Figure 4.15. Contributions of cash, in-kind services or materials, or any combination thereof may be accepted as part of the non-federal cost share. For FMA, not more than one half of the non-federal match may be provided from in-kind contributions.

Figure 4.15 FEMA Mitigation Grant Programs Match Requirements & Application Format

Grant Program	Federal/Local Match	Notes	Application Type
HMGP	75/25		Paper
PDM	75/25		e-grants
PDM (Small, impoverished community)	90/10	Qualification requirements for “small impoverished”: <ul style="list-style-type: none"> • Community of 3,000 or less identified by the State as rural that is not a remote area within the corporate boundary of a larger city • Average per capita annual income not exceeding 80% of the national per capita income, based on best available data (http://www.bea.gov) • Local unemployment rate exceeding by 1% or more the most recently reported, average yearly national unemployment rate (http://www.bls.gov/eag/eag.us.htm) • Meets other criteria required by the State/Tribe/Territory in which the community is located. 	e-grants
FMA	75/25		e-grants
FMA (Severe repetitive loss property)	90/10	In Missouri, this cost share is less than the usual 75/25 because the State has an approved “enhanced” state mitigation plan.	e-grants
RFC	100/0	RFC is only available to applicants who cannot meet the cost share requirement of FMA.	e-grants
SRL	90/10	In Missouri, this cost share is less than the usual 75/25 because the State has an approved “enhanced” state mitigation plan.	e-grants

Hazard Mitigation Grant Program (HMGP)

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP assists states and local communities in implementing long-term mitigation measure following a Presidential Disaster Declaration. After a major disaster, communities may be able to identify additional areas where mitigation can help prevent losses in the future.

HMGP funding is allocated using a sliding scale formula based on the percentage of funds spent on Public and Individual Assistance programs for each Presidential Disaster Declaration. Due to the Enhanced Missouri State Hazard Mitigation Plan, the State of Missouri receives 20percent of the federal total of a disaster declaration as additional mitigation funds through the HMGP.

In Missouri, the mitigation funds are initially awarded to projects in the counties included in the disaster declaration. If funds remain, applications are opened up to any county state-wide. The HMGP can be used to fund projects to protect either public or private property. The proposed projects must fit within the state and local government’s overall mitigation strategy for the disaster area and comply with program guidelines.

Eligibility for funding under the HMGP is limited to state and local government, certain private not-for-profit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations. Applicants work through their state which is responsible for setting priorities for funding and administering the program. In Missouri the state agency responsible is SEMA. More information on the HMGP can be found at FEMA's website – fema.gov/government/grant/hmgrp/.

Flood Mitigation Assistance Program (FMA)

FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. Applicants must be participants in good standing with the NFIP and properties to be mitigated must have flood insurance.

States administer the FMA program and are responsible for selecting projects for funding from the applicants submitted by all communities within the state. The state forwards selected applications to FEMA for eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

FMA funding for the state depends upon the number of repetitive losses in the state. The frequency of flooding in Missouri, coupled with the losses incurred in recent years, has caused Missouri's funding to rise. This is a good program for smaller projects such as mitigating low water crossings. For FMA, not more than one half of the non-Federal match funds may be provided from in-kind contributions. More information on the FMA program is available at fema.gov/government/grant/fma/.

Repetitive Flood Claims Grant Program (RFC)

The Repetitive Flood Claims (RFC) grant program was authorized in 1968 to assist states and communities in reducing flood damages to NFIP insurance properties that have had one or more claims to the NFIP. In order to apply for funding through this 100% federal share program, a community must show that it can't meet FMA requirements due to lack of cost share match funding or due to a lack of administrative capacity to manage the activities. This does not mean that it must be a low-income community. More information on the RFC grant program is available at fema.gov/government/grant/rfc/.

Severe Repetitive Loss Grant Program (SRL)

The Severe Repetitive Loss (SRL) grant program was authorized in 2004 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) properties insured under the NFIP. A SRL property is defined as a property that is covered under an NFIP policy and:

- (a) Has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; OR
- (b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b), at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart. There are very specific requirements for this grant program and they should be reviewed thoroughly before applying. More information on this program is available at fema.gov/government/grant/srl/.

Community Development Block Grant (CDBG) Program

The objective of the CDBG program is to assist communities in rehabilitating substandard dwelling structures and to expand economic opportunities – primarily for low-to-moderate-income families. After a Presidential Disaster Declaration, CDBG funds may be used for long-term needs such as acquisition, reconstruction and redevelopment of disaster affected areas.

| There is no low-to-moderate income requirement following a Presidential Disaster Declaration.

5 PLAN MAINTENANCE PROCESS

The plan maintenance section of this document details the formal process that will ensure that the Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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 Washington 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
- Washington 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, Washington 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. Washington County will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

Upon adoption, the Washington 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.

Washington 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 Washington 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 Washington 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

April 9, 2009

«First_Name» «Last_Name»
«Position»
«Address»
«City», «State_» «Zip»

Dear «First_Name»:

The Washington County Multi-Jurisdictional Hazard Mitigation Plan that was put into place in 2004 must be revised every five years. It is time to begin reviewing and revising this plan so that Washington 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 Washington County Courthouse on Monday, April 27, 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 Washington 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 Washington County and entities located in Washington 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 Washington 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	Phone #
Bob	Reed	Washington County Presiding Commissioner	102 N. Missouri	Potosi	MD	63664	63664
Fodd	Myers	Washington County Assoc. Comm.	102 N. Missouri	Potosi	MD	63664	63664
Randy	O'Neal	Washington County Assoc. Comm.	102 N. Missouri	Potosi	MD	63664	63664
Janet	Adams	Washington County Clerk	102 N. Missouri	Potosi	MD	63664	63664
Andy	Skiles	Washington County Sheriff	116 W. High Street	Potosi	MO	63664	63664
Zeris	Coffman	Washington County EMD	102 N. Missouri	Potosi	MD	63664	63664
Leah	Osahr	Washington Co. Memorial Hospital	300 Health Way	Potosi	MD	63664	63664
Board of	Trustees	Village of Caledonia	P.O. Box 100	Caledonia	MD	63631	63631
Board of	Aldermen	City of Irondale	P.O. Box 53	Irondale	MD	63648	63648
Board of	Trustees	Village of Mineral Point	P.O. Box 127	Mineral Point	MD	63660	63660
Board of	Aldermen	City of Potosi	121 E. High Street	Potosi	MD	63664	63664
Ronald	Kennon	Mayor, City of Irondale	P.O. Box 53	Irondale	MD	63648	63648
Rita	Patterson	Chairperson Village of Mineral Point	P.O. Box 127	Mineral Point	MD	63660	63660
John	Lucas	Caledonia Fire/Water Superintendent	P.O. Box 30	Caledonia	MD	63631	63631
		Irondale Chief of Police	P.O. Box 53	Irondale	MD	63648	63648
Bill	Byes	Irondale Fire Chief/Maint. Superintendent	P.O. Box 53	Irondale	MD	63648	63648
Roy	Ingsden	Potosi Chief of Police	121 East High Street	Potosi	MD	63664	63664
Edward	Vincent	Potosi Building Commissioner	121 East High Street	Potosi	MD	63664	63664
Doris	Coffman	Potosi EMD	121 East High Street	Potosi	MD	63664	63664
Curtis	Bouse	Potosi Street/Water/Sewer Super.	121 East High Street	Potosi	MD	63664	63664
T.R.	Dudley	Mayor, City of Potosi	121 East High Street	Potosi	MD	63664	63664
Robert	Vinyard	Caledonia Village Clerk	P.O. Box 100	Caledonia	MD	63631	63631
Cassandra	Hartz	Irondale City Clerk	P.O. Box 53	Irondale	MD	63648	63648
Patricia	Graves	Mineral Point Village Clerk	P.O. Box 127	Mineral Point	MD	63660	63660
Roger	Coffman	Potosi City Clerk	121 East High Street	Potosi	MD	63664	63664
Sam	Johnson	Potosi Natural Gas Supt.	121 East High Street	Potosi	MD	63664	63664
Judy	Wright	Washington County Health Department	520 Purcell Drive	Potosi	MD	63664	63664
Scott	Couch	Richwoods Fire Department	HCR 63, Box 518	Richwoods	MD	63071	63071
William	Ma Gunn	Washington Co. Ambulance District	111 South Water St.	Potosi	MD	63664	63664
Oscar	Johns	Belgrade Volunteer Fire Department	P.O. Box 72	Belgrade	MD	63622	63622
Norman	Nichols	Bellevue Volunteer Fire Department	P.O. Box J	Bellevue	MD	63623	63623
Fire	Chief	Potosi Fire Protection District	P.O. Box 338	Potosi	MD	63664	63664
Doug	Howett	President, Washington County Chamber	P.O. Box 404	Potosi	MD	63664	63664

Dr. Gary	Milner	Superintendent, Kingston K-14	10047 Diamond R.	Cadet	MO	63630
Randy	Davis	Superintendent, Potosi R-III	400 N. Mine	Potosi	MO	63664
John	Westerman	Superintendent, Richwoods R-VII	10788 State Hwy. A	Richwoods	MO	63071
Steve	Yount	Superintendent, Valley R-VI	1 Vicking Dr.	Caledonia	MO	63631
Craig	Bone	Independent Journal	10218 E. State Hwy. 47	Cadet	MO	63630
Neil	Richards	Crawford Electric Cooperative	P.O. Box 340	Potosi	MO	63664
Dan	Blesi	Ameren UE	P.O. Box 10	Bourbon	MO	65441
Jim	Porter		Rt. 2, Box 5000	Mineral Point	MO	63660 800-552-7583
			911 12252 N. State Hwy. 21	Cadet	MO	63630 438-0040

Advisory Committee Meetings

Advisory Committee Meeting
Washington County Hazard Mitigation Plan Update

AGENDA

10:00 a.m. ~ April 27, 2009

Washington 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 Washington 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

NOTICE OF OPEN MEETING

Date and time of posting 2:00 p.m. on Friday, April 24, 2009

Notice is hereby given that the Washington Co. Hazard Mitigation Plan
Advisory Committee

will conduct a meeting at 10 a.m. on Mon., April 27, 2009
at Washington Co. Courthouse.

The tentative agenda of this meeting includes:

Welcome and Introductions; Review of Action Items; Review of
Current Washington County Hazard Mitigation Plan, Discussion
of Goals and Objectives; Possible Changes to Goals and Objectives
in the Next 5 Years; Setting of Date and Time of Next Meeting;
Adjourn

Representatives of the news media may obtain copies of this notice by contacting:

Name: Meramec Regional Planning Commission

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.

Hazard Mitigation Plan Review Meeting
Washington County
April 27, 2009
10:00 a.m.

Name	Business	Email Address	Phone #
1. Matthew A. Jackson	Washington Co 911	mjackson@wcccd911.org	438-0070
2. T.R. Dudley	City of Potosi	trdudley@potosicityhall.org	438.276 438
3. Devin Coffman	Emerg. Mgt	coffmandevin@yahoo.com	363 573
4. John Lucas	Village of Caledonia	JohnWLucas@yahoo.com	779-34
5. Janet Adams	County Clerk Wash Co	adamsclerk@hotmail.com	573- 438-6111
6. Todd Myers	County Commission	washington007@Centurytel.net	
- 7. Randy O'Neil	County Commission WASH CO.		use Janet Adams email
- 8. Bob Reed	Residing Comm WASH CO.	feeman102@yahoo.com	
9. Sandy Allison	Washington ED	WashcotDA@yahoo.com	573-438-6196
10. PAUL A. MERRILL	Potosi Fire	PAmerill3522@yahoo.com	573-438-5465 cell 573-210-6634
11. Andy Skiles	WCSO	skiles900@yahoo.com	
12.			
13.			
14.			

mailed form
4/27/09

Advisory Committee Meeting
Washington County Hazard Mitigation Plan Update

AGENDA

10:00 a.m. ~ May 13, 2009

Washington County Courthouse

I. Welcome and Introductions – Tammy Snodgrass

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 Washington 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

NOTICE OF OPEN MEETING

Date and time of posting: **May 11, 1:00 p.m.**

Notice is hereby given that the **Washington County Hazard Mitigation Advisory Committee** will meet at **10:00 a.m.** on **Thursday, May 13, 2009** at the Washington County Courthouse located in Potosi, MO.

The tentative agenda of this meeting includes:

- **Welcome**
- **Review of Action Items**
- **Review of Current Washington 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.

The Washington 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 **Tuesday, May 13, 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.

Hazard Mitigation Plan Review Meeting
Washington County
May 14, 2009
10:00 a.m.

	Name	Business	Email Address	Phone #
1.	Bob Reed	Washington		573-438-434
2.	Todd Moyers	" "		573-438-4346
3.	Andy Skiles	Washington Co So		573-438-5478
4.	Paula Merrill	PFD		573-438-5465 573-438-3635
5.	Dario Coffman	Wash Co EMA	CoffmanDario@yahoo.com	
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				

Public Notices

March 4, 2013

FOR IMMEDIATE RELEASE: SHANNON BECK OR BONNIE PRIGGE, MRPC, 573-265-2993

DRAFT OF WASHINGTON COUNTY
HAZARD MITIGATION PLAN UPDATE AVAILABLE FOR PUBLIC REVIEW

The draft update of the Washington County Hazard Mitigation Plan is now available on the web for public review. Meramec Regional Planning Commission, in partnership with Washington County, has been updating the 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 county EMA website at www.meramecregion.org.

Paper copies of the plan will be available for review at the Washington County Courthouse.

The deadline for comments and suggestions is March 27, 2013.

The county must have an approved hazard mitigation plan in order for Washington 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 set 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 (573) 265-2993.

POSTCARD MAILED TO ALL JURISDICTIONS IN AND ADJACENT TO WASHINGTON COUNTY:

3/5/13

Attention Members of the Washington County Hazard Mitigation Planning Committee, County Jurisdictions and neighboring Jurisdictions:

The final draft of the Washington County Hazard Mitigation Plan is now available for review on the MRPC website – www.meramecregion.org .

A hard copy of the draft document is available at the Washington County 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 the draft to SEMA for review, but they are allowing us some time for public input. Please notify me no later than March 22, 2013 with any recommended changes or corrections. Washington County jurisdictions will still have another opportunity to review and adopt the plan after it has been approved by FEMA. Please contact Tammy Snodgrass via email at tsnodgrass@meramecregion.org or (573) 265-2993 if you have questions or wish to make comment.

Name	Title	Address	City	State	Zip
Pres. Comm. Marvin Wright	Washington County	102 N. Missouri	Potosi	MO	63664
Mayor Robert Vinyard	City of Caledonia	P.O. Box 100	Caledonia	MO	63631
Alderman Doris Kleim	City of Irondale	P.O. Box 53	Irontdale	MO	63648
Chairperson Robin Huskey	City of Mineral Point	701 State Rd. Box 127	Mineral Point	MO	63660
Mayor T.R. Dudley	City of Potosi	121 E. High St.	Potosi	MO	63664
Dr. Gary Milner, Superintendent	Kingston K014	10047 Diamond rd.	Cadet	MO	63630
Randy Davis, Superintendent	Potosi R-III	400 N. Mine	Potosi	MO	63664
Laurie Huff, CAO	Richwoods R-VII	10788 State Hwy A	Richwoods	MO	63071
Brad Crocker, Superintendent	Valley R-VI	1 Viking Drive	Caledonia	MO	63631
Pres. Comm. Leo Sanders	Crawford County	P.O. Box AS	Steelville	MO	65565
Mayor Leonard Armstrong	City of Bourbon	P.O. Box 164	Bourbon	MO	65441
Mayor Ray Mortmeyer	City of Cuba	P.O. Box K	Cuba	MO	65453
Chairman Kathy Byrd	City of Leasburg	P.O. Box 39	Leasburg	MO	65535
Mayor Terry Palmer	City of Steelville	P.O. Box M	Steelville	MO	65565
Mayor Thomas Leasor	City of Sullivan	201 W. Washington	Sullivan	MO	63080
Pres. Comm. John Griesheiman	Franklin County	400 E. Locust	Union	MO	63084
Mayor Sandy Lucy	City of Washington	405 Jefferson St.	Washington	MO	63090
Mayor Mike Livingood	City of Union	500 E. Locust	Union	MO	63084
Mayor Herbert Adams	City of Pacific	300 Haven Dr.	Pacific	MO	63069
Mayor Ron Blum	City of St. Clair	#1 Paul Pakrs Dr.	St. Clair	MO	63077
Mayor George Panhorst Jr.	City of New Haven	101 Trent St.	New Haven	MO	63068
Mayor Joanna Partmentier	City of Gerald	P.O. Box 59	Gerald	MO	63037
Chairman Ken Hayes	Village of Oak Grove	260 James St.	Sullivan	MO	63080
Ken Waller, Administrator	Jefferson County	P.O. Box 100	Hillsboro	MO	63050
Mayor Frank Roland	City of Hillsboro	P.O. Box 19	Hillsboro	MO	63050
Ron Counts	City of Arnold	2101 Jeffco Blvd.	Arnold	MO	63010
Mayor Terry Oberer	City of Byrnes Mill	127 Osage Exec. Cir.	Byrnes Mill	MO	63051
Mayor Tom Schilly	City of Crystal City	130 Mississippi	Crystal City	MO	63019
Mayor Werner Stichling	City of DeSoto	17 Boyd St.	DeSoto	MO	63020
Mayor Mike Case	City of Festus	711 W. Main	Festus	MO	63028
Mayor Gina Vinyard	City of Herculaneum	1 Parkwood Ct.	Herculaneum	MO	63048
Mayor Patricia Reno	City of Kimmswick	6041 Third St. Box 27	Kimmswick	MO	63053
Mayor John Knobloch	City of Pevely	P.O. Box 358	Pevely	MO	63070
Mayor Larry Fodge	City of Olympian Village	205 Kronos	DeSoto	MO	63020
Pres. Comm. Dr. David Cramp	St. Francois County	1 W. Liberty St., Annex Bldg. Ste 301	Farmington	MO	63640
Mayor Cindy Lyster	City of Bismark	924 Center Box 27	Bismark	MO	63624
Mayor LeeRoy Calvert	City of Bonne Terre	118 N. Allen St.	Bonne Terre	MO	63628
Mayor David Kater	City of Desloge	300 N. Lincoln	Desloge	MO	63601
Mayor Stuart Landrum	City of Farmington	110 W. Columbia St., Long Mem Bldg.	Farmington	MO	63640

Mayor Troy Dickens	City of Leadwood	12 Wier St.	Leadington	MO	63601
Pres. Comm. Donald Barzowski	Iron County	P.O. Box 42	Ironton	MO	63650
Mayor Dana Pratt	City of Annapolis	204 School St.	Annapolis	MO	63620
Mayor Roy Carr	City of Arcadia	P.O. Box 86	Arcadia	MO	63621
Mayor Bob Halket	City of Ironton	123 N. Main	Ironton	MO	63650
Mayor Shelby Chan	City of Pilot Knob	P.O. Box 188	Pilot Knob	MO	63663
Mayor Len King	City of Viburnum	P.O. Box 596	Viburnum	MO	65566

Authorized Representation Resolutions

July 16, 2010

Name
Address
City

RE: Request for Information and Authorizing Resolution

Dear _____ :

I am writing to make you aware of the hazard mitigation planning process that is being conducted in Washington County and to encourage you to take the appropriate steps to be part of that process. Participating in the hazard mitigation planning process will insure that your (School, city, etc.) is eligible for future hazard mitigation grants.

The Meramec Regional Planning Commission (MRPC) is in the process of completing a five-year update of the Hazard Mitigation plan for Washington County. In order to be eligible for future funding opportunities related to hazard mitigation, schools and communities must actively participate in the planning process. We realize that many cities and school districts do not have the personnel resources to attend planning meetings, so in lieu of direct participation, the planning committee is allowing jurisdictions to sign an Authorizing Resolution which states that the city or school district will provide information upon request, but is authorizing MRPC to represent them in the planning process. This allows the jurisdiction to be considered part of the plan, and providing information to the planning committee fulfills the (city or school's) responsibilities as plan participants.

You will be notified when the draft plan is available on-line and asked to review the document and provide feedback. When the plan has been approved at the state and federal level, we will contact you and ask that you pass a resolution formally accepting the plan.

It is very important that your jurisdiction be included as participating in the plan. If you do not return the signed Authorizing Resolution, we will not be able to include your (city or school district) in the plan document and you will forfeit any possibility of applying for hazard mitigation grants. Potential grant projects would include tornado safe rooms, road and bridge improvements to mitigate flood problems and burying overhead power lines.

Enclosed is a sample resolution. Please complete, adopt and return the document at your earliest convenience. If you have any questions, please do not hesitate to contact me at (573) 265-2993.

Sincerely,

Tamara F. Snodgrass
Environmental Programs Manager

Enclosure

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

[Handwritten mark]

RECEIVED

MAY 17 2010

MERAMEC RPC
209
JAMES, MO

Bill NO 298

ORDINANCE NO ~~209~~

AN ORDINANCE OF THE CITY OF IRONDALE, MISSOURI PROVIDING FOR PARTICIPATION OF A HAZARD MITIGATION PLAN

**Governing Body: City Of Irondale
Address: 110 S Oak**

Whereas, the City of Irondale 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 Irondale 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 Irondale authorizes Meramec Regional Planning Commission on behalf of to prepare the which shall be reviewed and considered by adoption by upon completion.

Posted May 7th 2010

Duly read and passed this 10th day of May, 2010

[Signature of Ron Kennon]

Mayor Ron Kennon

[Signature of Cassandra Hartz]

City Clerk Cassandra Hartz

ATTEST:

[Signature of Cassandra Hartz]

City Clerk Cassandra Hartz

[Faint, illegible text at the bottom of the page]

Resolution for Authorized Representation

Resolution #

Name of Jurisdiction: Valley R-VI School District

Governing Body: Valley R-VI School District Board of Education

Address: 1 Viking Drive, Caledonia, MO 63631

Whereas, Valley R-VI 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 Valley R-VI 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 resolve, Valley R-VI School District Board of Education authorizes Meramec Regional Planning Commission on behalf of Valley R-VI School District to prepare the Washington County Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered by adoption by Valley R-VI School District Board of Education upon completion.

Adopted this 15th Day of July, 2010 at the meeting of the Valley R-VI School District Board of Education.



President, Valley R-VI School District Board of Education

Resolution for Authorized Representation
Resolution # _____

Name of Jurisdiction: Potosi R-3 School District

Governing Body: Board of Education

Address: 400 North Mine Street, Potosi MO 63664

Whereas, Potosi R-3 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 Potosi R-3 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, Board of Education authorizes Meramec Regional Planning Commission on behalf of Potosi R-3 School District to prepare the County B Multi-Jurisdictional Hazard Mitigation Plan which shall be reviewed and considered by adoption by Board of Education upon completion.

Adopted this 20 day of May, 2010.



Authorizing Signature

Resolution for Authorized Representation
Resolution # _____

Name of Jurisdiction: Richwoods R-VII School District

Governing Body: Richwoods R-VII School Board

Address: 10788 State Highway A, Richwoods, MO 63071

Whereas, **Richwoods R-VII 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 **Richwoods R-VII 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, **Richwoods R-VII School Board** authorizes Meramec Regional Planning Commission on behalf of **Richwoods R-VII School District** to prepare the **Washington County Hazard Mitigation Plan** which shall be reviewed and considered by adoption by **Richwoods R-VII School Board** upon completion.

Adopted this 17 day of **June, 2010** at the meeting of the **Richwoods R-VII School Board**.



Authorizing Signature

Appendix B

References

Repetitive Loss Properties

Washington County, MO

Community Name	Community Number	Mitigated?	Occupancy Type	Date of Loss	Date of Loss
Mineral Point	290571	No	Single Family	04/11/1994	09/23/1993

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

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Appendix C
Adoption Resolutions

Appendix D
Federal/State Mitigation Programs,
Activities and Initiatives



Building Disaster Resistant Communities



Hazard Mitigation Financial Resource Guide



A Guide for Locating
Financial Assistance for
Hazard Mitigation & Ancillary Activities

Missouri State Emergency Management Agency

<i>Program / Activity</i>	<i>Type of Assistance</i>	<i>Agency & Contact</i>
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.</p> <p><i>Neighborhoods:</i> Grants for housing and some public facilities.</p> <p><i>Infrastructure:</i> Grants for storm sewers, drainage and land acquisitions.</p> <p><i>Downtown Revitalization:</i> Grants for improving public infrastructure and facilities in a central business district.</p> <p><i>Emergencies:</i> Grants for public</p>	<p>Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146 Tel: (573) 751-3600 Fax: (573) 526-4157</p>

	improvement or facilities except work on general public office buildings, includes water facilities and solid waste disposal facilities.	
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<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</p> <p>Or</p> <p>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</p> <p>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</p>

		Tel: (573) 751-4146
Disaster Recovery Initiative	Grants to fund gaps in available recovery assistance after disasters (including mitigation).	<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</p> <p>Missouri Housing Development Commission</p> <p>(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,</p>	<p>USDA-RHS Contact the Local RHS Field Office, or the Director, Single Family Housing</p>

	build, or rehabilitate a home in a rural area.	Guaranteed Loan Division, RHS: (202) 720-1452
Farm Ownership Loans	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.	USDA-FSA Director, Farm Programs Loan Making Division, FSA: (202) 720-1632 Missouri Department of Agriculture (573) 751-4211

HOME Investments Partnerships Program	Grants to States, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.	<p>HUD Community Planning and Development, Grant Programs, Office of Affordable Housing, HOME Investment Partnership Programs:</p> <p>(202) 708-2685 (202) 708 0614 extension 4594 1-800-998-9999</p> <p>Missouri Department of Economic Development Missouri Housing Development Commission</p> <p>(816) 759-6600</p>
Rural Development Assistance – Housing	Grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.	<p>USDA-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Single Family Housing: (202) 720-3773 Multi Family Housing: (202) 720-5177</p> <p>Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977</p>
Rural Development	Direct and guaranteed rural economic loans and business	USDA-Rural Utilities Service (RUS)

<p>Assistance -- Utilities</p>	<p>enterprise grants to address utility issues and development needs.</p>	<p>Program Support: (202) 720-1382</p> <p>Missouri State Rural Development Office</p> <p>Tel: (573) 876-0976</p> <p>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</p> <p>Missouri State Rural Development Office</p> <p>Tel: (573) 876-0976</p> <p>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</p>

		<p>W. Central MO – Kansas City District: (816) 983-3205</p> <p>E. Central MO – St. Louis District: (314) 331-8095</p> <p>Southern MO – Little Rock District: (501) 324-5551</p> <p>S. E. MO – Memphis District: (800) 317-4156</p>
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<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:</p> <p>N.W. MO – Omaha District: (212) 264-7813</p> <p>N.E. MO – Rock Island District: (309) 794-5249</p> <p>W. Central MO – Kansas City District: (816) 983-3205</p> <p>E. Central MO – St. Louis District: (314) 331-8095</p> <p>Southern MO – Little Rock District: (501) 324-5551</p> <p>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)</p> <p>N.W. MO – Omaha District: (212) 264-7813</p> <p>N.E. MO – Rock Island District: (309) 794-5249</p> <p>W. Central MO – Kansas City District: (816) 983-3205</p> <p>E. Central MO – St. Louis District:</p>

		<p>(314) 331-8095</p> <p>Southern MO – Little Rock District:</p> <p>(501) 324-5551</p> <p>S. E. MO – Memphis District:</p> <p>(800) 317-4156</p> <p>Missouri State Emergency Management Agency (SEMA)</p> <p>Tel: (573) 526-9116</p> <p>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</p> <p>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 border="0"> <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</p> <p>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</p> <p>Tel: (573) 368-2177 Fax: (573) 368-2111</p> <p>1-800-334-6946</p> <p>TDD: 1-800-379-2419E-mail: dams@mail.dnr.state.mo.us</p>																								

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<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</p> <p>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</p>

		Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966 Egray01@mail.state.mo.us
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<p><i>All-Hazard Mapping 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 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)</p> <p>Tel: (573) 526-9141</p> <p>Fax: (573) 526-9198</p> <p>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</p> <p>Chief, Office of Surface Water,</p> <p>(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 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 Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966 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>	
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<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 	<p>Missouri Department of Natural Resources (DNR)</p> <p>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</p> <p>(573) 526-6627</p> <p>Missouri Department of Agriculture</p> <p>(573) 751-2129</p> <p>State Surveyor (573) 368-2301</p> <p>State Surveyor (573) 368-2301</p>
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	<p>establish horizontal and vertical control monuments used for mapping and the development of land survey information system.</p>	
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	<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>
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		Environmental Improvement and Energy Resources Authority (573) 751-4919
Environmental Quality Incentives Program (EQIP)	<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</p> <p>Or</p> <p>NRCS EQUIP Program Manager: (202) 720-1834</p> <p>www.nrcs.usda.gov</p> <p>Columbia, MO District Office – USDA-NRCS</p> <p>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</p>	<p>Missouri Department of Natural Resources (DNR)</p> <p>Tel: (573) 751-3443</p> <p>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>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>	
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	<p>Completed District Audits, District Grants, District Administration Grants, Non-Profit Group Waste Tire Cleanup Cost</p> <p>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>	
Clean Water Act Section 319 Grants	Grants to States to implement non-point source programs,	EPA

	including support for non-structural watershed resource restoration activities.	Office of Water Chief, Non-Point Source Control Branch: (202) 260-7088, 7100 Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443
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		<p>Division of Environmental Quality</p> <p>Public Drinking Water Program</p> <p>1-800-334-6946</p> <p>TDD: 1-800-379-2419</p> <p>E-mail: drinkingwater@mail.dnr.state.mo.us</p>
Clean Water State Revolving Funds	Loans at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	<p>EPA</p> <p>EPA Office of Water</p> <p>State Revolving Fund Branch</p> <p>Branch Chief:</p> <p>(202) 260-7359</p> <p>A list of Regional Offices is available upon request</p>
Wetlands Protection – Development Grants	Grants to support the development and enhancement of State and tribal wetlands protection programs.	<p>US Environmental Protection Agency (EPA)</p> <p>EPA Wetlands Hotline: (800) 832-7828</p> <p>Or</p> <p>EPA Headquarters, Office of Water</p> <p>Chief, Wetlands Strategies and State Programs:</p> <p>(202) 260-6045</p> <p>Missouri Department of Natural Resources (DNR)</p>

		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.	<p>USDA-NRCS Director, Watersheds and Wetlands Division: (202) 720-3042 (202) 690-4614 www.nrcs.usda.gov</p> <p>Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912 Fax: (573) 875-0913</p> <p>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>

<p>Watershed Surveys and Planning</p> <p>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</p> <p>w/planning and implementing improvement.</p>	<p>US Department of Agriculture (USDA) – National Resources Conservation Service (NRCS) Watersheds and Wetlands Division: (202) 720-4527</p> <p>Deputy Chief for Programs: (202) 690-0848</p> <p>www.nrcs.usda.gov</p> <p>Columbia, MO District Office –</p> <p>USDA-NRCS</p> <p>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</p> <p>National Office – (202) 690-0848</p> <p>Watersheds and Wetlands Division:</p> <p>(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</p> <p>National Policy Coordinator</p> <p>NRCS Watersheds and Wetlands Division:</p> <p>(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</p>	<p>DOD-USACE</p> <p>Chief of Planning @ appropriate USACE Regional Office</p>

	restoring areas where a USACE project contributed to the degradation of an area.	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
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<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:</p> <p>(212) 264-7813</p> <p>N.E. MO – Rock Island District:</p> <p>(309) 794-5249</p> <p>W. Central MO – Kansas City District:</p> <p>(816) 983-3205</p> <p>E. Central MO – St. Louis District:</p> <p>(314) 331-8095</p> <p>Southern MO – Little Rock District:</p> <p>(501) 324-5551</p> <p>S. E. MO – Memphis District:</p> <p>(800) 317-4156</p> <p>Streams for the Future</p> <p>Fisheries Division</p> <p>Missouri Department of Conservation</p> <p>(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:</p>

		<p>(212) 264-7813</p> <p>N.E. MO – Rock Island District:</p> <p>(309) 794-5249</p> <p>W. Central MO – Kansas City District:</p> <p>(816) 983-3205</p> <p>E. Central MO – St. Louis District:</p> <p>(314) 331-8095</p> <p>Southern MO – Little Rock District:</p> <p>(501) 324-5551</p> <p>S. E. MO – Memphis District:</p> <p>(800) 317-4156</p> <p>Streams for the Future</p> <p>Fisheries Division</p> <p>Missouri Department of Conservation</p> <p>(573) 751-4115</p>
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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	US Department of Agriculture (USDA) – Farm Service Agency (FSA) Farm Loan Programs National Office: (202) 720-3467, 1632

	future flood potential)	
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.	<p>DOI-NPS General Services Administration Offices</p> <p>Fort Worth, TX: (817) 334-2331</p> <p>Boston, MA: (617) 835-5700</p> <p>Or</p> <p>Federal Lands to Parks Leader</p> <p>NPS National Office: (202) 565-1184</p>

<p>Recreation and Parks Grants</p>	<p>Grants available to cities, counties and school districts to be used for outdoor recreation facilities and land acquisition.</p>	<p>Missouri Department of Natural Resources Division of Parks Tel: (573) 751-8560 Fax: (573) 526-4395</p>
<p>Partners for Fish and Wildlife</p>	<p>Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.</p>	<p>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.</p>
<p><i>Tree Planting Program</i></p>	<p>Grants for Planting Trees for improving Missouri’s erosion control, conservation, stream bank stabilization, etc.</p>	<p>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/</p>
<p>Conservation Contracts</p>	<p>Debt reduction for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.</p>	<p>USDA-FSA Farm Loan Programs FSA National Office: (202) 720-3467, 1632 or local FSA office</p>

<p><i>Historic Preservation Fund Grants</i></p>	<p>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.</p> <p>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.</p>	<p>Missouri Department of Natural Resources (DNR)</p> <p>Tel: (573) 751-3443</p> <p>Division of State Parks</p> <p>Historic Preservation Program</p> <p>1-800-334-6946</p> <p>TDD: 1-800-379-2419</p> <p>E-mail: moshpo@mail.dnr.state.mo.us</p>
<p><i>The Foundation Directory</i></p>	<p>Annual source of information about grants & loans from federal and private sources. Available for a fee.</p>	<p>The Foundation Directory</p> <p>(800) 424-9836</p> <p>www.fconline.fdncenter.org/</p>

<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</p>	<p>NSF – Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of</p>

	risk	Engineering, Science and Technology Program: (703) 306-1743
National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences	Research into basic and applied earth and building sciences.	NSF – Directorate for Geosciences, Division of Earth Sciences: (703) 306-1550

<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,</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 202-691-5200 800-877-8339</p>

	<p>by looking for the contact information under Historic Preservation Fund Grants on page 14 of this document).</p>	<p>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</p> <p>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</p> <p>Mr. John Blodgett (573) 884-2727 FAX(573) 884-4635</p> <p>Ms. Evelyn J. Cleveland</p>

		<p>blodgettj@umsystem.edu clevelande@umsystem.edu</p> <p>Geographic Resources Center University of Missouri- Columbia 17 Stewart Hall Columbia, MO 65211</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. 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</p>

		<p>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)</p> <p>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</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>
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	<p>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>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 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>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)</p> <p>USFA Grants Office Tel: (866) 274-0960</p> <p>FAX: (866) 274-0942</p> <p>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.</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>
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	<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</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>
	<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</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</p>

	<p><i>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>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> <p>Center for Economic Information University of Missouri-Kansas City 207 Haag Hall Kansas City, MO 64131</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. 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)</p> <p>USFA Grants Office Tel: (866) 274-0960</p> <p>FAX: (866) 274-0942</p> <p>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>
	<p>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</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> <p>Small Business Research Information Center</p>

	<p>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>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>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>
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<p>Demographics, Societal Statistics and Economic Statistics (Continued)</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)</p> <p>USFA Grants Office Tel: (866) 274-0960 FAX: (866) 274-0942 E-mail: usfagrants@fema.gov</p>
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Assistance to Firefighters Grants Program		
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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</p>
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		<p>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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