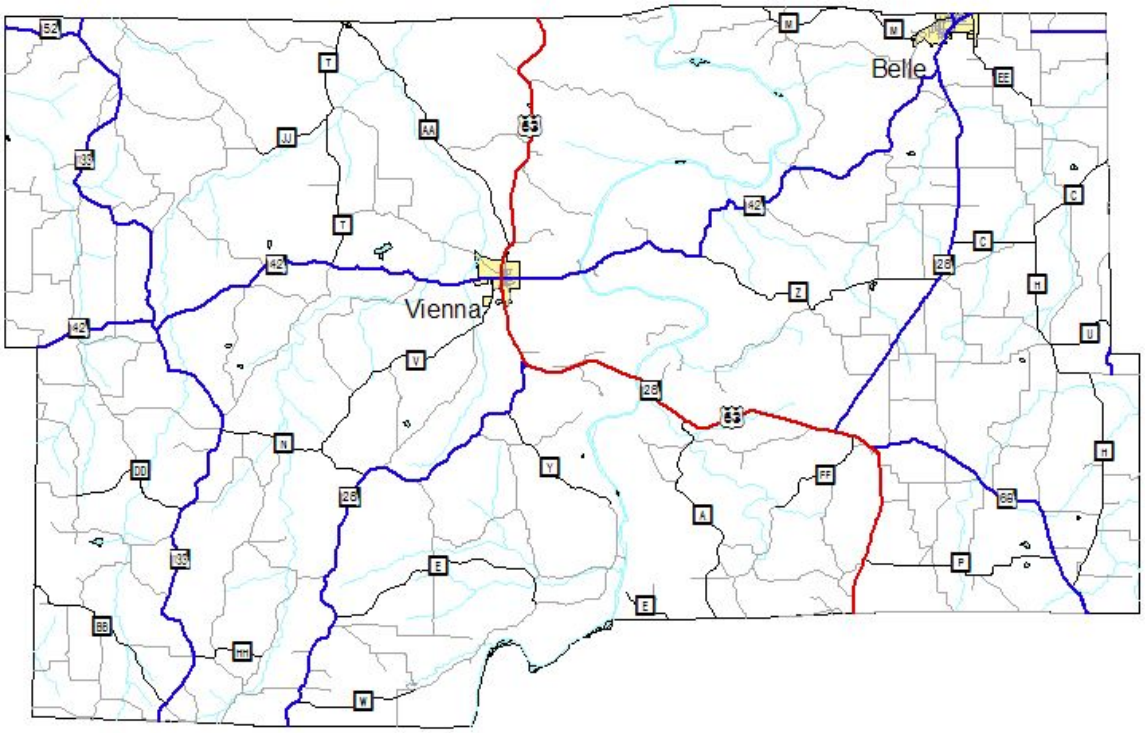
Maries County

Multi-Jurisdiction

Natural Hazard Mitigation Plan

Approved August 25, 2014



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

- Maries County
- City of Belle
- City of Vienna
- Maries County R-I School District
- Maries County R-II 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 Maries County, participating jurisdictions and state and federal agencies. The Maries 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 Maries, Dent, Maries, Maries, Osage, Maries, 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 Maries 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 Maries County Commissioners and the governing bodies of each participating jurisdiction and will be updated within a five-year timeframe.

Summary of Action Items Developed for All Jurisdictions	
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.; learn how to shut off their home utilities in times of emergency; and be self-sufficient for one to three days in the event of a disaster.
Priority	High
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

Summary of Action Items Developed for All Jurisdictions	
Action 1.1.2	Continue to educate residents about precautions that should be taken during threats of natural disasters such as severe weather and heat waves.
Priority	High
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, severe weather, tornados, floods
Applicable Jurisdictions	All jurisdictions
1.1.3	Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such as building personal shelters and assuring that propane tanks are appropriately tied down.
Priority	High
Lead	County Commission, County EMD
Partners	City governments
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards addressed	Tornado, flood
Applicable Jurisdictions	All jurisdictions
1.1.4	Promote development of emergency plans by businesses, local governments and schools.
Priority	High
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
1.1.5	Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness..
Priority	High
Lead	County EMD, County Commission
Partners	City governments, schools, Region I Homeland Security Oversight Committee
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All jurisdictions
1.1.6	Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.
Priority	High
Lead	Superintendent, School Board
Partners	Local emergency response agencies, EMDs
Projected Cost/Funding	Minimal/operating budget

Summary of Action Items Developed for All Jurisdictions	
Criterion for Completion	2014 and as needed after
Hazards Addressed	All hazards
1.1.7	Schools need to continue to conduct emergency preparedness exercises on a regular basis.
Priority	High
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
1.2.1	Continue to encourage cities to obtain early warning systems and improved communications systems.
Priority	High
Lead	City and County EMDs, County Commission
Partners	City governments, schools, sheriff's department
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Severe storm, tornado, severe winter weather, wildfire
Applicable Jurisdictions	All jurisdictions
1.2.2	Continue to promote use of weather radios by local residents to insure advanced warning about threatening weather.
Priority	High
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
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
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	Maries County

Summary of Action Items Developed for All Jurisdictions	
1.2.4, 2.1.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.
Priority	High
Lead	County EMD, County Commission
Partners	SEMA, FEMA, MRPC, MDC, MDNR, cities, schools
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Dam failure, tornados, sinkholes, land subsidence, wildfire
Applicable Jurisdictions	All jurisdictions
1.3.1	Continue to encourage tree trimming and dead tree removal programs by utility companies and local government.
Priority	High
Lead	County Commission, City Governments
Partners	Electric cooperatives, private contractors, public and private utilities
Projected Cost/Funding	Moderate/likely workable into budget
Criterion for Completion	Ongoing
Hazards Addressed	Tornado, Severe Storm, Severe Winter Storm
Applicable Jurisdictions	Maries County, Belle, Vienna
1.3.2	Continue to review and consider potential road and bridge upgrades to improve drainage, reduce flooding and the risk to residents and property.
Priority	High
Lead	County Commission
Partners	Local governments, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, Belle, Vienna
1.3.3	Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.
Priority	High
Lead	EMD, County Health Department
Partners	Local governments, schools, churches
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Severe Heat, Severe Storms, Tornado
Applicable Jurisdictions	Maries County, Belle, Vienna

Summary of Action Items Developed for All Jurisdictions	
1.3.4, 5.2.1	Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms.
Priority	Medium
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	Maries County, Belle, Irondale, Mineral Point, Potosi
1.3.5	Regularly review and update school emergency plan.
Priority	High
Lead	School Superintendent, School Board
Partners	County EMD, SEMA
Projected Cost/Funding	Low/operating budget
Criterion for Completion	Annually
Hazards Addressed	All Hazards
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
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
2.1.2	Encourage the development and implementation of minimum building codes in all communities.
Priority	Medium
Lead	County EMD
Partners	Local response agencies, city EMDs
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Ongoing until all communities have at least minimal building codes in place.
Hazards Addressed	Tornado, Severe Storm, Wildfire, Flood
Applicable Jurisdictions	Maries County, Vienna
2.1.3	Encourage businesses, local governments and schools to develop emergency plans.
Priority	High
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

Summary of Action Items Developed for All Jurisdictions	
2.1.5	Continue to evaluate and update emergency operation plans.
Priority	High
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
2.1.6, 5.1.4	Encourage cities to require contractor storm water management plans in all new development – both residential and commercial properties.
Priority	Medium
Lead	Public Works employees, Mayor, Board of Aldermen
Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
2.2.1	Educate residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program and enforce restrictions on development in the floodplain.
Priority	High
Lead	County Commission, county floodplain managers
Partners	SEMA, FEMA, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, Vienna
2.2.2, 5.1.2	Encourage all communities to develop storm water management plans.
Priority	Low
Lead	Mayor, Board of Aldermen, Public Works Department
Partners	Local builders associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
2.3.1	Encourage minimum standards for building codes in all cities.
Priority	Medium
Lead	Mayor, Board of Aldermen
Partners	Public works department
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Research and discussion completed by Dec. 2015.
Hazards Addressed	Tornado, Wind, Wildfire, Earthquake

Summary of Action Items Developed for All Jurisdictions	
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
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	Maries County, Belle, Irondale, Mineral Point, Potosi
2.3.3	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
Priority	High
Lead	County Commission, local floodplain managers
Partners	SEMA, FEMA
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, Irondale, Mineral Point, Potosi
2.3.4	Encourage the City of Belle to become a member of the NFIP.
Priority	High
Lead	County Commission
Partners	MTNF, MDC, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Initial meeting completed by 6/2015
Hazards Addressed	Flood
Applicable Jurisdictions	Belle
3.1.1	Distribute SEMA brochures on natural hazards, preparedness and NFIP at public facilities and events.
Priority	High
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
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
Lead	County EMD, County Commission, City EMDs
Partners	SEMA, city EMDs, local emergency response agencies
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing

Summary of Action Items Developed for All Jurisdictions	
Hazards Addressed	All hazards
Applicable Jurisdictions	Maries County, Vienna, Belle
3.2.1	Encourage local residents to purchase weather radios through press releases and brochures.
Priority	High
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
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
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
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
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
3.3.2	Distribute press releases by cities/county/schools regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
Priority	High
Lead	County EMD, County Commission, Floodplain Manager, School Superintendents
Partners	Local jurisdictions, SEMA, FEMA, city floodplain managers
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions

Summary of Action Items Developed for All Jurisdictions	
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
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	Maries County, Belle, Vienna
3.4.2	Publicize local, regional and/or statewide drills.
Priority	High
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
3.4.3	Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.
Priority	High
Lead	County EMD
Partners	Local jurisdictions, local response agencies, Region I HSOC, SEMA, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All jurisdictions
3.4.4	Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.
Priority	High
Lead	County EMD
Partners	SEMA, propane dealers
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood, Tornado, Severe Storm
Applicable Jurisdictions	All jurisdictions
4.1.1	Continue to encourage joint meetings of different organizations/agencies for mitigation related planning.
Priority	High
Lead	County EMD, County Commission, City EMDs
Partners	Local jurisdictions, emergency response agencies, SEMA, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing

Summary of Action Items Developed for All Jurisdictions	
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
4.1.2	Continue to encourage training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and businesses).
Priority	High
Lead	County EMD, County Commission
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
4.1.3, 6.1.5	Pool different agency resources to achieve widespread mitigation planning results.
Priority	High
Lead	County EMD, County Commission
Partners	All Jurisdictions, local emergency response agencies, county health department, SEMA, MRPC, Region I HSOC, MREPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
4.2.2	Encourage meetings between EMDs, city and county government, schools and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.
Priority	High
Lead	County Commission, County and City EMDs
Partners	Maries County Commission, Cities of Belle and Vienna, Maries County R-I and R-II School districts, FEMA, SEMA, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	All jurisdictions
5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Lead	Mayor and Board of Aldermen
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
5.2.1	Encourage the construction of storm shelters, especially tornado safe rooms near schools and large employment centers that currently do not have access to safe rooms.
Priority	Medium

Summary of Action Items Developed for All Jurisdictions	
Lead	County Commission, County EMD
Partners	Maries County Commission, Belle, Vienna, Maries County R-I and R-II School districts, SEMA, FEMA, MRPC, local chambers of commerce and economic developers
Projected Cost/Funding	High/Grants
Criterion for Completion	Ongoing until tornado safe rooms exist in each city and/or school and any other high population areas identified.
Hazards Addressed	Tornado, Severe Storm
Applicable Jurisdictions	All Jurisdictions
5.2.2	Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.
Priority	High
Lead	County and City EMDs
Partners	Maries County Commission, cities of Belle and Vienna, Maries County R-I and R-II school districts, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	All public buildings assessed and determinations made by 12/2018
Hazards Addressed	Tornado, Severe Storm
Applicable Jurisdictions	All Jurisdictions
5.3.1	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Priority	Medium
Lead	County floodplain manager
Partners	Local governments, SEMA, FEMA
Projected Cost/Funding	High/Grants
Criterion for Completion	Ongoing, with progress marked as properties are purchased.
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, City of Vienna
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
Lead	County EMD, County Commission
Partners	Local Jurisdictions, SEMA, FEMA, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions
6.1.2	Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
Priority	High
Lead	Maries County Commission
Partners	Road and Bridge Department, city government where applicable, MRPC, SEMA, FEMA

Summary of Action Items Developed for All Jurisdictions	
Projected Cost/Funding	Minimal/Operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, Cities of Belle and Vienna
6.1.3	Work with local/state/federal agencies to include mitigation in all economic and community development projects.
Priority	High
Lead	County Commission
Partners	SEMA, FEMA, MRPC, DED, RD
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	Maries County, Cities of Belle and Vienna
6.1.4	Encourage local jurisdictions to budget for mitigation projects.
Priority	High
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
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
Lead	County EMD, County Commission
Partners	Cities of Belle and Vienna, SEMA, FEMA
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Dam Failure, Earthquake, Flood, Land Subsidence/Sinkhole, Severe Storm, Tornado, Severe Winter Weather, Wildfire
Applicable Jurisdictions	Maries County, Cities of Belle and Vienna
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
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

Summary of Action Items Developed for All Jurisdictions	
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
Lead	County EMD, County Commission
Partners	All Jurisdictions
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2017, repeat in 2019
Hazards Addressed	All Hazards
Applicable Jurisdictions	All Jurisdictions

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.

- Maries County
- City of Belle
- City of Vienna
- Maries County R-I School District
- Maries County R-II 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, Maries County contracted with the Meramec Regional Planning Commission and participated fully in the preparation of the plan. Once this plan is approved, Maries 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 # _____

A RESOLUTION OF INTENT TO PARTICIPATE IN NATURAL HAZARD MITIGATION AND TO WORK TOWARD BECOMING A SAFER COMMUNITY

Whereas**,** the _____ recognizes that no community is immune from natural hazards whether it be tornado/severe thunderstorm, flood, severe winter weather, drought, heat wave, earthquake, dam failure, land subsidence or wildfire and recognizes the importance of enhancing its ability to withstand natural hazards a well as the importance of reducing the human suffering, property damage, interruption of public services and economic losses caused by those hazards; and

Whereas, the _____ may have previously pursued measures such as building codes, fire codes, floodplain management regulations, zoning ordinances and storm water management regulations to minimize the impact of natural hazards; and

Whereas, the Federal Emergency Management Agency and the State Emergency Management Agency have developed a natural hazard mitigation program that assists communities in their efforts to become Disaster-Resistant Communities which are sustainable communities after a natural disaster that focus, not just on disaster relief but also on recovery and reconstruction that brings the community to at least pre-disaster conditions in an accelerated, orderly and preplanned manner; and

Whereas, by participating in the Natural Hazard Mitigation program, the _____ will be eligible to apply for post-disaster mitigation funds; and

Whereas, the _____ desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

Whereas, the _____ will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

Whereas, the _____ will participate in the evaluation and review of the Plan after a disaster as well as complete a mandated five-year update submitted to the State Emergency Management Agency and the Federal Emergency Management Agency for review and approval; and

NOW, THEREFORE BE IT RESOLVED by the _____ as follows:

The _____ hereby adopts the Maries County Multi-Jurisdictional natural Hazards Mitigation Plan attached hereto for the purpose of building a safer community by reducing natural hazard vulnerability.

ADOPTED this _____ day of _____, 2014.

_____ ATTEST: _____

Certifying Official Signature Name and Title

1 INTRODUCTION AND PLANNING PROCESS

1.1 Purpose

The purpose of the Maries 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.

The original plan was completed in 2006 with a revision and update completed in 2014.

In an effort to ensure the purpose of the Maries 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 Maries 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 Maries 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 Maries 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 Maries County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the participating jurisdictions within the County's borders, including the following:

- Maries County
- City of Belle
- City of Vienna
- Maries County R-I School District
- Maries County R-II School District

Jurisdictions added in the 2014 revision:

- Maries County R-I School District
- Maries County R-II School District

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

Jurisdiction name	Continuing Jurisdiction	New Jurisdiction	Discontinued Jurisdiction
Maries County	X		
City of Belle	X		
City of Vienna	X		
Maries County R-I Schools		X	
Maries County R-II 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. Maries 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 Maries 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 update was completed in accordance with the revised Local Hazard Mitigation Plan Review Guide document, dated October 2011.

The plan contains a mitigation action listing, a discussion of the purpose and methodology used to develop the plan, a profile on Maries 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 Maries 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 Maries County Hazard Mitigation Planning Committee (HMPC) first organized in 2005 when the Missouri State Emergency management Agency (SEMA) provided funding for hazard mitigation planning to counties throughout the state of Missouri. Maries 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 Maries 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 Maries County. The HMPC was re-activated in 2011 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 on August 22, 2006. Three plan update meetings were held. The first meeting was held on September 8, 2011; the second on September 26, 2011; and the third on July 25, 2013. All meetings were advertised on MRPC's website and public notices were provided through the Maries 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 Maries County Multi-Hazard Mitigation Plan was developed as a result of a collaborative effort among Maries County, the cities of Belle and Vienna, the Maries County R-I and R-II School Districts, 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 Maries County.

Interviews were conducted with stakeholders from the community and three 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 an 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 2011-13 update and revision process, Maries 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:

- Ray Schwartze, Presiding Commissioner
- Doug Drewell, Associate Commissioner
- Ed Fagre, Associate Commissioner
- Rhonda Brewer, County Clerk
- Judy Logan Honse, County Assessor
- Mark Buschmann, Circuit Clerk and Recorder
- Jayne Helton, County Collector
- Rhonda Slone, County Treasurer
- Chris Heitman, Maries County Sheriff
- Ken Ramsey, Emergency Management Director
- Tony Gieck, Mayor (2011), Alderman (2012-13), City of Belle
- Donna Stough, Office Manager, City of Belle
- Carla Butler, Treasurer, City of Belle
- Frankie Hicks, City Clerk, City of Belle
- Steve Vogt, Alderman in 2011 and Mayor in 2013, City of Belle
- Steve Honse, Alderman, City of Belle
- Dave Grubbs, Alderman, City of Belle
- Joe Lockard, Alderman, City of Belle
- Kevin Guffey, Alderman, City of Belle (2013)
- Michael Dixon, Jr., Chief of Police, City of Belle (2011)
- Dwight Francis, Fire Chief, Belle Volunteer Fire Department
- Darryl Jenkins, Public Works, City of Belle
- Jamie Jones, Mayor, City of Vienna
- Sherry James, City Clerk, City of Vienna
- Brenda Davis, Alderman, City of Vienna
- Carol Miller, Alderman, City of Vienna
- Christine Robertson, Alderman, City of Vienna
- Laura Stratman, Alderman, City of Vienna
- Dennis Bullock, Alderman, City of Vienna
- Shannon Thompson, Chief of Police, City of Vienna
- Shon Westart, Public Works Superintendent, City of Vienna

- Mark Pottorff, Superintendent, Maries County R-I School District
- Dr. Zach Templeton, Superintendent, Maries County R-II School District (2011)
- Gary Doerhoff, Superintendent, Maries County R-II School District (2013)
- Albert Crump, Maries County IDA
- Intercounty Electric Cooperative
- Gascosage Electric Cooperative
- Janet Driscoll, Dixon Ambulance District
- Craig Faith, Maries/Osage Ambulance District
- Andy Littrell, Ozark Central Ambulance District
- Mark Honse, Fire Chief, Vienna Fire Protection District
- Ameren
- Don Chamber, Fire Chief, Vichy Volunteer Fire Protection Association
- Darrin Bacon, Manager, Rolla Regional Airport
- Nathan Abel, Public Works, City of Belle
- Jodie Waltman, Maries/Phelps County Health Department
- Chief Dennis Lachowicz, Dixon Rural Fire Protection District

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

Maries 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 Maries County Commission meeting on September 8, 2011. MRPC mailed out letters of invitation to all of the jurisdictions listed above. MRPC's invitations were mailed out to representatives of each of Maries 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 Maries 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, they were asked to participate by providing information, responding to surveys and reviewing the plan document.

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.

Maries 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 Maries County Hazard Mitigation Planning Meetings

Meeting	Topics Covered	Date
Maries 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	September 8, 2011
Maries County Hazard Mitigation Planning Committee	Welcome & introductions, discussion of hazard mitigation programs/strategies and progess made in past 5 years, discussion of possible changes to goals and objectives for next 5 years	September 26, 2011

Meeting	Topics Covered	Date
Maries County Hazard Mitigation Planning Committee	Welcome & introductions, overview and update of planning process, review of action items and prioritization, plan for administering and implementing action items	July 25, 2013

Agenda items at the first meeting on September 8, 2011 included a review of the plan update requirements; a review of the current Maries 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 n 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:

Tony Floyd, Intercounty Electric Cooperative
Leisa Stilley, Intercounty Electric Cooperative
Stephen Brown, Maries County Emergency Management
Dave Clifton, Assistant Emergency Management Director, Maries County
Ken Ramsey, Emergency Management Director, Maries County
Rhonda Brewer, Maries County Clerk
Ray Schwartze, Presiding Commissioner, Maries County
Doug Drewel, Associate Commissioner, Maries County
Edward Fagre, Associate Commissioner, Maries County
Steve Vogt, Alderman, City of Belle
Dwight Francis, Belle Fire Department
Nathan Abel, Public Works, City of Belle
Laura Schiermeier, Maries County Gazette

The following jurisdictions and organizations were in attendance at the September 26, 2011 meeting of the Maries County HMPC:

Ray Schwartze, Maries County Presiding Commissioner
Doug Drewel, Maries County Associate Commissioner
Edward Fagre, Maries County Associate Commissioner
Rhonda Brewer, Maries County Clerk
Ken Ramsey, Emergency Management Director, Maries County
Dave Clifton, Assistant Emergency Management Director, Maries County
Chris Heitman, Maries County Sheriff
Laura Schiermeier, Maries County Gazette

The following jurisdictions and organizations were in attendance at the July 25, 2013 meeting of the Maries County HMPC:

Ray Schwartze, Maries County Presiding Commissioner
Doug Drewel, Maries County Associate Commissioner
Edward Fagre, Maries County Associate Commissioner
Rhonda Brewer, Maries County Clerk
Ken Ramsey, Emergency Management Director, Maries County
Laura Schiermeier, Maries County Gazette

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 Maries County Hazard Mitigation Planning Meetings

Jurisdiction	Participating Jurisdiction	Participated in Planning Process	HMPC September 8, 2011 Meeting	HMPC September 26, 2011 Meeting	HMPC July 25, 2013	Completed Surveys/ Provided Information
Maries County	X	X	X	X	X	X
City of Belle	X	X	X			X
City of Vienna	X	X				X
Maries R-I School District	X	X				X
Maries R-II 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, the planning committee reviewed their participation and determined that if the jurisdictions provided information, completed surveys, responded to questions and/or reviewed the plan document and provided input they were considered active participants in the planning process. 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 Maries County Plan

Name	Jurisdiction	Completed Survey	Provided Information
Rhonda Brewer, County Clerk	Maries County		X
Ray Schwartze, Presiding Commissioner	Maries County	X	X
Ken Ramsey, County EMD	Maries County		X
Chris Heitman, Sheriff	Maries County		X
Steve Vogt, Mayor	City of Belle		X
Nathan Abel, Public Works	City of Belle	X	X
Frankie Hicks, City Clerk	City of Belle		X
Daryl Jenkins, Public Works	City of Belle		X

Name	Jurisdiction	Completed Survey	Provided Information
Sherry James, City Clerk	City of Vienna		X
Shon Westart, Public works Supt.	City of Vienna		X
Joe Dunlap, Superintendent	Maries County R-I School District		X
Beth Hollis, Secretary	Maries County R-I School District		X
Dr. Patrick Call, Superintendent	Maries County R-II School District	X	X
Peggy Terrill, Secretary	Maries County R-II 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 Maries 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. Maries 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 Maries 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 Maries 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 Maries 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 Maries County Profile

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

2.1.1 History and Development

The first land entry within the present limits of Maries County was made on Jan. 11, 1826, at which time Charles Lane entered an 80-acre tract. In April of the following year, he entered the adjacent 80 acre tract giving him 160 acres of land known for a hundred years thereafter as the Old Pay Down Mills. Mill sites were in great demand by the early settlers, and Lane probably had such a use for the land in mind when he acquired it.

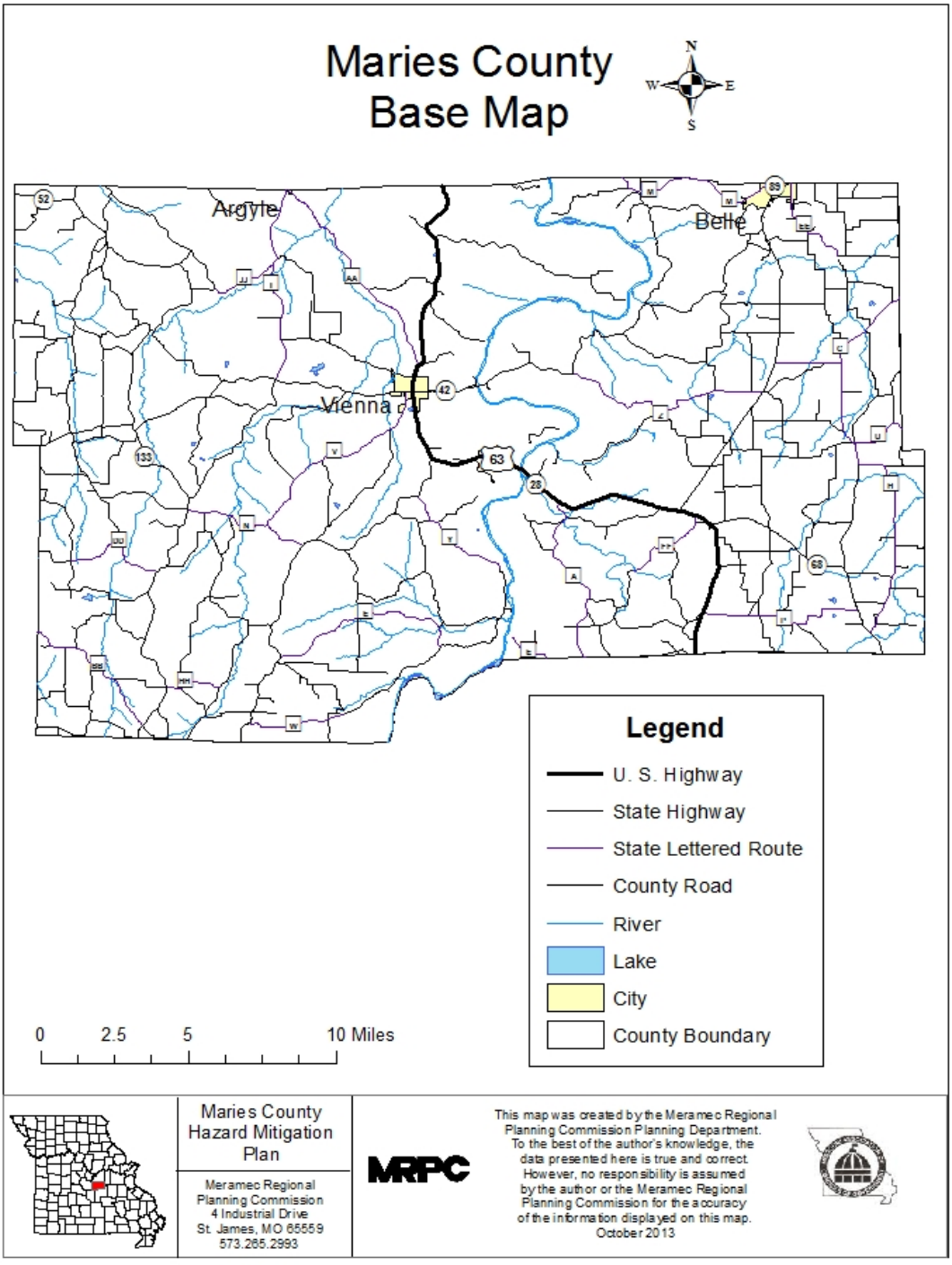
The trace known as Boone's Lick Road was the site of the first three post offices to be established in the county. The first of these was established on the farm of Lunsford L. Lane in Lane's Ford in 1837. Mr. Lane was the postmaster. The second post office, also located on the road, was established in July 1842, in William Hawkins' store and lasted until June 1864. The third post office, located near the crossing of the Boone's Lick and Springfield roads, was established in February 1851 and was located in the home of William Pinnell.

The first school district was organized in Maries County in 1843. Its boundaries were indefinitely described, but it included the northwestern portion of the present Maries County, and the southwestern part of the present Osage County. Davis Woody was the first president of the board of education of the new district.

Current Maries County Courthouse

By the beginning of the 1850s, the population of the area now embraced by Maries County had grown large enough that agitation began for the formation of a separate county. A bill for the organization of the county was introduced into the legislature in December 1854 and was approved by the governor on March 2, 1855. The county was named for two streams, the Maries and the Little Maries. Maries is a derivative of a French word *marais*, which means marsh, lake or pond.

Figure 2.1 Base Map of Maries County



[Although listed on some Maries County maps, the city of Argyle is not included in the Maries County Hazard Mitigation Plan. Argyle is included in the Osage County Hazard Mitigation Plan.]

When originally formed, Maries County extended farther south than it does at present, taking in the city of Rolla and barely missing Newburg, both now in Phelps County. This situation existed only a short time, since Phelps County was formed shortly afterward. Maries County lost some territory to Phelps County, but gained almost as much from Crawford County at the same time.

On July 20, 1855, title to the 70 acres of land on which Vienna, the county seat, now stands was acquired from William Shockley, who donated the tract in consideration of the county seat being located there. The construction of the first courthouse was completed, and the building occupied in October of 1856. It was the most elevated building in the town, standing on the ridge between the Gasconade and Osage rivers and the roof divided the falling rain to flow into the Gasconade on the east and into the Osage to the west. The building was completely destroyed by fire on Nov. 6, 1868, and all court records were lost or destroyed. Work on a new building began in 1869 and was completed in 1870. This second courthouse was razed in 1939 to make way for the construction of the present courthouse.

The City of Belle was the location of a post office and train depot along the route of the Chicago, Rock Island and Pacific Railroad built across a portion of Maries County in 1904. The community is a fourth-class city with a four member board of aldermen and a mayor. The city is located in the northeast corner of the county and straddles the Maries/Osage county line. The community lies at the convergence of Highways 28 and 89. Belle is the largest city in the county with a population of 1,545.

The City of Vienna was formed in 1855 as the county seat. Initially the community had a population of about 250. It contained a brick school house, a newspaper – the *Central Missourian*, two churches, one hotel, four stores and a wagon shop.[i] Vienna is a fourth-class city with a four member board of aldermen and a mayor. The city is located in central Maries County at the convergence of Highways 63 and 42. The current population for the city is 610.

2.1.2 Geography and Topography

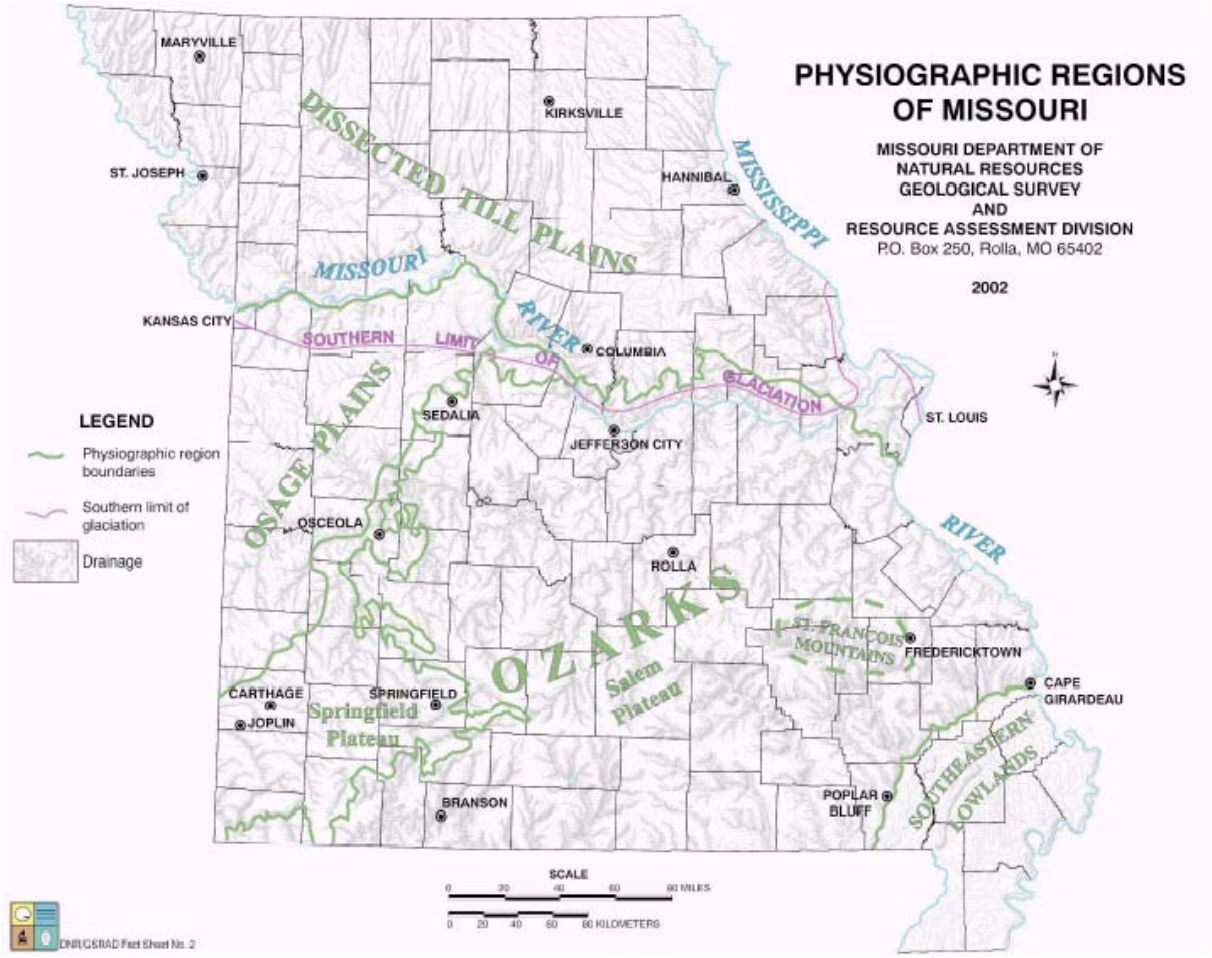
Maries County falls into two major topographic areas. The topography in the eastern portion of the county is typical of the Bourbeuse Watershed, with gently rolling hills and prairie-like terrain. West of the Bourbeuse Watershed the terrain grows rough and hilly. The most rugged terrain is in the western portion of the county in the Maries River Watershed. The maximum relief in the county is approximately 500 feet.

The landscape pattern of Maries County is highly diverse. Highways 63 and 28 closely approximate the location of a winding ridgetop that divides the major watersheds in the county. To the west, tributaries flow to the Maries River and/or to other small tributaries that all drain to the Osage River in neighboring counties. On the eastern side, most of the drainage is toward the Gasconade River. On the far eastern side of the county water flows through tributaries that run into the Bourbeuse River. The dominant landscape between these rivers consists of moderately sloping to steep uplands dissected by flood plains along small streams. In the eastern part of the county, broad plateaus occur on crests of the major divides.[ii]

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 2.3
Physiographic Regions of Missouri



Watersheds. 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.[iii]

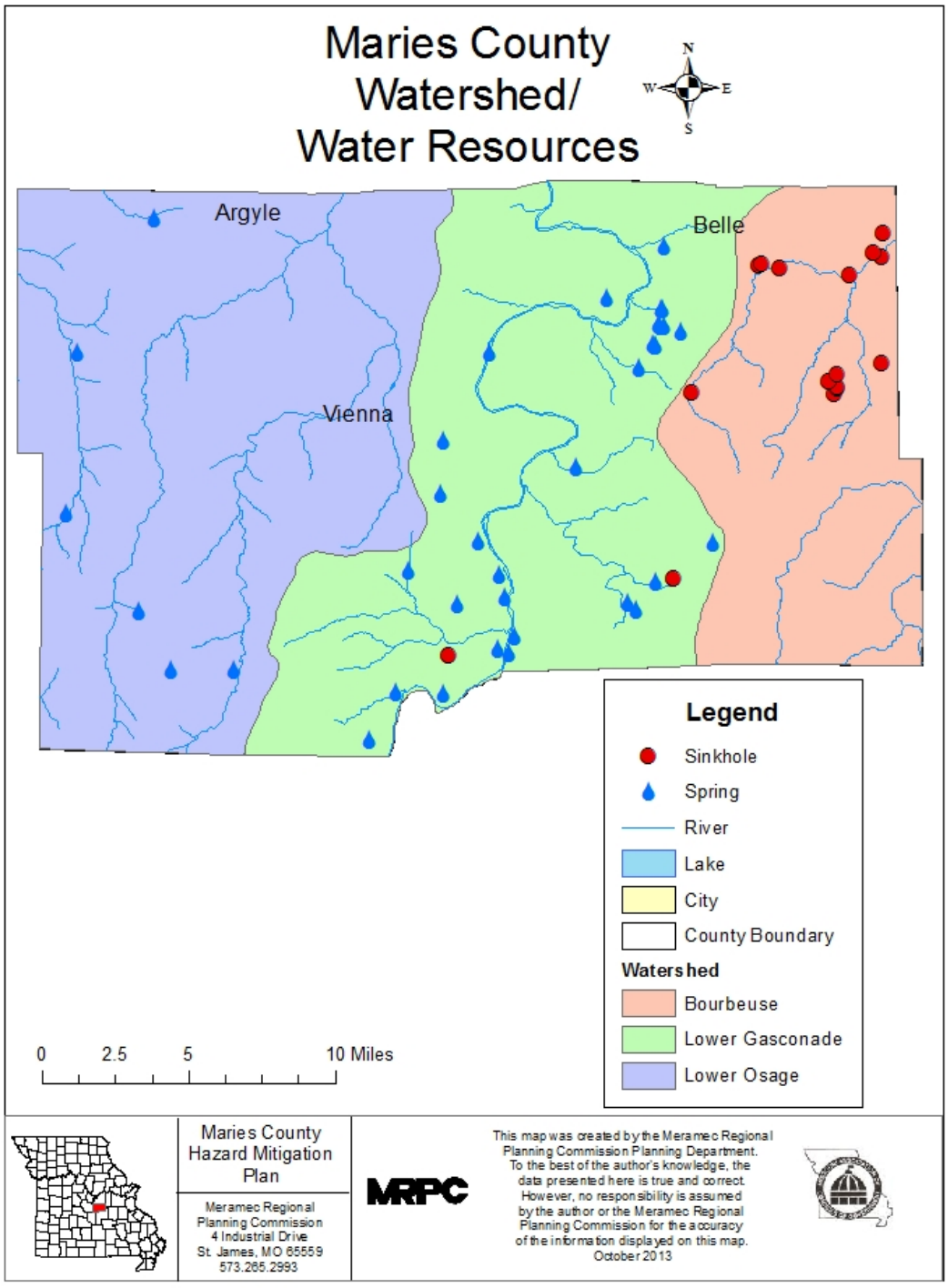
There are three major watersheds in Maries County: Bourbeuse, Lower Gasconade, Lower Osage. These watersheds are illustrated in Figure 2.4. The Bourbeuse River lies on the eastern side of the county and includes the following tributaries: Little Bourbeuse Creek, Upper Bourbeuse River, and Dry Fork Creek. The Lower Osage River lies on the western side of the county and includes Tavern Creek, Sugar Creek, Little Maries River and Upper Maries River. The Lower Gasconade basin run northward through the middle of the county and includes Spring Creek.

The main stem of the Bourbeuse River does not cross Maries County, but several of its tributaries do. The entire watershed drains 843 square miles. Approximately half of the watershed area is used for cropland and pasture. The other half is primarily deciduous forest. Water quality in the Bourbeuse River watershed is basically good. Issues that could adversely affect the watershed include organic waste from livestock, sediment from erosion and discharge from sewer treatment facilities.

Riparian corridors are negatively affected by riparian land use, especially along tributary streams. The basin exhibits good aquatic biodiversity. Fish taken from this watershed are considered safe for human consumption. There are 90 fish species located in the watershed, including the highfin carpsucker, which is listed on the Missouri Department of Conservation's Species of Concern. In the most recent survey, 31 living mussel species were sampled, down from 39 collected in previous surveys.[iv]

The Gasconade River watershed is located within the Ozark Plateau of the Interior Ozark Highlands. The river meanders north to northeast through Webster, Texas, Laclede, Pulaski, Dent, Maries, Osage, Phelps, and Gasconade counties to join the Missouri River. The Gasconade River is 271 miles long from mouth to headwaters with 263 miles having permanent flow. The Upper and Lower Gasconade River watersheds drain 2,806 square miles. The Upper Gasconade River watershed has an average gradient of 27.6 feet/mile, and the Lower Gasconade River watershed has an average of 3.9 feet/mile. A number of springs within the middle Gasconade River portions are due to the karst geology of the Roubidoux and Gasconade Dolomite Formation and losing stream segments. The karst topography causes losing portions in the Osage Fork, Roubidoux, North Cobb, Little Piney, Spring, and Mill creeks, and Gasconade River. The entire Gasconade River watershed is reported to have 76 springs and the largest concentration of big springs in the state.[v]

Figure 2.4
Maries County Watersheds



As a whole, the Gasconade River watershed is rural with low population density and high farmland density. The most populated areas are Pulaski and Phelps counties, which are experiencing land development from growth surrounding Fort Leonard Wood and the City of Rolla. Lower watershed areas of Maries, Osage, and Gasconade counties have low population density. The Upper and Lower Gasconade River watersheds have 49% and 33%, respectively, grassland and cropland as land use. A general trend in the rural Gasconade River watershed toward increased cattle numbers per pastured acre has continued to the present. Forest comprises approximately 46% of the land cover within the Upper Gasconade River watershed and 66% within the Lower Gasconade River watershed. Forests are in good health and have sustainable forest production. Forest land is largely under private ownership with federally-owned forest having the second largest holdings, followed by state-owned lands having a smaller percentage. Public land is 12% or 221,040 acres within the entire watershed. To provide water-based recreational opportunities, 23 public stream accesses have been developed in the watershed. Gasconade River watershed annual precipitation ranges from 40.35 to 42.67 inches with a annual mean of 41.66 inches. This precipitation and the local geology provides good base flow conditions and lower variability in stream flow throughout major portions of the watershed. Average runoff had greater extremes from the late 1970s to the present than during the 1960s to the late 1970s.[vi]

The Gasconade River watershed's designated stream uses, assigned by the Missouri Department of Natural Resources (MDNR) are warm water aquatic life protection and fishing, and livestock and wildlife watering. Threats to beneficial uses in the Gasconade River watershed are point and non-point sources of pollutants. The number of point pollution sources and flow from point pollution sources is low. In fact, improvements have been made to point source discharges through monitoring by the MDNR and sewage treatment upgrades. Also, the Gasconade River has recovered well from the December 1988 oil spill that released hundreds of thousands of gallons of crude oil into the main stem Gasconade River from a broken pipeline near Vienna. On the contrary, non-point source pollution remains a difficult challenge. Numerous MDNR Soil and Water Program Special Area Land Treatment projects in the Upper Gasconade River Hydrologic Unit (HU), and portions of the Upper Osage Fork HU are addressing nutrient problems that have cattle manure as their sources. Sand and gravel mining in sensitive areas can and has effected fisheries, especially sensitive cool- and cold-water fisheries. Other potential non-point pollution sources are two landfills in Wright and Phelps counties. Runoff from farms, mining operations, construction sites, forest operations, residential septics, and impervious surface in urbanized areas create a complex resource management challenge.[vii]

The East Osage River Basin is found in central Missouri in the Missouri counties of Osage, Maries, Cole, Pulaski, Miller, Camden, Morgan, Benton, and Hickory and encompasses 2,474.52 mi^2. Lake of the Ozarks was formed in 1931 in the western half of the East Osage River Basin.[viii]

This basin lies within a dissected plateau known as the Salem Plateau and is represented by four of Missouri's natural divisions. Karst features are common and soils are generally acidic with moderate to low fertility. Erosion rates are generally low although new housing developments, road construction, intensive confinement of livestock and overgrazing have denuded land causing locally-increased erosion and sediment pollution.[ix]

The basin has undergone a major shift in land use during the last 300 years. Historically, the basin was occupied by the native Osage tribe. As European settlers moved into the basin, they degraded environmental quality and displaced the native people. European settlers cleared timber, over harvested fish and game, and plowed soil on steep hillsides. In the early days, people used the Osage River and its tributaries as a main mode of transportation and constructed wing dikes to control the flows of the river. In 1931, construction of Bagnell Dam was completed forming Lake of the Ozarks-a prime recreational and tourist destination. Harry S Truman Dam and Reservoir was completed in 1979. Bagnell Dam and Truman Dam both currently provide hydroelectric power generation. Agriculture in the basin has experienced a shift from a crop-based system in the earlier days of settlement to a livestock-based system today. Many concentrated animal feeding operations (CAFOs), gravel mining operations, waste water treatment plants, and urban construction projects currently exist within the basin. The Missouri Department of Natural Resources (MDNR), Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), Missouri Department of Conservation (MDC), Natural Resources Conservation Service (NRCS), and county Soil and Water Conservation Districts have worked with landowners to protect natural resources in the basin.[x]

Precipitation in the basin is typical of a mid-Missouri basin with an average of 42 inches per year. The U.S. Geological Survey (USGS) has maintained 16 gauging stations within the basin. Due to the karst topography of the basin, a number of losing streams and springs exist within the area. Truman Dam and Bagnell Dam on the Osage River have significantly impacted the hydrology of the region.[xi]

Water of the basin is used for household use, commercial use, recreational use, and hydroelectric use. There are more than 85,000 residents of the basin served by public supplied surface water, public supplied groundwater, or private wells. Water quality is normally good, but pollution incidents occasionally occur, causing stream contamination and fish kills. The Clean Water Act requires each state to maintain a list of critically impaired streams. Currently, there are 1.9 miles of 303(d)-listed impaired streams and 50 impaired reservoir acres found within the basin. Sources of impairment include damming, riparian degradation, channel alteration, urbanization, flow alteration, sedimentation, low dissolved oxygen, point source pollution, and nonpoint source pollution.[xii]

Habitat conditions of the basin have been considerably altered in some areas. Logging, land clearing, burning, and overgrazing have degraded fish and wildlife habitats within the basin. Stream channels have become destabilized due to peaking-style discharge from dams, gravel mining, and channelization. Riparian corridors are in fair condition throughout the basin with an average of 61% riparian forest and 35% riparian grassland. There is only about one percent of the basin in riparian cropland and less than one percent in urban land-use. The Osage River below Bagnell Dam has the highest percentage of riparian cropland (20 percent) in the basin.[xiii]

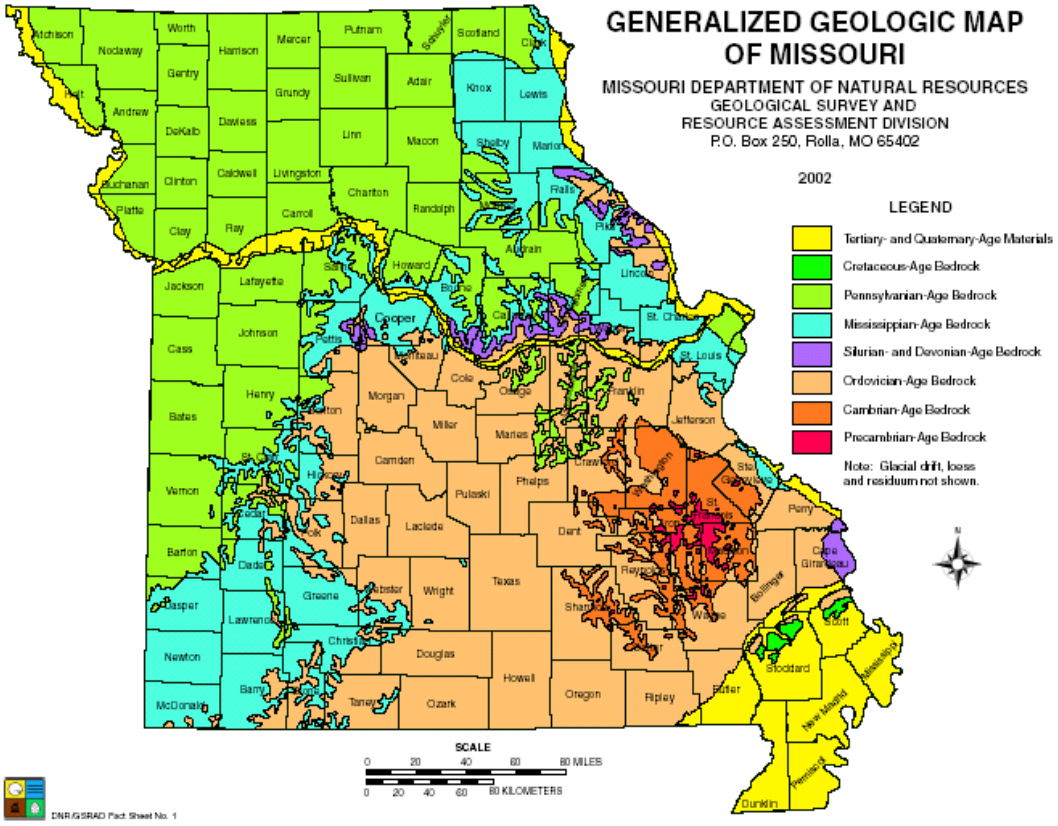
The basin has a rich diversity of animal and plant species within its boundaries. Some species which historically occurred within the basin could not cope with the changes brought about by the European settlers. Other species such as the Niangua darter, lake sturgeon, and pink mucket mussel still exist, although their future is imperiled due to habitat changes, over harvest, introduction of exotic species, or water quality changes. The MDC has sampled the fish

communities of the basin since 1940. Each sub-basin hosts a different fish community structure depending on a variety of factors including inter-species competition, habitat availability, pollution events, or hydrologic characteristics.[xiv]

Geography. As demonstrated in Figure 2.5 *Generalized Geologic Map of Missouri*, Maries County's geology consist of basically two types of formations—the Ordovician Age Bedrock—predominant through most of the county, and the Cretaceous Age Bedrock—found in the eastern quarter of the county.

The county is located in the Ozark Plateau – the largest outcrop area of Ordovician–age rocks in the United States.[xv] This rock is 505 to 441 million years old and made up primarily of carbonates and thin shales with three distinctive sandstone layers: the Gunter at the base of the column, the red and white Roubidoux which is often used as a building stone and the St. Peter glass sand. This stone is the result of a time period when Missouri was covered by a shallow sea and the stone frequently produces aquatic fossils from that time period.[xvi] Portions of this formation contain rock that dissolves and fractures over time from rainwater, thus resulting in the karst features found throughout the Ozarks. Figure 2.5 shows the geologic regions of the state.

Figure 2.5
Generalized Geologic Map of Missouri



Maries County has been a participant in the National Flood Insurance Program since July 1987. The City of Vienna has been a participant in the NFIP programs since November 1979. The City of Belle is not a member of the NFIP.

As part of its floodplain management program, the county requires that houses be built one foot above base flood elevation. A permit must be granted by the county commission for any new construction inside the floodplain.

2.1.2 Soil Types

According to *The Soil Survey of Maries County, Missouri*, published by the Natural Resources Conservation Service (NRCS), there are nine different soil types found in Maries County. However, 82 percent of the county is dominated by three soil associations – the Union-Swiss Association, which makes up 20 percent of the county; Gatewood-Gravois Association, which makes up 34 percent of the survey area; and the Rueter-Union Association which makes up 28 percent of the county. Other soil associations present include the Jamesfin-Cedargap-Racoon Association, which makes up 12 percent of the county; Beemont-Gravois Association which makes up five percent of the county and the Mariosa Association which makes up just one percent of the county. All three of the primary soil associations in the county are found mainly on ridges and side slopes and are made up of loess and residuum materials.

The major flood plains in the county are along the Gasconade and Maries Rivers and their tributaries. Loamy and silty alluvium was deposited along these rivers from periodic overflow. Gravelly basal deposits underlie alluvial soils along the smaller streambeds, where they are underlain by the karsted portions of the Gasconade geologic formation. This formation, where exposed, is also rife with small caves and springs.[xvii]

2.1.3 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 Maries County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Inches	2	2.3	4.1	4	4.4	3.3	3.4	4.3	3.9	3.3	3.8	3.4	42.2

Source: *http://countrystudies.us*

Because of its inland location, Missouri and Maries County are subject to frequent changes in temperature. The mean annual temperature is in the mid-50s with the January mean of about 32 degrees and July mean of about 78 degrees.

Table 2.2 Average Low and High Temperatures for Maries County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg-Low	20	25	34	44	54	61	65	64	56	45	36	25	44
Mean	32	36	47	57	65	74	78	76	68	58	47	36	56.1
Avg-High	42	47	58	68	77	84	88	87	80	71	58	47	72.6

Min and Max represent the coldest and warmest average months on record.[xviii]
Source: http://www.countrystudies.us

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.

2.1.4 Population/Demographics

According to the 2010 U.S. Census, the population of Maries County was 9,176. With the county being 530 square miles, this translates to a population density of 17.3 persons per square mile. The 2010 Census indicates that the county's population increased since 2000 by three 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
Maries County	9,176
Belle	1,545
Vienna	610

Source: 2010 US Census

In the 1940s, 1950s and 1960s the population for Maries County decreased – 14.1 percent from 1940 to 1950; 1.9 percent from 1950 to 1960 and 5.9 percent from 1960 to 1970. After three decades of declining population, the county began steadily growing from a low of 6,851 in 1970

to 9,176 in 2010. Table 2.4 shows population trends for the county and communities in Maries County from 1950 to 2010.

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

Community	1950	1960	1970	1980	1990	2000	2010
Maries County	7,423	7,282	6,851	7,551	7,976	8,903	9,176
Belle	471	536	505	514	611	628	610
Vienna	906	1,016	1,133	1,099	1,218	1,344	1,545

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

The City of Belle lost population in the 1970s and then grew until 2000. The community had a population loss of 2.9 percent from 2000 to 2010. The City of Vienna lost population in the 1980s, but has had steady population growth of 10 to 15 percent in the 1990s and 2000s. The Missouri Office of Administration, Division of Budget and Planning projections show Maries County's population growing slightly at 2.7 to 3 percent per decade through 2030. But the projections indicate the county's population will likely remain below 11,000 during that time period.

According to the 2010 U.S. Census Bureau statistics, 97.71 percent of Maries County's population is white. The racial breakdown of the remaining 2.29 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 2.23 percent.

Table 2.5 Maries County Population Trends and Breakdown of Racial Groups

Year	1970	1980	1990	2000	2010
Total Population	6,851	7,551	7,976	8,903	9,203
White Alone	6,847	7,533	7,909	8,674	8,992
Black/African American Alone	0	0	67	29	145
Amer. Indian/ AK Native Alone	***	5	27	49	11
Asian Alone	***	5	19	10	0
Hawaiian/ Pacific Islander Alone*	***	Included with Asian	10	0	0
Some Other Race Alone***	4	8	11	31	44
Two or More Races**	**	**	**	110	11
% White	99.94	99.76	99.16	97.43	97.71
% Non-White	0.06	0.24	0.84	2.57	2.29

Source: 1970, 1980, 1990, 2000, 2010 U.S. Census of Population, Bureau of the Census, US Department of Commerce

** Asian Alone, Hawaiian/Pacific Islander were combined in the 1980 Census*

*** Two or More Races were not listed on the 1970, 1980 or 1990 Census*

**** Other includes Native American, Asian, Pacific Islander and all other races*

Table 2.6 shows the age and sex composition of the county for the years 1980 through 2010. The age and sex composition for the county has stayed relatively stable for the past 30 years.

TABLE 2.6 - AGE-SEX COMPOSITION OF THE POPULATION FOR MARIES COUNTY, 1980 - 2010

	2010				2000				1990				1980			
Age Group	Number of Males	% of Total Males	Number of Females	% of Total Females	Number of Males	% of Total Males	Number of Females	% of Total Females	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	310	3.4	252	2.7	323	7.2	264	2.0	261	6.6	282	7.0	267	7.0	243	6.5
5-9	288	3.1	298	3.2	345	7.7	286	6.5	288	7.3	267	6.6	294	7.7	268	7.2
10-14	324	3.5	303	3.3	340	7.6	350	7.9	316	8.0	287	7.1	307	8.0	301	8.1
15-19	326	3.6	275	3	326	7.3	290	6.6	312	8.0	271	6.7	404	10.6	323	8.7
20-24	239	2.6	229	2.5	236	5.3	207	4.7	226	5.7	229	5.7	226	5.9	229	6.1
25-29	225	2.5	225	2.5	235	5.2	240	5.4	308	7.8	255	6.3	255	6.7	226	6.1
30-34	256	2.8	227	2.5	258	5.8	278	6.3	261	6.6	274	6.8	233	6.1	236	6.3
35-39	259	2.8	245	2.7	376	8.4	313	7.1	240	6.1	238	5.9	210	5.5	218	5.9
40-44	259	2.8	305	3.3	327	7.3	335	7.6	247	6.3	242	6.0	207	5.4	197	5.3
45-49	406	4.4	357	3.9	305	6.8	279	6.3	227	5.8	271	6.7	194	5.1	187	5.0
50-54	352	3.8	349	3.8	282	6.3	292	6.6	234	6.0	229	5.7	203	5.3	215	5.8
55-59	336	3.7	308	3.4	251	5.6	290	6.6	230	5.8	214	5.3	234	6.1	209	5.6
60-64	292	3.2	285	3.1	250	5.6	230	5.2	205	5.2	213	5.2	214	5.6	214	5.7
65-69	240	2.6	288	3.1	217	4.8	208	4.7	208	5.3	222	5.5	206	5.4	229	6.1
70-74	213	2.3	210	2.3	177	4.0	190	4.3	138	3.5	180	4.5	160	4.2	184	4.9
75-79	153	1.7	157	1.7	126	2.8	151	3.4	131	3.3	156	4.0	120	3.1	122	3.3
80-84	107	1.2	128	1.4	59	1.3	121	2.7	70	2.0	109	2.7	46	1.2	90	2.4
85+	53	0.6	97	1.1	46	1.0	97	2.2	43	1.1	92	2.3	41	1.1	39	1.0
Total	**4,638**	**50.5**	**4,538**	**49.5**	**4,479**	**50.3**	**4,424**	**49.7**	**3,945**	**49.5**	**4,031**	**50.5**	**3,821**	**50.6**	**3,730**	**49.4**

SOURCE: 1980, 1990, 2000 & 2010 Census, U.S. Census Bureau

Table 2.7 shows the median age of the population of Maries County for 1970 through 2010. In 1970 the average age of the population was 34.6. Since 1980 the average age of the population has increased steadily by 8.2-years to 42.8 years of age, a significant jump in a 40 year period. This can likely be attributed to younger people migrating out of the county for jobs.

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

1970			1980			1990			2000			2010		
Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
34.2	**35.0**	**34.6**	**33.2**	**36.1**	**34.6**	**35**	**38.1**	**36.6**	**37.5**	**39.8**	**38.5**	**41.7**	**43.5**	**42.8**

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

Table 2.8 compares the family income of Maries County residents with the rest of the Meramec Region, State of Missouri and United States. This table shows that Maries 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 Maries 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
Maries County	320 8.9 %	231 6.4%	256 7.1%	413 11.4%	167 4.6%	185 5.1%	2,043 56.5%
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%	41,958 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 and U.S. Census of Population 1980-2010 Census Bureau, U.S. Department of Commerce

Table 2.9 compares Maries County's median income with the rest of the Meramec Region, State of Missouri and nation. Maries 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 Maries County Median Income Comparison

Location	Median Family Income	Percent of U.S. Median	Persons in Poverty	Percent in Poverty
Maries County	$48,504	77.0	1,259	13.9
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 and U.S. Census of Population 1980-2000 Census Bureau, U.S. Department of Commerce

Table 2.10 shows the educational attainment of Maries County residents – both the number and percentage of the population of 6,205 25-years of age and older. As demonstrated by the table, 36.4 percent of the population has some education beyond high school, with 5.9 percent holding an associate degree, 8.9 percent holding a bachelor's degree and 5.3 percent with graduate or professional degrees. In Maries County, 20.4 percent of the population has not attained a high school diploma which is high as compared to the percentage for Missouri of 13.9 percent and for the Meramec region of 18.4 percent.

Table 2.10 Maries County General Education Attainment (2010)

Education Attainment	Elementary - High School No Diploma	High School Diploma	Some College No Degree	Associate Degree	Bachelor's Degree	Graduate or Professional Degree
Number of Population	1,268	2,676	1,011	367	555	328
Percent of Population	20.4	43.1	16.3	5.9	8.9	5.3

Source: 2006 – 2010 American Community Survey 5 year estimates and 1990 and 2000 Census, U.S. Census Bureau

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, in 2010 Maries County's civilian labor force increased by 41.8 percent from 1980. The unemployed person percentage was the same in 1980 as in 2010. However, in the two decades between it dropped to 5.7 percent in 1990 and 3.6 percent in 2000. The female civilian labor force percentage of unemployed dropped from 11.7 percent in 1980 to 3.8 percent in 1990, 3.6 percent in 2000 and then bumped back up to 6.4 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, Maries County had an unemployment rate of 8.9 percent, two tenths lower than the region's rate of 9.1 percent and 1.5 percent higher than the state average unemployment rate. Since 1980 Maries County has experienced unemployment rates between 3.5 and 9 percent. Since 1990, the unemployment rate for females has been consistently lower than that for males in the county.

Table 2.11 Maries County Labor Force

2010	Total	Male	Female
Persons 16 years & Older	7,273	3,595	3,678
Total Labor Force	4,552	2,452	2,100
Civilian Labor Force (CLF)	4,534	2,434	2,100
Persons Employed	4,132	2,166	1,966
Persons Unemployed	402	268	134
% Unemployed CLF	8.9%	11%	6.4%
Persons not in Labor Force	2,721	1,143	1,578
2000	**Total**	**Male**	**Female**
Persons 16 years & Older	6,892	3,390	3,502
Total Labor Force	4,290	2,369	1,921
Civilian Labor Force (CLF)	4,280	2,359	1,921
Persons Employed	4,126	2,273	1,853
Persons Unemployed	154	86	68
% Unemployed CLF	3.6%	3.6%	3.5%
Persons not in Labor Force	2,602	1,021	1,581
1990	**Total**	**Male**	**Female**
Persons 16 years & Older	6,141	3,011	3,170
Total Labor Force	3,648	2,069	1,579
Civilian Labor Force (CLF)	3,624	2,045	1,579
Persons Employed	3,418	1,899	1,519
Persons Unemployed	206	146	60
% Unemployed CLF	5.7%	7.1%	3.8%
Persons not in Labor Force	2,533	942	1,591
1980	**Total**	**Male**	**Female**
Persons 16 years & Older	5,743	2,891	2,852
Total Labor Force	3,205	1,911	1,294
Civilian Labor Force (CLF)	3,197	1,903	1,294
Persons Employed	2,914	1,771	1,143
Persons Unemployed	283	132	151
% Unemployed CLF	8.9%	6.9%	11.7%
Persons not in Labor Force	2,538	980	1,558

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

SOURCE: 1980-2000 census of Population

2.1.5 Schools/Vocational/Technological Schools/Colleges/Universities

Maries County has two public school districts and one parochial school. There are no colleges located within the county. The school districts and the size of the student population are identified in Table 2.12.

Table 2.12 Maries County School Districts and Student Enrollment 2012

School District	Maries County R-I	Maries County R-II	Visitation Inter-Parish School (Parochial)
Student Enrollment	536	835	45

Source: Missouri Department of Elementary and Secondary Education website www.dese.mo.gov
Source: http://www.vi-ps.org

Maries County R-I has two facilities: Vienna Elementary School and Vienna High School. Both schools are co-located on the same campus at 300 Fourth Street, Vienna, Missouri.

Maries County R-II has three facilities: Belle Elementary School located at 402 West Third, Belle, Missouri; Maries County Middle School located at 300 South Main, Bland, Missouri; and Belle High School located adjacent to the elementary school at 504 West Third, Belle, Missouri.

Visitation Inter-Parish School, a Roman Catholic parochial school, has one facility located at 105 North Coffey Street, Vienna, Missouri and is associated with Visitation Catholic Church. The school offers classes for kindergarten through eighth grade.

2.1.6 Business/Industry

The major private employers located in Maries County are Kingsford Charcoal Products near Belle with 124 employees and Maries Manor Nursing Home with 63 employees in Vienna. Large public employers in the county include Maries County schools with 132 employees, and Maries County government with 60 employees.

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

Category	Number
Total Employed:	4,132
Agriculture, forestry, fishing and hunting, mining:	347
Construction	373
Manufacturing	688
Wholesale trade	129
Retail trade	390
Transportation and warehousing, and Utilities	247
Information	58
Finance, insurance, real estate and rental and leasing:	232
Professional, scientific, management, administrative and waste management services:	179
Educational services, and health care, and social assistance:	736
Arts, entertainment, recreation, accommodation and food services:	175
Other services, except public administration	252
Public administration	326

Source: 2010 American Community Survey

According to the 2007 Census of Retail Trade, conducted by the U.S. Department of Commerce, there are 26 retail trade establishments in Maries County, with annual combined sales of $46,261,000.[xix]

2.1.7 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, Maries County had 892 farms with an average farm size of 267 acres. Five years later in the 2002 Census of Agriculture, the number of farms had dropped to 883 and the average farm size had decreased to 265 acres. In 2007 the number of farms increased to 898 but the average farm size increased to 268 acres.[xx] 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, Maries County's market value of agricultural sales was $26,061,000. The average market value of agricultural products sold per farm was $29,021, the second highest in the region and well above the regional average of $24,256.

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 Maries County.

Table 2.14 Timber Resources of Maries County

Category	Total	Softwoods	Hardwoods
All Live Trees on Timberland (in cubic feet)	162,819,606	5,704,608	139,425,231
Net Volume of Growing-Stock on Timberland (in cubic feet)	131,186,903	15,750,233	115,436,670
Average Annual Mortality of Growing-Stock on Timberland(in cubic feet)	2,137,007	577,597	1,559,410
Average Annual Harvest Removals of Growing-Stock Trees on Timberland (in cubic feet)	1,234,439	205,000	1,029,439

Source: 2012 Forest Inventory, http://apps.fs.fed.us/fia/fido/customrpt/app.html#display-output

2.1.8 Environmentally Sensitive Areas

The location and characteristics of natural areas need to be included when considering hazard mitigation projects. Environmentally sensitive areas exist in Maries 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.[xxi]

The Missouri Department of Conservation maintains several public use and conservation areas in the county. There are six acres and a boat ramp at the Bell Chute Access on the Gasconade River; 256 acres in Clifty Creek CA with an additional 230 acres adjacent in Clifty Creek Natural Area; 11.8 acres and an old fire tower in the Freeburg Towersite; 4.6 acres and a boat ramp on the Gasconade River at the Paydown River Access; 285.96 acres and a 29 acre lake at Rinquelin Trail Lake CA; and 1,819.12 acres at Spring Creek Gap CA. Figure 2.5 is a map of conservation areas located in Maries County. The Gasconade River is a popular recreational destination, especially during summer weekends.

Table 2.15 provides a summary of public use areas and conservation areas located in Maries County.

Table 2.15 Summary of Public Use Areas and Conservation Areas

County	Area
Maries	Bell Chute River Access Clifty Creek Conservation Area Clifty Creek Natural Area Freeburg Towersite Paydown River Access Rinquelin Trail Lake Conservation Area Spring Creek Gap Conservation Area

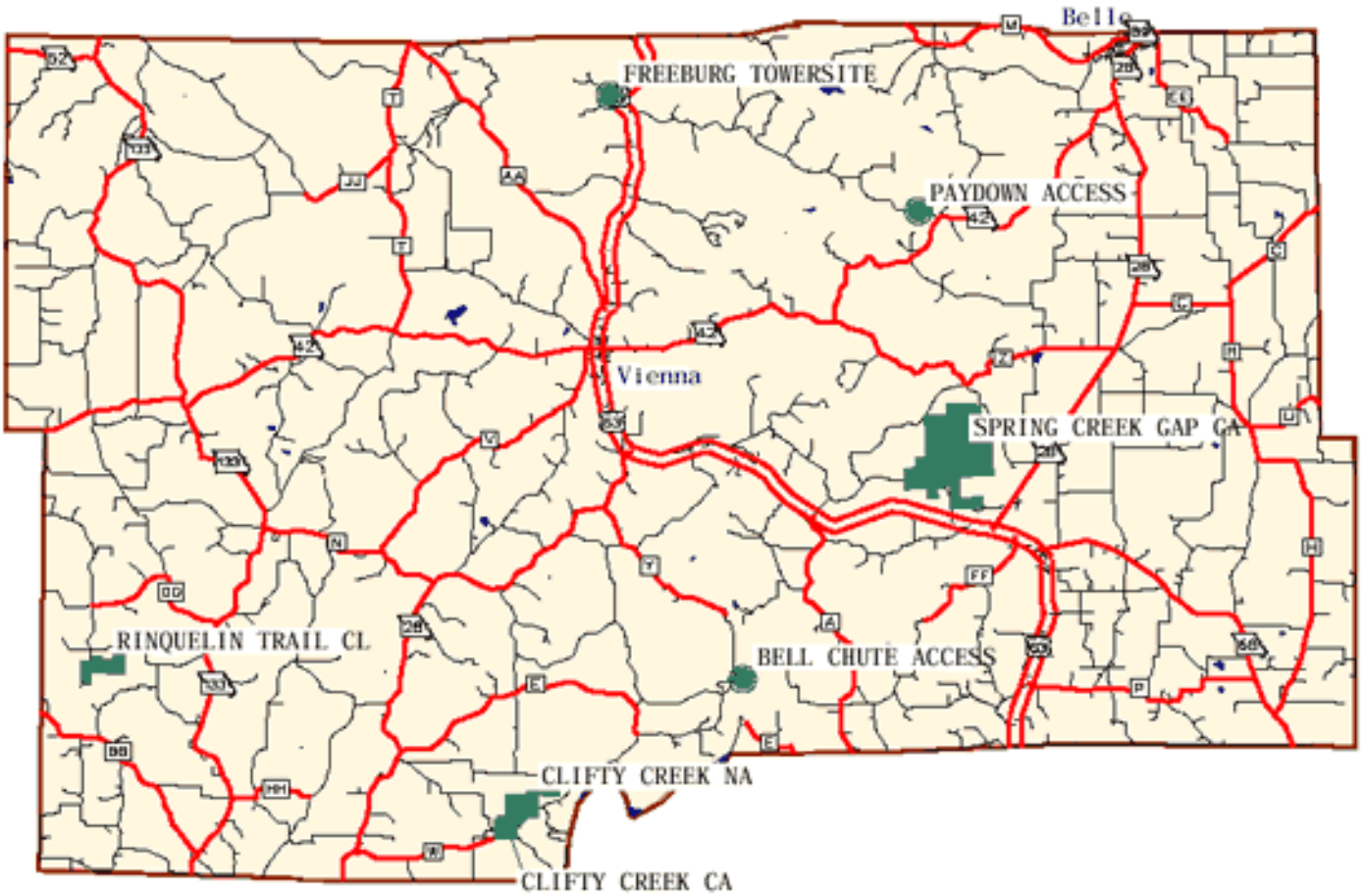
Source: Missouri Department of Conservation Atlas, 2003

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

Maries County is home to four natural springs that are large enough to have had flow studies done by the Missouri Department of Natural Resources: Davis Spring, Little Gaines Ford Spring, Nagogami Spring and Paydown Spring all are located in the Gasconade River Basin.

- Davis Spring, 26,000 gpd
- Little Gaines Ford Spring, 19,000 gpd
- Nagogami Spring, 3,880,000 gpd
- Paydown Spring, 11,900,000 gpd

Figure 2.5 Missouri Department of Conservation Lands in Maries County



Source: Missouri Department of Conservation, 2003.

2.1.9 Endangered Species and Species of Concern

According to the Missouri Department of Conservation, several of Missouri's imperiled or critically imperiled species are found in Maries County. These include four species of mussels – the Black Sandshell, Ebonyshell, Elephantear, Elktoe, Pink Mucket, Scaleshell and Spectaclecase mussels that are found in the county's streams and rivers. Also occupying the county's streams are four species of fish that are listed as either imperiled or critically imperiled - the Alabama Shad, Crystal Darter, Highfin Carpsucker and Niangua Darter. The Eastern Hellbender, a large salamander found in Ozark streams is also considered critically imperiled in the state. There are two insects on the list – the Frison's Seratellan Mayfly and the Ozark Stone – a species of stonefly. Running Buffalo Clover is a plant that is listed as endangered on both the state and federal lists.

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 Maries County

Maries County

Overview

The jurisdiction of Maries County includes all unincorporated areas within the county boundaries. Maries 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.

Maries 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.

Maries County has staff resources in floodplain management and emergency management. The county has an emergency management director who is appointed by the county commission. The EMD also serves as the floodplain coordinator. The county has a 9-1-1 center located in the Sheriff's Office at Central Communications Center that is located at 211 Fourth Street, Vienna, MO 65582. Table 2.16 outlines Maries County's personnel resources in 2009.

Table 2.16 Maries County Administrative and Technical Resources

Personnel Resources	Department/Position	Comments
Floodplain Coordinator	Meramec Regional Planning Commission	Contracted by County Commission
Emergency Management Director	Office of Emergency Management	Appointed by County Commission

There are four fire protection districts located in the county. All are made up of volunteers. Those departments include Dixon Rural Fire Protection District – Brinktown Station; Vichy Volunteer Fire Protection Association, Vienna Fire Protection District, and Belle Volunteer Fire Department.

The county is served by the Ozark Central Ambulance District located in Belle and the Maries/Osage Ambulance District located in Vienna.

Existing Plans and Policies

Maries County participates in the National Flood Insurance Program. The county does have a flood plain ordinance. The county commission contracts with the Meramec Regional Planning Commission to provide floodplain administration services. Construction occurring in the floodplain in unincorporated areas of the county is required to obtain a permit from the County and all new construction is required to meet the minimum flood-proofing standards outlined in the county floodplain ordinance. Maries 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.

Other Mitigation Activities

The County Emergency Management Director, local fire departments, Sheriff's Department and the Maries County Health Department periodically conduct public education campaigns to raise awareness on hazards 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, the Meramec Regional Emergency Planning Committee, Region I Homeland Security Oversight Committee and emergency response agencies on joint drills and trainings. The county has two mobile generators that can be used throughout the county. The county courthouse has backup generator power available. Storm spotter training is held regularly in the county. The County joined the NFIP in 1987 and now regulates floodplain development in unincorporated areas.

2.2.2 Cities

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

City of Belle

Overview

Belle is located at the junction of Highways 28 and 89 in the northeast corner of Maries County. Part of the city is located in Osage County and Part is located in Maries County. The city has

been included in the Maries County Hazard Mitigation Plan. The community was incorporated in 1904. According to the 2010 U.S. Census, Belle is the largest city in the county with a population of 1,545. Belle is a fourth-class city with a four member board of aldermen and a mayor. City personnel include a city clerk/collector, city treasurer, court clerk, municipal court judge/city attorney, police chief, fire chief and two public works employees.

Technical and Fiscal Resources

Belle does not participate in the National Flood Insurance Program and does not have a Flood Insurance Study. Law enforcement for Belle is provided by the city police chief. The city has one warning siren. The warning siren is controlled by the Osage County Emergency Operations Center and Belle Fire Department.

Belle is served by the county 9-1-1 center located in Vienna and the Osage County 9-1-1 Center located in Linn. The Ozark Central Ambulance District provides ambulance service for Belle. The Belle Volunteer Fire Department provides fire protection.

Belle does have building codes which the city enforces by requiring building permits and inspections for new builds as well as renovations. The city employs a non-certified inspector to carry out inspections and the board of aldermen enforces the codes. In addition the city requires site plan review.

The city does have both a zoning ordinance and a storm water ordinance in place which is enforced by the public works department.

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

Existing Plans and Policies

Belle's Fire Department has an ISO rating of seven inside the city limits and ten outside of the city limits. The city has an Emergency Operations Plan on file and is also included in the county LEOP. The city also has both a capital improvements plan, and infrastructure plan in place.

Other Mitigation Activities

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

City of Vienna

Overview

Vienna is the county seat for Maries County and is located at the junction of Highways 63 and 42 in the center of the county. According to the 2010 Census, the community has a population of 610. Vienna, a fourth-class city, has four aldermen and a mayor to make decisions regarding city issues.

Technical and Fiscal Resources

Vienna is a member of the National Flood Insurance Program. The only portion of the city that lies within the floodplain is the northwest corner that includes the city's lagoons. There is no other development in the area nor plans to develop the designated floodplain. Vienna does not have a Flood Plain Ordinance, Flood Plain Manager nor a Flood Insurance Study. Elevation Certificates are not maintained. Vienna has a police chief and one additional full time officer as well as two part time officers who provide law enforcement for the city. The city's volunteer fire department provides fire protection for the community and surrounding area. The Central Communications Center (9-1-1) is located in the courthouse at 211 Fourth Street, Vienna, MO. The Ozark Central Ambulance District is located in Vienna and covers the city and surrounding areas of the county.

The city of Vienna does not have building codes nor planning and zoning. The city does not require building permits, inspections nor review of site plans, but does have a building ordinance that gives city officials the right to inspect buildings. When necessary the mayor can appoint a building inspector. The building ordinance is enforced by the city council.

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 and sewer, 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

Vienna is part of the county local emergency operations plan. The volunteer fire department has an ISO rating of five within the city limits and nine for areas outside a five mile radius of Vienna.

Other Mitigation Activities

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

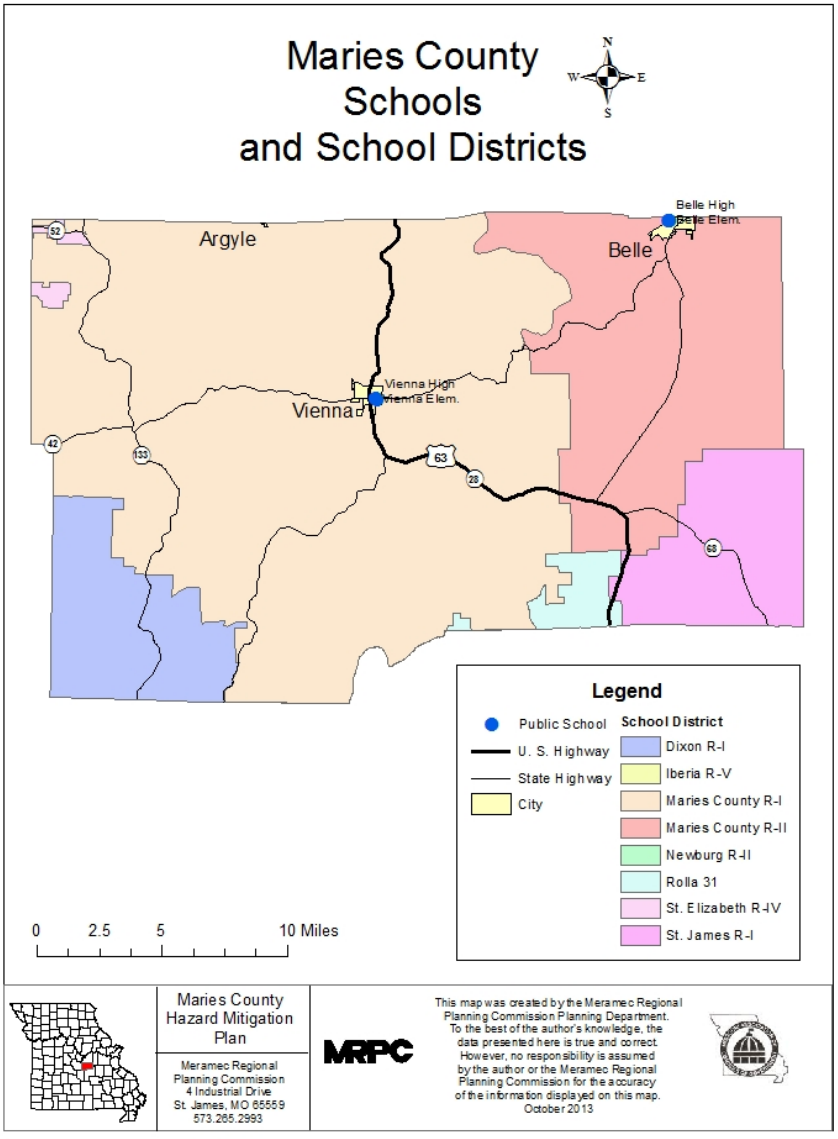
Table 2-17 Maries County & Participating Cities Summary of Mitigation Capabilities

Capability	Maries County	Belle	Vienna
Emergency Operations Plan	Y	Y	Y
Building Code/Year	N	Y	N
Fire Department ISO Rating	N/A	7/10	5/9
Floodplain Management Ordinance	Y	N	N
Zoning Ordinance	N	Y	N
Site Plan Review Requirements	N	Y	N
National Flood Insurance Program	Y	N	Y
Economic Development Plan/Policy	N	N	N
Storm Water Management Ordinance	N	Y	N
Flood Insurance Study	N	N	N
Elevations Certificates Maintained	N	N	N

2.2.3 School Districts

The following school districts are participating jurisdictions in this plan: Maries County R-I and Maries County R-II. As public institutions responsible for the care and education of the county's children, these school districts share an interest with Maries County in public safety and hazard mitigation planning. Figure 2-6 provides the boundaries of the school districts. The county has portions of seven school districts, but the majority of the county is served by Maries County R-I and R-II school districts. These two districts are the only schools with physical facilities located in the county.

Figure 2-6



Technical and Fiscal Resources

The school districts in Maries 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 public address systems capable of providing specific instructions in the event of an emergency. Both districts 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. Maries County R-I has a NOAA weather radio. Both school districts use internet to monitor weather.

Neither of the school districts have dedicated grant writers on staff. Existing staff work on grants when necessary. Generally 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

Both school districts in the county have crisis management plans in place.

Other Mitigation Activities

All schools participating in the plan conduct regular fire, earthquake and tornado drills on a monthly, quarterly or yearly 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 2012-13 Enrollment

Maries County R-I	2011-12 Enrollment – Total: 744
Vienna Elementary School (K-6)	266
Vienna High School	270
Maries County R-II	2011-12 Enrollment – Total: 2,376
Belle Elementary School (K-4)	356
Maries County Middle School (5-8)	253
Belle High School (9-12)	226

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

2.2.4 Colleges/Universities

There are currently no college or university campuses or branches located in Maries County.

[i] *Gazetteer of Missouri,* page 348

[ii] *Soil Survey of Maries County, Missouri,* publication of the United States Department of Agriculture, Natural Resources Conservation Service

[iii] U.S. Geological Survey Fact Sheet FS-027-96

[iv] Missouri Watershed Inventory and Assessment, Missouri Department of Conservation, http://mdc.mo.gov
[v] Ibid
[vi] Ibid
[vii] Ibid
[viii] Ibid
[ix] Ibid
[x] Ibid
[xi] Ibid
[xii] Ibid
[xiii] Ibid
[xiv] Ibid
[xv] http://geology.about.com/library/bl/maps/blmissourimap.htm.
[xvi] http://members.socket.net/~joschaper/ordo.html. *Ordovician Period*
[xvii] *Soil Survey of Maries County, Missouri,* publication of the United States Department of Agriculture, Natural Resources Conservation Service
[xviii] http://www.average-temperature.com/temps/MO/Rolla
[xix] 2002 Census of Retail Trade – U.S. Department of Commerce- census.gov/prod/ec02/ec0244amott
[xx] 1997 & 2002 Census of Agriculture, USDA, National Agriculture Statistics Service
[xxi] U.S. Geological Survey Fact Sheet FS-027-96

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 Maries County from hazard events, including loss of life, personal injury, property damage and economic losses. The risk assessment process provides an opportunity for the county and the jurisdictions within the county to better understand their potential risks from natural hazards and to better prepare for those potential events through mitigation planning.

The risk assessment for Maries County and its jurisdictions followed the methodology described in the FEMA publication Local Mitigation Planning Handbook (March 2013). This methodology includes the following steps:

- Describe the hazards
- Identify the community assets
- Analyze risks
- Summarize vulnerability

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. Maries County is uniform in terms of climate and topography as well as construction characteristics and development trends. Therefore, 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 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. In Section 3.2, under each hazard description, the section titled :Likely Location" discusses how some hazards vary between 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. 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, as determined by the Hazard Mitigation Planning Committee (HMPC).

3.1 Identification of Hazards Affecting Maries 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

The 2013 State Mitigation Plan provided the following list of potential hazards for consideration in the hazard mitigation planning process:

- Flooding (River and Flash)
- Dam Failure
- Levee Failure
- Drought
- Earthquake
- Extreme Temperatures
- Severe Thunderstorm (Damaging Winds, Hail and Lightening)
- Land Subsidence/Sinkholes
- Severe Winter Weather (Snow and Ice)
- Tornadoes
- Fires (Structural, Urban and Wild)

The following hazard were included in the Maries plan approved on August 22, 2006.

- Tornadoes/Severe Thunderstorms
- Riverine Floods
- Severe Winter Weather
- Drought
- Heat Wave
- Earthquakes
- Dam Failure
- Wildfires

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

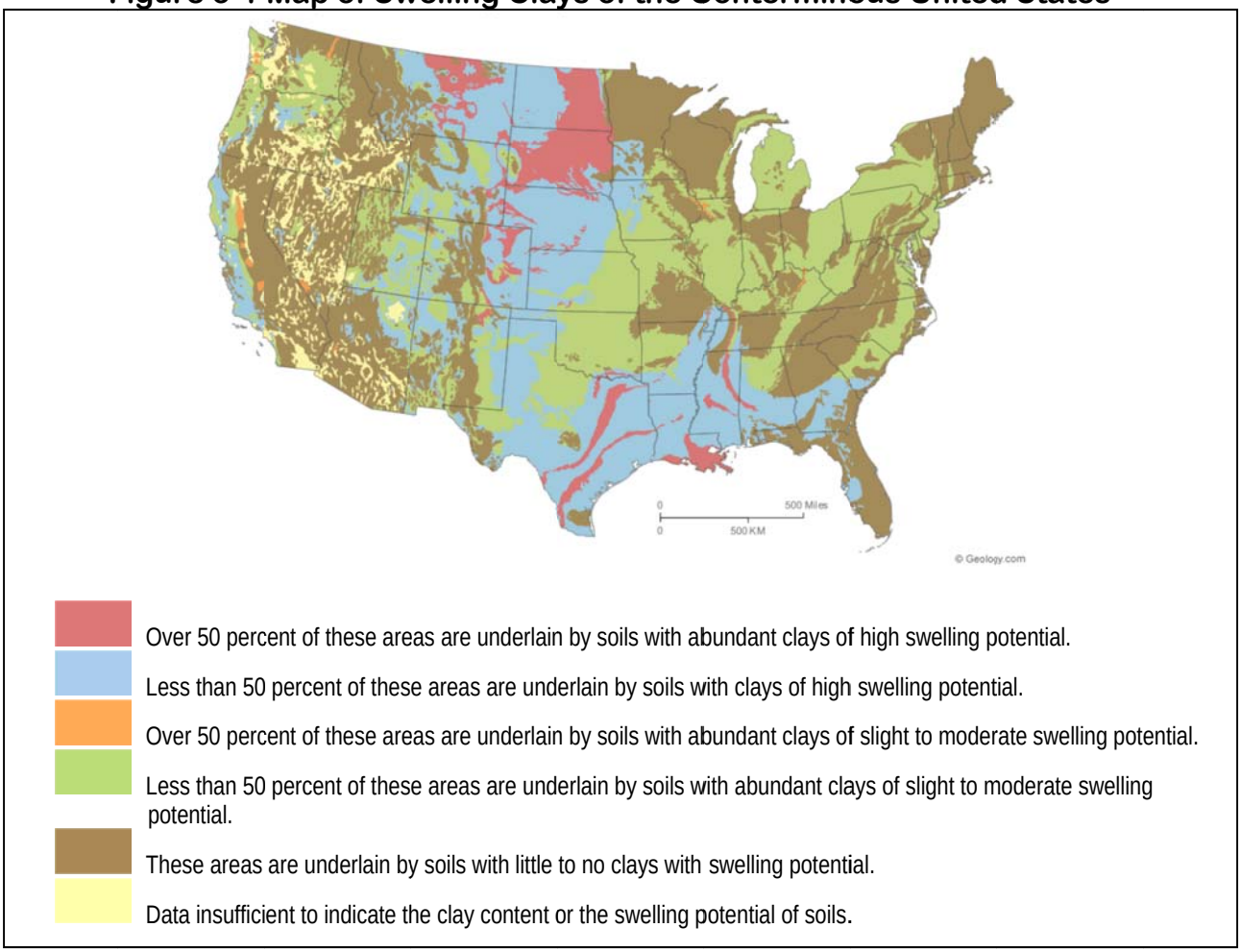
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Land Subsidence/Sinkholes
- Severe Thunderstorm (Hailstorm/Windstorm)/
- Tornadoes
- Severe Winter Weather
- Wildfire

In determining which hazards to include in the Maries County Plan Update, the HMPC decided to maintain the format of the previously approved plan. This format included extreme cold within the category of Winter Weather, while profiling Extreme Heat separately. 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
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. As can be seen in Figure 3-1, maries County is comprised of soils with little to no clays with swelling potential.
Levee Failure	Planning research revealed no Corps of Engineer regulated levees in the planning area. If there are any privately owned levees in Maries Co., they could not be identified. It is likely that levees in maries County are low-head agricultural levees, the breach of which would cause minimal damage. 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.

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



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

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

- 2010 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 (NCDC)
- 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 Maries County HMPC identified ten 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. Technical and man-made hazards are not included in the plan due to limited resources and time limitations and the fact that technical/man-made hazards are addressed in other emergency operations plans.

Table 3.2 Hazards Identified for Maries County Plan and Affected Jurisdictions

Hazard	Maries County	Belle	Vienna	Maries Co. R-I	Maries Co. R-II
Dam Failure	X		X		
Drought	X	X	X	X	X
Earthquake	X	X	X	X	X
Extreme Heat	X	X	X	X	X
Flood	X		X		
Severe Thunderstorms-Hail/Wind	X	X	X	X	X
Tornado	X	X	X	X	X
Severe Winter Weather	X	X	X	X	X
Land Subsidence/ Sinkholes	X				
Wildfire	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 Maries 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 63 federally declared disasters since 1957. Of those, 33 have occurred between 2000 and 2013. 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 Maries County from 2000 through 2013.

Table 3.3 Disaster Declaration History of Maries County 2000-2013

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
4144	9/6/2013	Severe Storms, Straight-line Winds and Flooding	Public Assistance	Barry, Camden, Cedar, Dade, Dallas, Laclede, Maries, McDonald, Miller, Osage, Ozark, Phelps, Pulaski, Shannon, Taney, Texas, Webster, Wright
4130	7/18/2013	Severe Storms, Straight-line Winds, Tornadoes and Flooding	Public Assistance	Barton, Callaway, Cape Girardeau, Chariton, Clark, Howard, Iron, Knox, Lewis, Lincoln, Maries, Marion, Miller, Montgomery, Osage, Perry, Pike, Putnam, Ralls, Saint Charles, Saint Louis, Sainte Genevieve, Scotland, Shelby, Stoddard, Sullivan, Texas, Webster
1961	3/23/2011	Winter Storm	Public Assistance	Adair, Andrew, Audrain, Barton, Bates, Benton, Boone, Caldwell, Callaway, Carroll, Cass, Cedar, Chariton, Clark, Clinton, Cole, Cooper, Dade, Dallas, DeKalb, Grundy, Henry, Hickory, Howard, Johnson, Knox, Laclede, Lafayette, Lewis, Linn, Livingston, Macon, Madison, Maries, Marion, McDonald, Miller, Moniteau, Monroe, Montgomery, Morgan, Newton, Osage, Pettis, Platte, Polk, Pulaski, Putnam,

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
				Ralls, Randolph, Ray, St. Clair, Saline, Schuyler, Scotland, Shelby, Sullivan, Vernon and Worth
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, 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 County, Sainte Genevieve, Saline, Schuyler, Scotland, Scott, Shannon, Shelby, Stoddard, Stone, Sullivan, Taney, Texas, Vernon, Warren, Washington, Wayne, Webster, Worth, Wright
1847	6/26/2009	Severe Storms, Tornados and Flooding	Public Assistance	Adair, Barton, Bollinger, Camden, Cape Girardeau, Cedar, Crawford, Dade, Dallas, Dent, Douglas, Greene, Hickory, Howell, Iron, Jasper, Knox, Laclede, Lewis, Madison, Maries, Marion, Miller, Newton, Oregon, Ozark, Perry, Osage, Polk, Pulaski, Ray, Reynolds, Ripley, St. Francois, Ste. Genevieve, Saline, Shannon, Shelby, Stone, Sullivan, Texas, Vernon, Washington, Wayne, Webster, and Wright
3303	1/30/2009	Severe Winter Storm	Public Assistance	All 114 Missouri counties
1809	11/13/2008	Severe Storms, Flooding and a Tornado	Individual and Public Assistance	Adair, Audrain, Barry, Bollinger, Boone, Butler, Callaway, Cape Girardeau, Carter, Chariton, Christian, Clark,

Declaration Number	Declaration Date	Disaster Description	Type of Assistance Received	Counties Included in Disaster Declaration
				Crawford, Dent, Douglas, Dunklin, Howard, Howell, Jefferson, Knox, Lewis, Lincoln, Linn, Madison, Maries, Marion, Miller, Mississippi, Montgomery, New Madrid, Oregon, Osage, Ozark, Perry, Ralls, Randolph, Ray, Reynolds, Ripley, Schuyler, Scotland, Scott, Shannon, Shelby, St. Genevieve, St. Charles, St. Louis, Stoddard, Stone, Sullivan, Taney, Texas, Wayne, Webster and Wright Counties, and the Independent City of St. Louis.
1749	3/19/2008	Severe Storms and Flooding	Individual and Public Assistance	Audrain, Barry, Barton, Boone, Bollinger, Butler, Callaway, Camden, Cape Girardeau, Carter, Cedar, Christian, Cole, Cooper, Crawford, Dade, Dallas, Dent, Douglas, Dunklin, Franklin, Gasconade, Greene, Hickory, Howard, Howell, Iron, Jasper, Jefferson, Laclede, Lawrence, Lincoln, Madison, Maries, McDonald, Miller, Mississippi, Montgomery, Moniteau, Morgan, New Madrid, Newton, Oregon, Osage, Ozark, Pemiscot, Perry, Pike, Polk, Pulaski, Reynolds, Ripley, St. Charles, St. Clair, St. Francois, St. Louis, Ste. Genevieve, Shannon, Scott, Stoddard, Stone, Taney, Texas, Vernon, Warren, Washington, Wayne, Webster, and Wright Counties and the Independent City of St. Louis
1742	2/5/2008	Severe Storms, Tornadoes and Flooding	Public Assistance	Barry, Dallas, Laclede, Maries, McDonald, Newton, Phelps, Stone, Webster
3281	12/12/2007	Severe Winter Storms	Public Assistance	All Missouri counties
1676	1/15/2007	Winter Storms and Flooding	Public Assistance	Barry, Barton, Callaway, Camden , Christian, Cole, Crawford, Dade, Dallas, Dent, Franklin , Gasconade, Greene, Hickory , Jasper, Laclede, Lawrence , Lincoln , Maries, McDonald, Miller, Montgomery , Newton , Osage, Polk, Pulaski, St. Charles , St. Clair, St. Louis, Stone, Warren , Webster, Wright, and the independent City of St. Louis
3232	9/10/2005	Hurricane Katrina	Evacuation Support	All Missouri counties

Source: Missouri State Emergency Management Agency, www.sema.dps.mo.gov

Although the county has been included in 12 federal disaster declarations since 2005, the mitigation goals, objectives and priorities have not changed. The county has always experienced weather related damages and there has been little to no change in growth patterns and development in Maries County since 2006.

3.2 Profile of Hazards Affecting Maries 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

The HMPC reviewed the format of the previously approved mitigation plan, and determined that some rearrangement was warranted by new FEMA mitigation planning guidance. Each hazard that has been determined to be a potential risk to Maries 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 Maries County. This process will increase the county's ability to assess and prioritize hazards and mitigation strategies.

Each hazard profile includes:

- Description and general characteristics of the hazard
- Hazard history in the planning area, including the frequency and amount of damage in the past. This information will be used as a basis for the probability of events in the future.
- Information on the geographic location of hazards (if applicable)
- Warning time and duration
- Based on past events, discussion of Probable Risk of future occurrences
- Discussion of magnitude/severity of the hazard
- Recommendations for mitigating the damages of the hazard

In order to maintain consistency and incorporate multiple factors into the ranking process, the HMPC prioritized the hazards based on a calculated priority risk index (CPRI). The CPRI evaluates four elements of risk: probability (based on previous events), 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 – 25-49 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)
- One week or less (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™:

(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 done in the Missouri Hazard Mitigation Plan. Based on the data available and the ranking process provided in the 2010 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 (2010) and Missouri Hazard Analysis (2008).

Table 3.4 summarizes the results of the CPRI exercise for the planning area as a whole.

Table 3.4 Maries County Hazard Profile Summary

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Dam Failure	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						
County:	4	1	4	3	3.0	High
Cities & Schools	4	1	4	2	2.9	High
Land Subsidence/ Sinkholes	1	1	4	3	1.45	Low
Severe Thunderstorm (Hail Storm/Wind storm)	4	1	4	1	3	High
Tornado	1	2	4	1	1.75	Low
Severe Winter Weather	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: Maries 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 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 thunderstorm (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 notable 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 in 1977 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, Maries 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 widely publicized dam failure in recent years was the failure of the Taum Sauk Hydroelectric Power Plant Reservoir atop Profitt Mountain in Reynolds County, Missouri.

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 Profitt 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.

The significance of the damage done by the Taum Sauk Reservoir dam failure 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 many need to be rehabilitated, lack of available funding and often questions of ownership are 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. **Overtopping** - inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
2. **Piping:** internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
3. **Erosion:** inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
4. **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 Maries 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]

The Missouri Department of Natural Resources (MDNR), maintains records on 5,243 dams in the state. This includes all regulated and unregulated dams . The 2013 Missouri State Hazard Mitigation Plan states that Missouri has 682 state-regulated dams, of which 460 are considered High Hazard 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 5,243, only 682 fall under state regulations, while another 64 dams are under federal control.

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.[vii]

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.

Hazard Event History

As stated in the Missouri State Hazard Mitigation Plan (MSHMP), according to Stanford University's National Performance of Dams Program, there have been 82 incidents involving dams in Missouri since 1975. Of the 82 incidents listed, 17 (21 percent) were considered dam failures. None of the incidents occurred in Maries County.

Likely Locations

According to the Missouri Spatial Data Information Services (MSDIS), based on information from the MDNR Water Resources Center (WRC), there are a total of 30 dams located in Maries County. The majority are privately owned. Of those 30 dams, a total of six are rated as high hazard risk dams. The National Inventory of Dams, maintained by the U.S. Army Corps of Engineers, shows the same six as high hazard risk.

Of most concern would be those dams that are 35 feet or more in height. There are three dams in the county that are at least 35 feet in height and are regulated by the state. All three of those dams of 35 feet or more in height are rated as high hazard risk dams – Dudenhoeffer Dam, Lake Maxwell Dam, and Rinquelin Trail Dam. In addition, three additional dams that are not regulated by the state that are rated as High Hazard: Bowman Lake Dam, Danube Corporation Lower Dam, and Murphey Lake Dam. The remaining 24 dams are considered low risk. All of the dams registered with the 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 Maries County that shows high hazard dams and also categorizes the dams by dam height.

Table 3.5 shows a listing of dams in Maries County, dam height, drainage area, lake area and their hazard risk. Based on the locations of the dams in Maries County, and in particular the high hazard dams, the jurisdictions most vulnerable to dam failure are the cities of Vienna and portions of Maries 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.

Figure 3-2

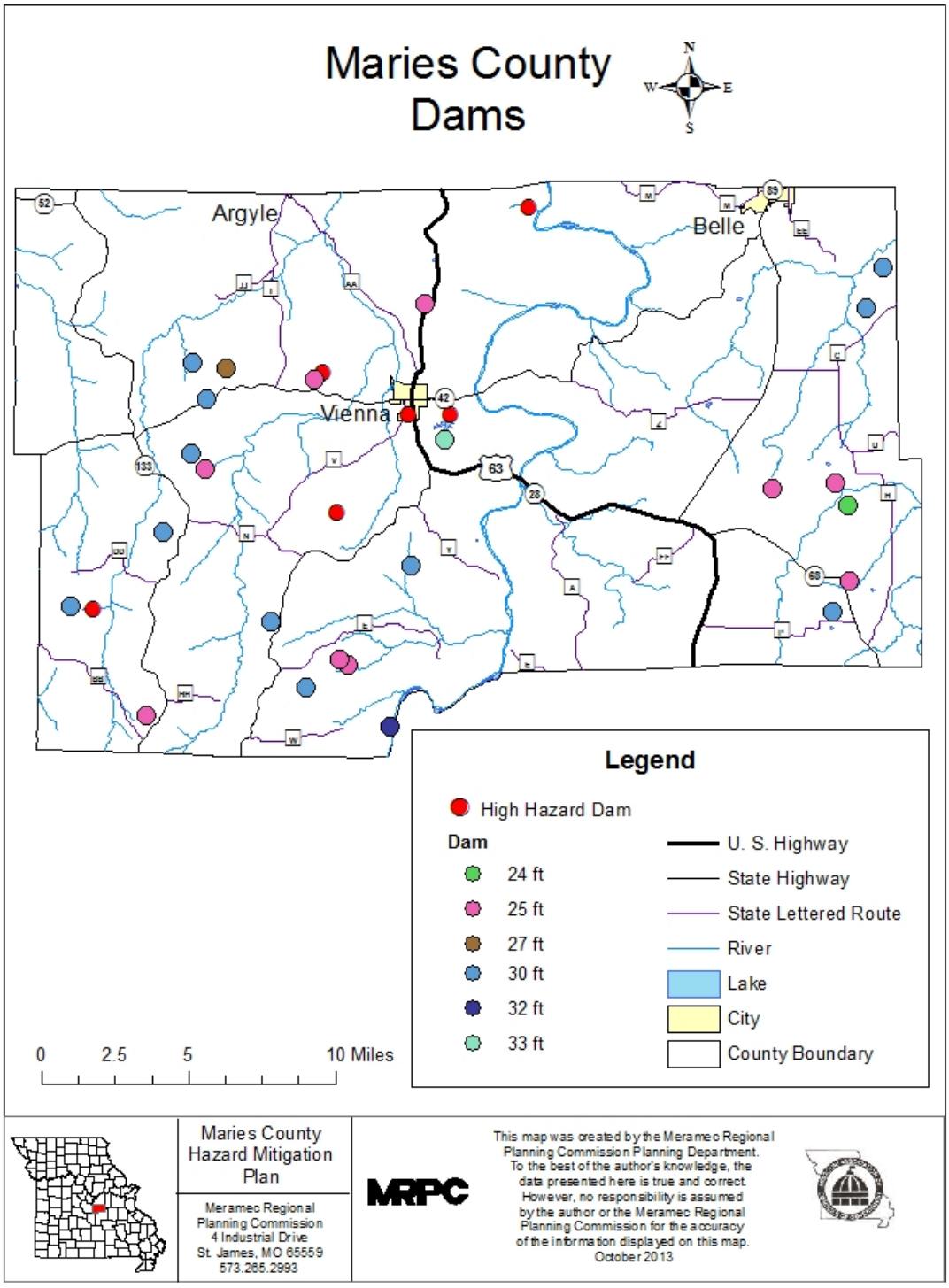

Maries County Dams
N
W
E
S
Argyle
Belle
Vienna
52
42
63
28
133
68
89
Legend
High Hazard Dam
Dam
24 ft
25 ft
27 ft
30 ft
32 ft
33 ft
U. S. Highway
State Highway
State Lettered Route
River
Lake
City
County Boundary
0
2.5
5
10 Miles
Maries County Hazard Mitigation Plan
Meramec Regional Planning Commission
4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
This map was created by the Meramec Regional Planning Commission Planning 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.
October 2013

Table 3.5 Maries County Dams

Name of Dam	Dam Height (ft)	Drainage Area (ac-ft)	Lake Area (ac)	Hazard Risk
Apex Lake Dam	30	170	4	Low
Blake Lake Dam	30	50	4	Low
Bowman Lake Dam	23	55	9	High
Cowan Lake Dam	25	70	3	Low
Danube Corporation Lower Dam	32	900	37	High
Danube Corporation Upper Dam	25	50	5	Low
Dillon Lake Dam	25	60	12	Low
Dudenhoeffer Dam	55	376	39	High
Hayes Lake Dam	30	130	5	Low
Hidden Lake Dam	25	90	4	Low
Hoban Lake Dam	30	280	9	Low
Kleffner Lake Dam	25	120	5	Low
Koch Lake Dam	32	180	4	Low
Kuhrts Lake Dam	30	40	4	Low
Lake Maxwell Dam	80	978	107	High
Miller Lake Dam	25	120	4	Low
Murphey Lake Dam	27	225	10	High
Nepomuceno Lake Dam	27	125	9	Low
Norbert Sandbothe Pond	33	0	4	Low
Rinquelin Trail Dam	35	580	27	High
Share Lake Dam	30	65	5	Low
Sherrell Lake Dam	25	40	3	Low
Slinkman Lake Dam	30	55	6	Low
Swarthout Lake Dam	25	28	4	Low
Veasmann Lake Dam	30	40	3	Low
Vogt Dam	30	130	6	Low
Wensler Lake Dam	24	200	8	Low
Whippoorwill Lake Dam	30	65	9	Low
Wilson Lake Dam	30	70	5	Low
Wilson Lake Dam	25	160	3	Low

Source: Missouri Department of Natural Resources – website: http://www.dnr.mo.gov/env/wrc/damsft[viii]

An insufficiency exists in the data for dams in Maries County. MDNR is in the process of helping dam owners develop emergency action plans (EAP) for all state regulated, high-hazard potential dams in the state, but to date, there are only two that have inundation maps on file – Lake Maxwell Dam and Dudenhoeffer Lake Dam. Those inundation maps are included in Figures 3-4 through 3-7 Although there are topographical and aerial photography maps available, no information on failed dam inundation areas exists for the other high hazard dams in the county. 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 and 3-8 should be considered a

representation of potential impact areas. The county will continue to strive to improve the data on dam inundation.

Six of the dams are classified by MDNR as high hazard risk dams. Many of these high hazard dams have structures or infrastructure located below the dam. The aerial maps included in Figures 3-3 through 3-8 better illustrate the impact areas should any of these dams fail and show the high hazard risk 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.

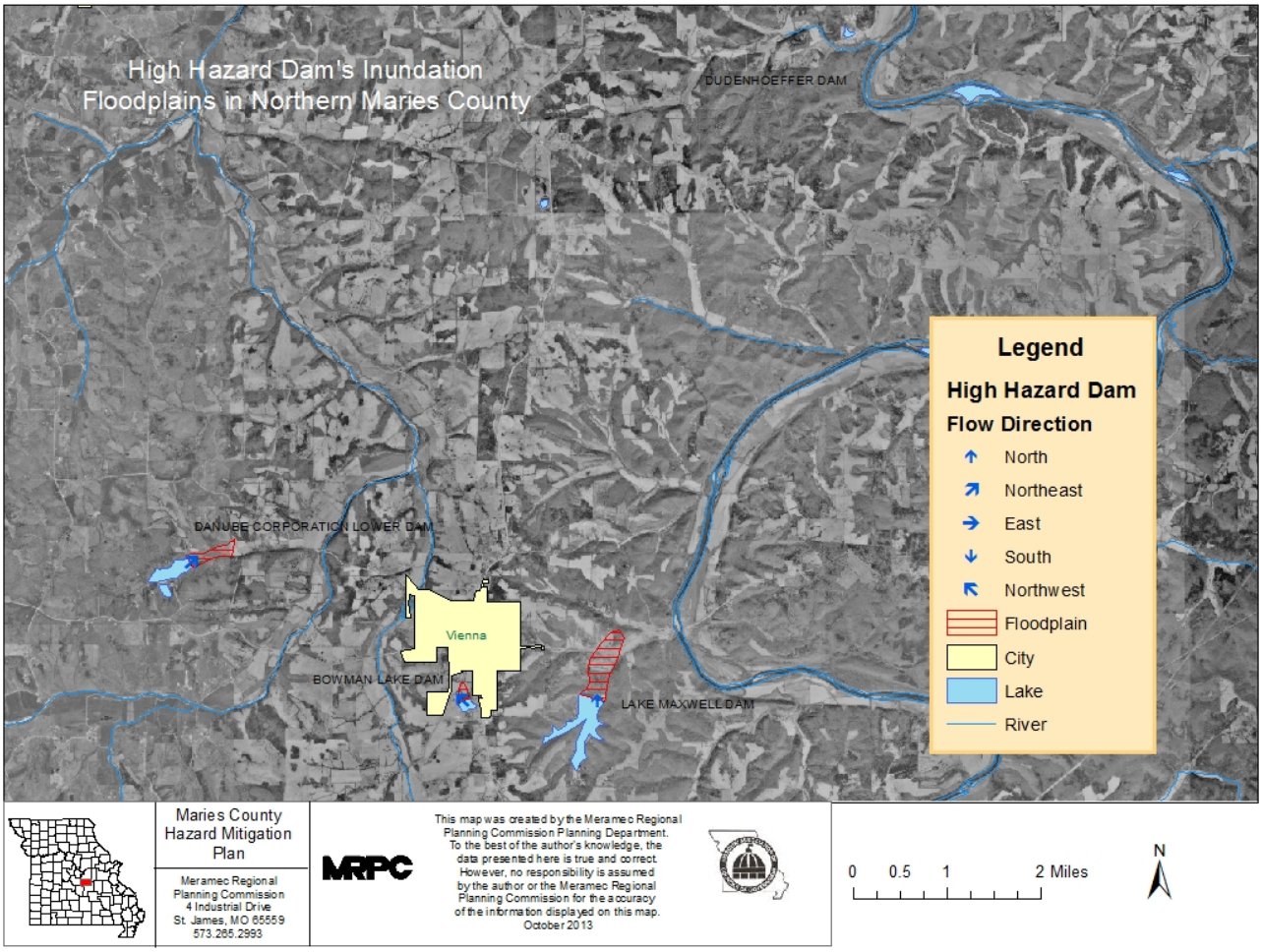
There are three high hazard risk dams located in the central part of the county around Vienna. Danube Corporate Lower Dam is located approximately 3 miles west of Vienna, north of Highway 42. There are two farms with homes and outbuildings located in the probable inundation area below the dam. The first is located approximately 350 yards below the dam and well within the hazard zone if a catastrophic failure were to occur. The second farm is located approximately 1,490 yards from the dam and along Maries County Road 213, which could also suffer damage. The land below the dam is currently in pasture, forest and cropland.

Bowman Lake Dam is located adjacent to the city limits of Vienna on the south side of the community. It lies on the west side of Highway 63. The estimated inundation area runs north- into an open, undeveloped area for over 600 yards before reaching some utility buildings and Maries County Road 640. 230 yards beyond CR 640, the inundation zone intersects with another pair of utility buildings before reaching Highway 42. It is doubtful that damage would extend beyond this area.

Lake Maxwell Dam is located southeast of Vienna, approximately one mile from the city limits. According to the maps developed by MDNR, the inundation zone would flow north-northeast .6 miles to Highway 42 and then flow along 42 for .6 miles to the Gasconade River. This would impact Highway 42, Maries County Road 336, a private road on the south side of 42 and possible Maries County Road 335 on the east side of the Gasconade River. There might be one or more residences near the river that would also be impacted. Figures 3-4 through 3-5 are the inundation maps developed and provided by MDNR. Figure 3-4 shows a more extensive map of the inundation area including approximate times of impact following a catastrophic failure. Figure 3-5 shows the area immediately below the dam in greater detail.

Dudenhoeffer Dam is located in the north central part of the county, approximately 2.5 miles due east of Highway 63 and one mile north of Maries County Road 302. Based on the maps provided by MDNR, should a catastrophic failure occur, few, if any structures would be affected. There would be damage to one or more private roads as well as pasture land. The outflow from the lake would eventually end up in the Gasconade River, approximately 1.6 miles from the dam site. [GIS data available did not have Dudenhoeffer Dam, so this dam is not included in Figure 3-3, but more detailed information can be found in Figures 3-6 and 3-7.]

Figure 3-3



The two remaining high hazard dams are located in southwest and south central Maries County. The inundation zones for these two dams are approximated in Figure 3-8. Rinquelin Trail Dam is located approximately two miles west of Highway 133 and approximately two due north of Highway BB. The dam lies .2 of a mile south of Maries County Road 630. Should a catastrophic failure occur, there is one home located approximately .3 of a mile west of the dam that might be affected. Maries County Road 630 is approximately one half mile from the dam and would likely be damaged. Just east of the county road is a small tributary of the Osage River and the flood water would be carried down it. Approximately 1.5 miles downstream, State Highway DD crosses this tributary. Depending on the volume and power of the water, there is potential for this bridge to be impacted. There are no other structures within several miles of the inundation area that would likely be affected.

Murphey Lake Dam is located approximately four miles southwest of Vienna, between Maries County Roads 616 and 617. Two smaller lakes lie immediately below Murphey Lake Dam.

There is a power line right of way located .3 of a mile below the dam that would likely be impacted if the dam were to fail. In addition, there is a farm house located with .5 a mile of the dam that may also be impacted by a catastrophic failure. Other than these two features, the land below the dam is made up of forest and pasture for more than three miles.

Figure 3-4

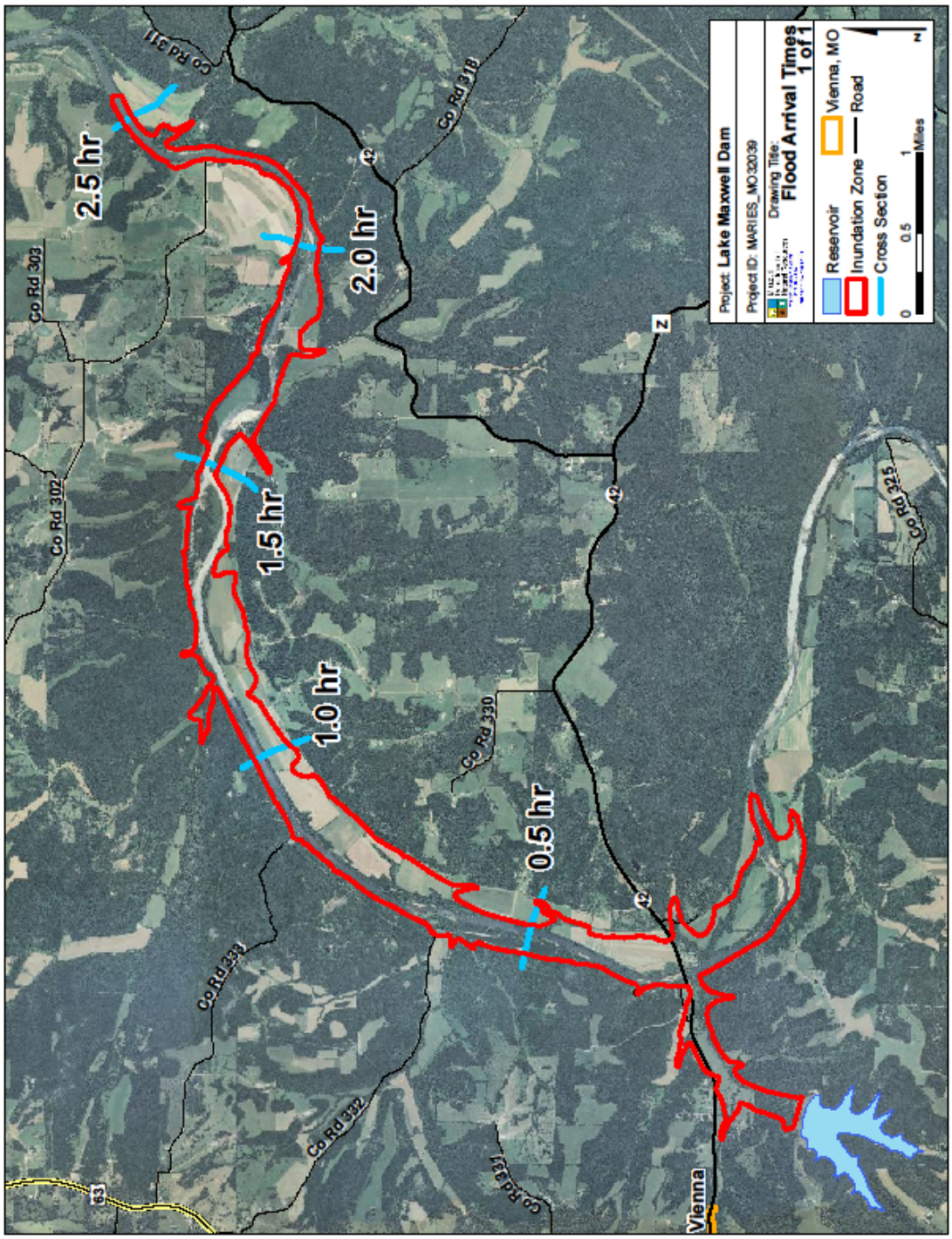


Figure 3-5

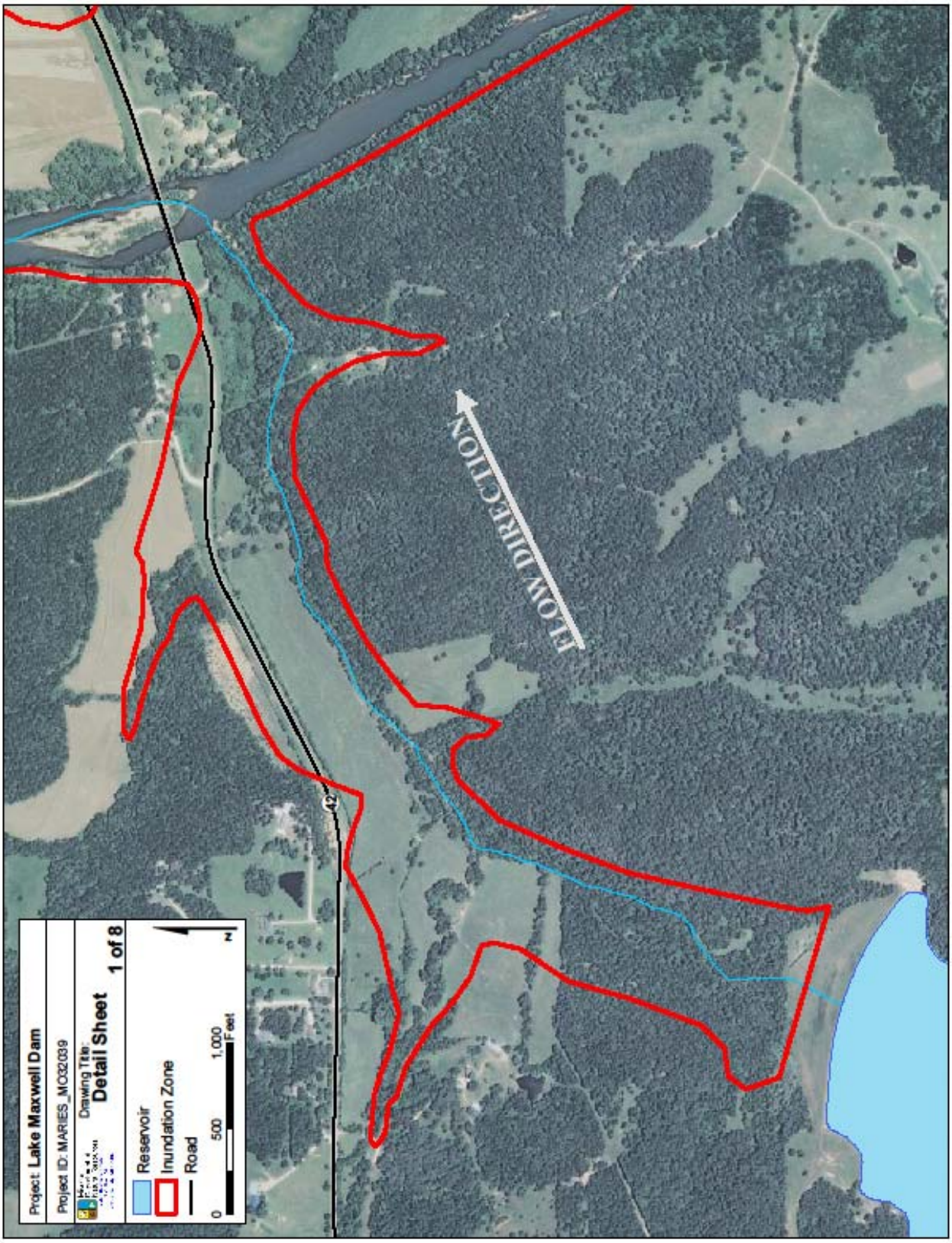

Project: Lake Maxwell Dam
Project ID: MARIES_MO32039
Drawing Title:
Detail Sheet
1 of 8
Reservoir
Inundation Zone
Road
0
500
1,000
Feet
N
FLOW DIRECTION
42

Figure 3-6

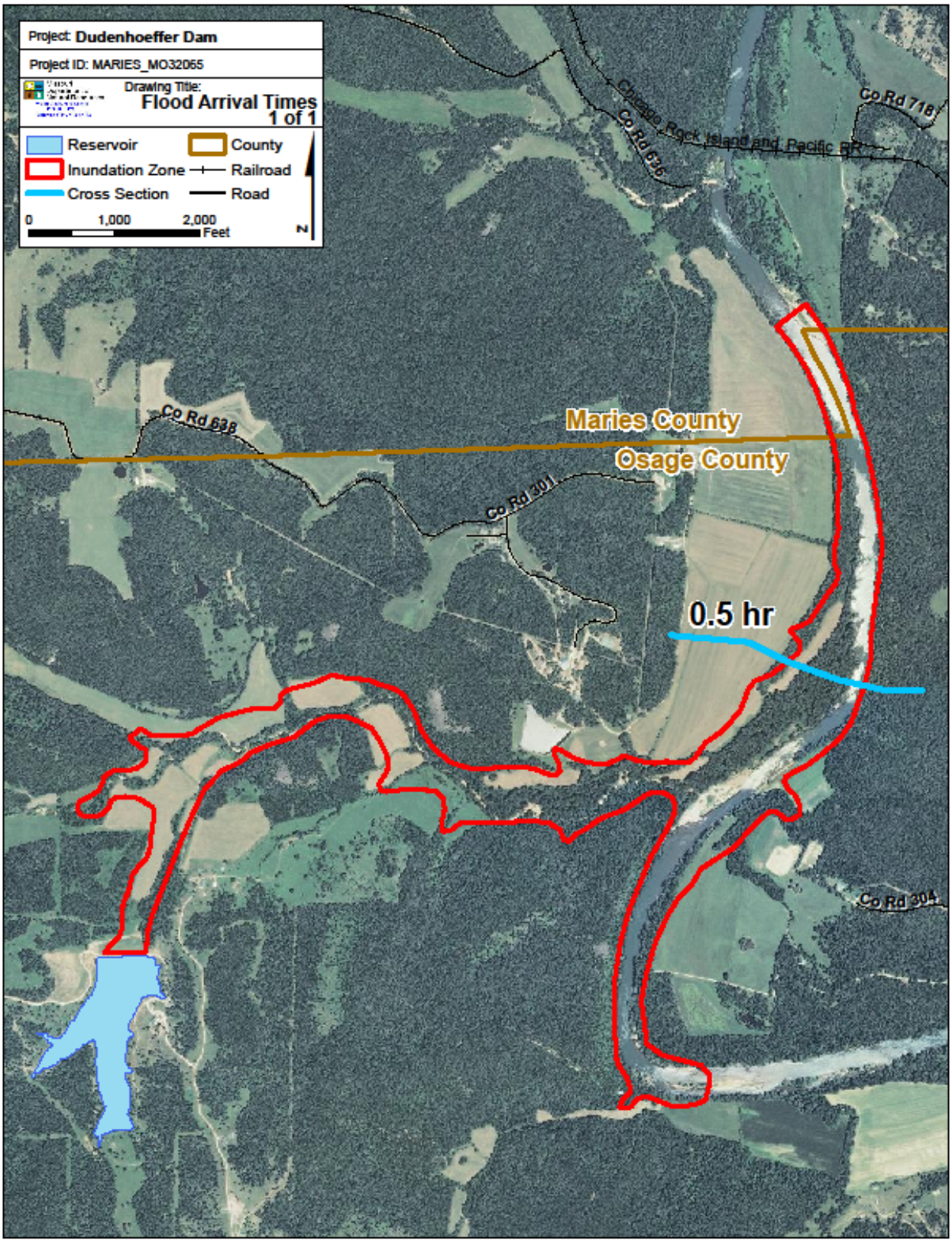

Project: Dudenhoeffer Dam
Project ID: MARIES_MO32065
Drawing Title:
Flood Arrival Times
1 of 1
Reservoir
Inundation Zone
Cross Section
County
Railroad
Road
0
1,000
2,000
Feet
N
Chicago Rock Island and Pacific RR
Co Rd 636
Co Rd 718
Co Rd 638
Maries County
Osage County
Co Rd 301
0.5 hr
Co Rd 304

Figure 3-7

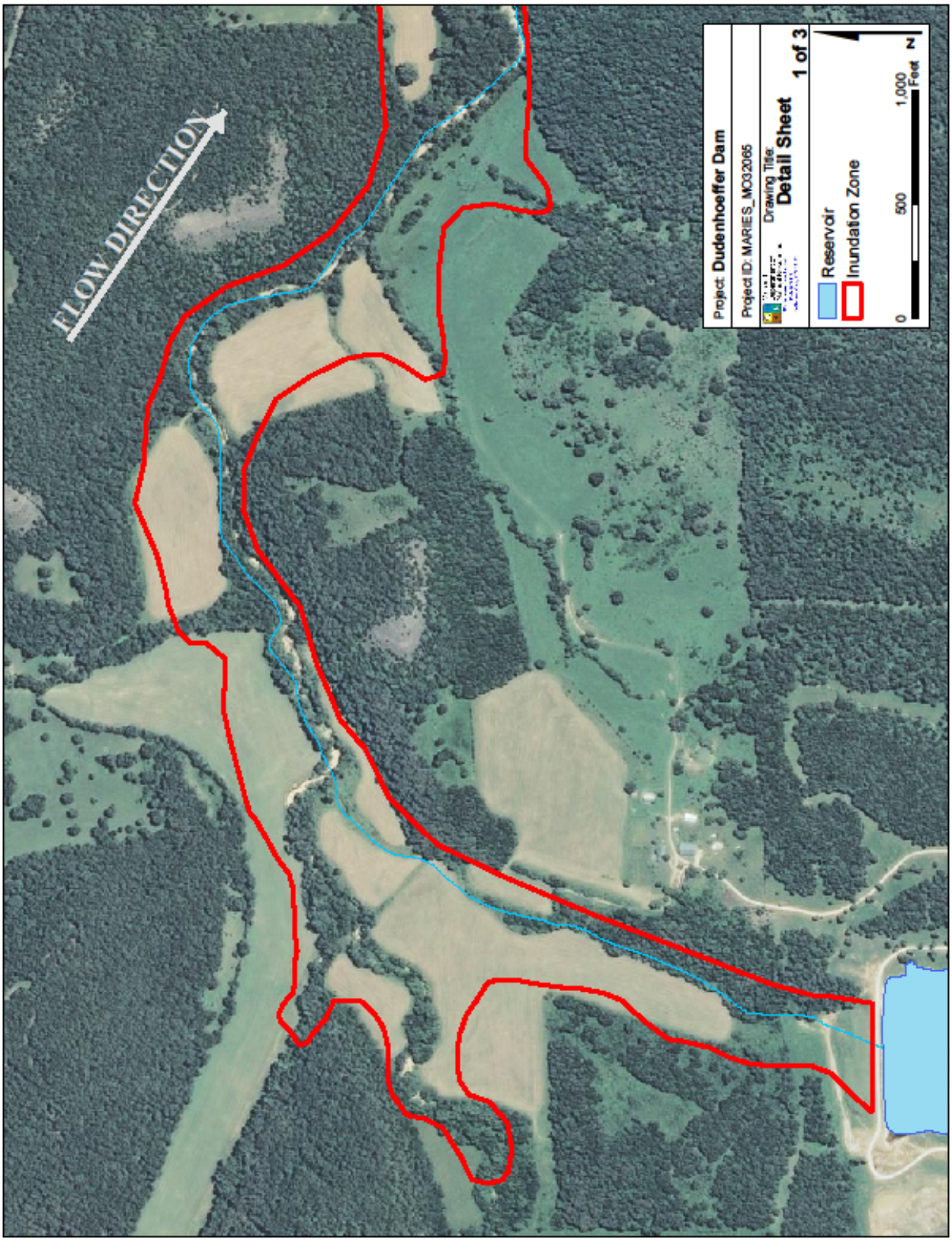
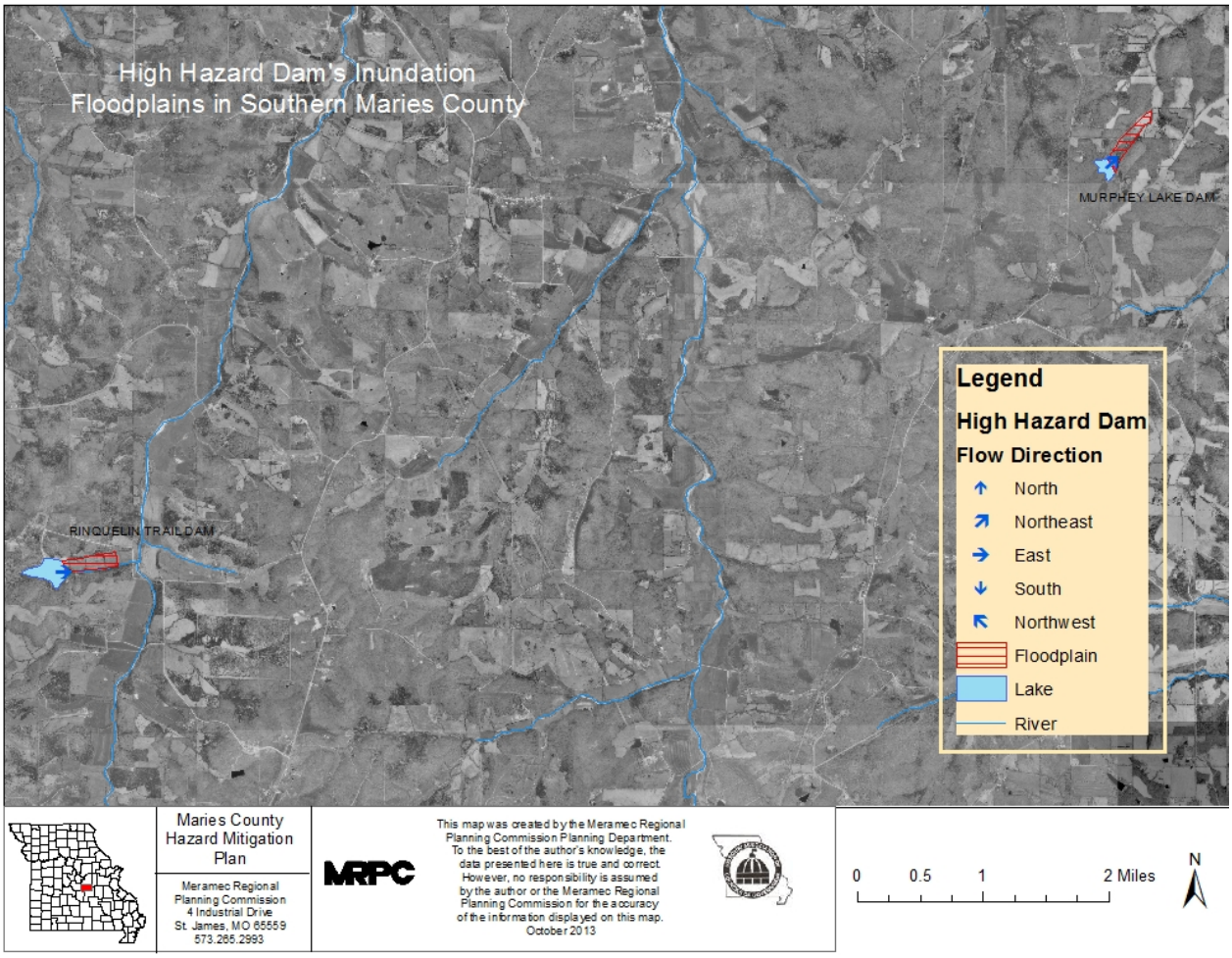

FLOW DIRECTION
Project: Dudenhoeffer Dam
Project ID: MARIES_MO3065
Drawing Title:
Detail Sheet
1 of 3
Reservoir
Inundation Zone
0
500
1,000
Feet
N

Figure 3-8



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[ix], 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 of dollars to remediate.

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 takes 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 actual breach and subsequent flooding will be less than one week, although the remediation will tak significantly

longer. For this reason the CPRI rating assigned was Probable (3), with a warning time of six hours or less (4) and a duration of less than a week (3).

Severity/Magnitude

Discussion of the possible severity of dam failure, as well as the severity of dam failures that have occurred in Missouri, are in previous sections. In addition, previous sections discuss property that could be damaged should dam failure occur. A dam failure in Maries 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. 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 Maries County that are economically significant enough to have a similarly adverse economic impact. Based on this, all jurisdictions in Maries County were assigned a CPRI rating of Negligible (1) – 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. Although the city of Vienna and portions of Maries County have more proximity to high hazard dams, the number of roads, homes and businesses that might be affected is restricted to less than 10 percent of the properties in both of these jurisdictions.

Statement of Probable Likeliness 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, the probability of a future occurrence is not likely.

Probability

Based on previous events of dam failure in the planning area, a failure causing significant damages was assigned the CPRI rating of 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, the probability of a future occurrence is not likely.

Recommendations

- 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 plans and perform exercises in preparation for dam failures.
- Encourage and support the development of emergency action plans for all high hazard dams in the county.

Hazard Summary – Dam Failure – All Jurisdictions in Maries County

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.[x]

Hazard Characteristics

Drought is not 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 four "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.

4. **Socioeconomic Drought**, defined as drought that impacts supply and demand of some economic commodity

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.[xi]

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.[xii]

According to the National Climatic Data Center (NCDC) and the Missouri Department of Natural Resources (MDNR), since 1900, there have been 14 drought events reported for the Southeast Climate Region of which Maries County is included. Those events have varied in length from 9 to 38 months. The most severe droughts occurred between 1930 and 1936 (three different events) and again in 1956 when the greatest rainfall deficit ever recorded for the region occurred. In recent memory, the area suffered from drought in 1999, 2000, 2006, 2007 and most recently 2012-13.

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 Maries 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.[xiii] Total crop damages from the 1999-2000 drought were estimated at $660,000 for the entire state.[xiv]

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. The drought that struck Maries County in 2012 was part of a much larger climate event that affected much of the United States

and is still on-going in some areas of the country. It is estimated that this widespread drought could result in $75 to $150 billion in damages and economic losses nationwide. Fortunately, drought conditions reversed for Maries County in 2013.

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.

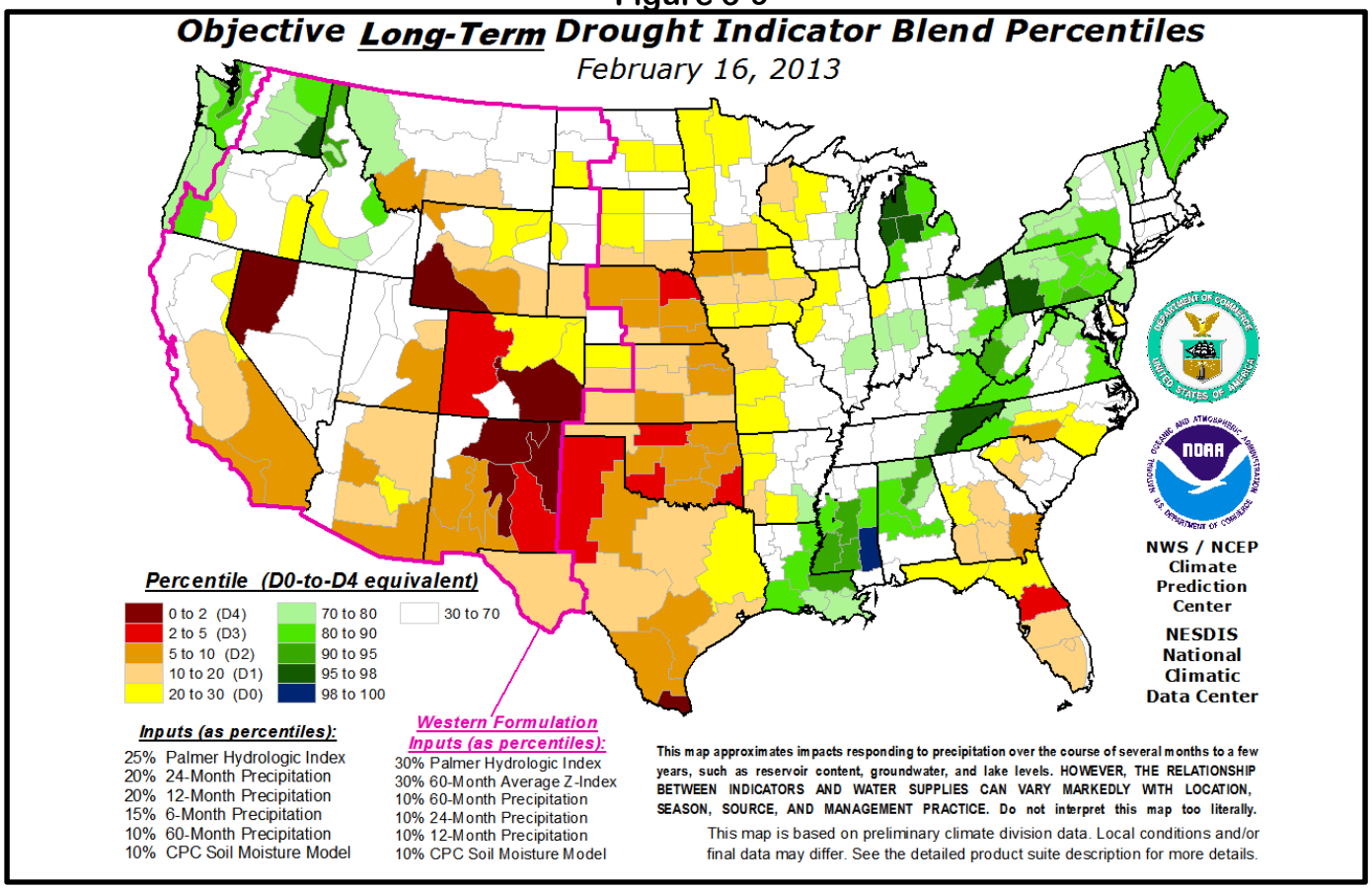
Likely Locations

Maries County is located in the southern half of Missouri where abundant groundwater resources can serve to offset the severity of drought that may limit surface water resources. Furthermore, row crop farming and the use of irrigation is very limited or non-existent in the county, so the demand for water for agricultural purposes is not as great as in other parts of the state.

All areas of Maries County are susceptible to drought, but particularly cities where concentrated numbers 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.

Figure 3-9 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.

Figure 3-9



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. The State of Missouri uses the Drought Response System to rate, monitor and inform the public of drought conditions and is divided into four phases:

- **Phase I: Advisory Phase** – requires a drought monitoring and assessment system to provide enough lead time for state and local planners to take appropriate action
- **Phase II: Drought Alert** - when the PDSI reads -1.0 to -2.0, and stream flows, reservoir levels, and groundwater levels are below normal over a several month period, or when the Drought Assessment Committee (DAC) determines that Phase II conditions exist based on other drought determination methods
- **Phase III: Conservation Phase** – when the PDSI reads -2.0 o -4.0, and stream flows, reservoir levels and groundwater levels continue to decline, along with forecasts indicating an extended period of below-normal precipitation, or when the DAC determines that Phase III conditions exist based on other drought determination models
- **Phase IV: Drought Emergency** – when the PDSI is lower than -4.0, or when the DAC determines that Phase IV conditions exist based on other drought determination methods (Hays, 1995)[xv]

Warning Time and Duration

A drought evolves slowly and can last for months or even years. Based on this information, the assigned CPRI rating is (1), or a Probable warning time of more than 24 hours (1). The assigned CPRI for duration is a (4), or more than one week.

Probability

Based on the history of previous events in the planning area, the CPRI rating for drought is 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 Maries County is likely but severe drought is very unlikely.

Severity/Magnitude

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.[xvi]

The next drought to affect Maries County will likely have no or little impact on the daily activities of Maries County residents and businesses. If a major drought should occur, farmers may suffer low crop yields and/or have difficulty finding adequate pasture and watering sources for livestock.

The CPRI rating assigned is 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, Maries County is located in a region of the state 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 Maries County will most likely have a negligible effect on residents.

Recommendations

- 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. T
- 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 Maries 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]

Hazard Characteristics

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.

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.

MMI	Felt Intensity
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.[xix]

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.[xx]

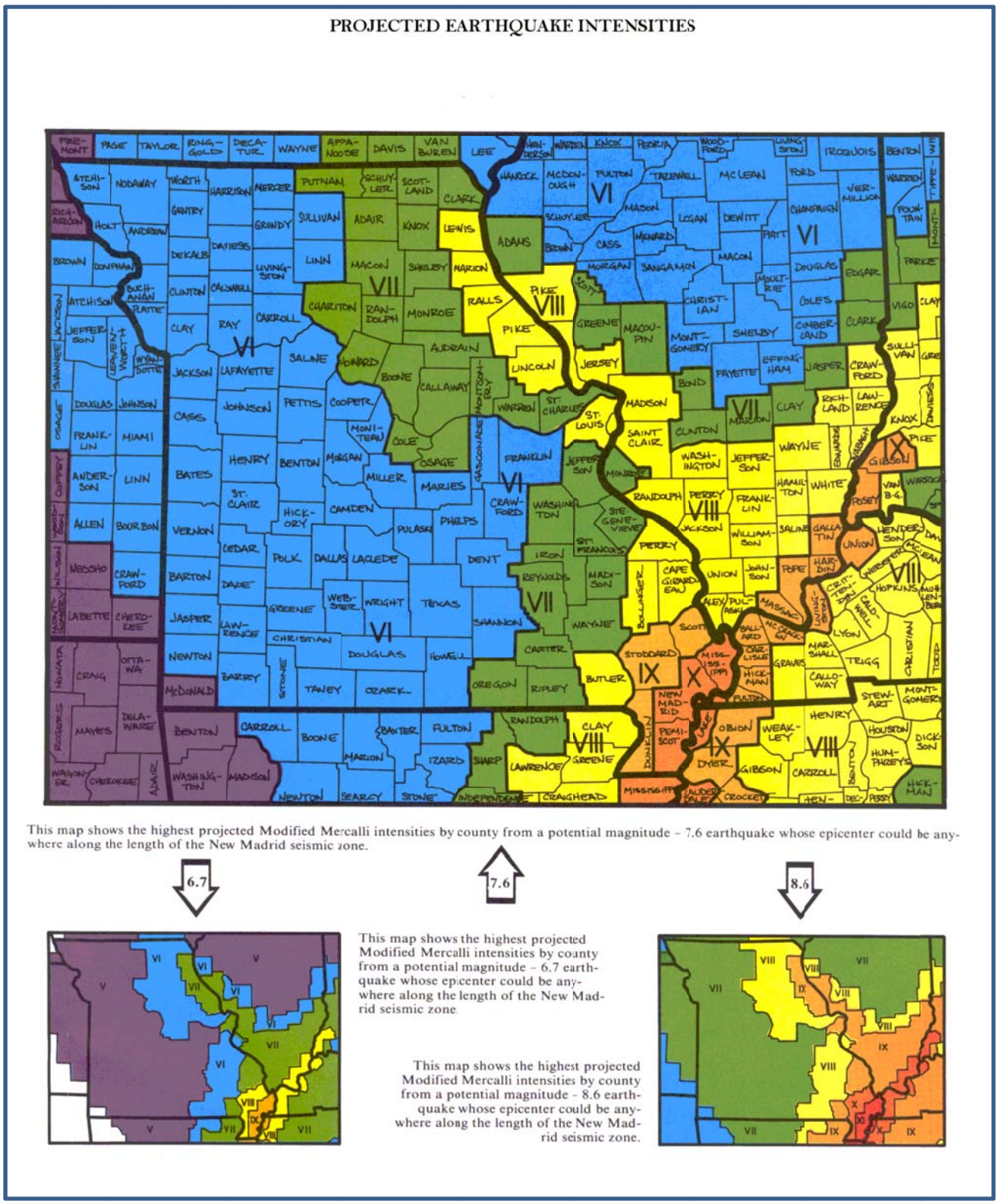
Figure 3-10 shows projected earthquake intensities for Missouri and the surrounding states that are affected by the New Madrid Fault.

Hazard Event 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.

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

Figure 3-10



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

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 Maries, 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 nearby Crawford County. According to information from the USGS, a micro-earthquake 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 Maries 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.

Maries County is located in east central Missouri, less than 160 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, Maries County, with a Mercalli rating of VI, the quake would be felt by all, with some heavy furniture moved and broken plaster. However, damage from the event would be slight.

The HAZUS scenario for Maries County however, showed a somewhat different outcome should a major earthquake occur in southeast Missouri. The HAZUS scenario was run based on a 7.7 magnitude earthquake. The results indicated that as many as 920 buildings would be at least moderately damaged with an estimated 38 buildings damaged beyond repair. These numbers are moderated somewhat when comparing the total building stock value to estimated structural damage costs. The county has an estimated building stock value of $851 million and the HAZUS report indicated that there would be as much as $8.8 million in structural damage (one percent of the total building stock value). In addition, the HAZUS report estimates that three of the 64 bridges in the county would sustain some damage. Utility systems would remain functional, although there could be breaks or leaks in water, wastewater and natural gas lines. An estimated 22 households might be displaced and as many as 13 people might seek temporary shelter in the county. More details on the HAZUS earthquake report is included in Section 3.3 Vulnerability

Assessment. It should be noted that this HAZUS report is in striking contrast to HAZUS reports generated for surrounding counties and so there may be a problem with the data.

Additional impacts 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. For this reason, the CPRI rating assigned was probable warning time of less than six hours (4). Duration of more than one week (4).

Severity/Magnitude

Discussions of the possible severity of an earthquake and the severity and magnitude of previous earthquakes that have occurred in Missouri, are in previous sections. In addition, previous sections discuss the level of damage that might occur based on the Mercalli Scale. Since Maries 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, Maries County could also be impacted by the number of refugees traveling through the area seeking safety and assistance and the staging of state and federal relief/response. It should be noted that scenarios run with HAZUS for Maries County are somewhat in conflict with the Earthquake Intensity Map, showing more structural damage to buildings as well as infrastructure. However, after further analysis, the severity of the damage still falls within the category of negligible. HAZUS reports show structural damage costs to buildings at approximately one percent and utilities being shut down for 24 hours or less. Based on this, all jurisdictions in Maries County were assigned a CPRI rating of 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.

Probability

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] Based on this data, a CPRI rating assigned was Occasional (2): An event is probable within the next five years—a 20 percent probability of occurring.

Recommendations

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

Hazard Summary – Earthquake – All Jurisdictions in Maries 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.

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]

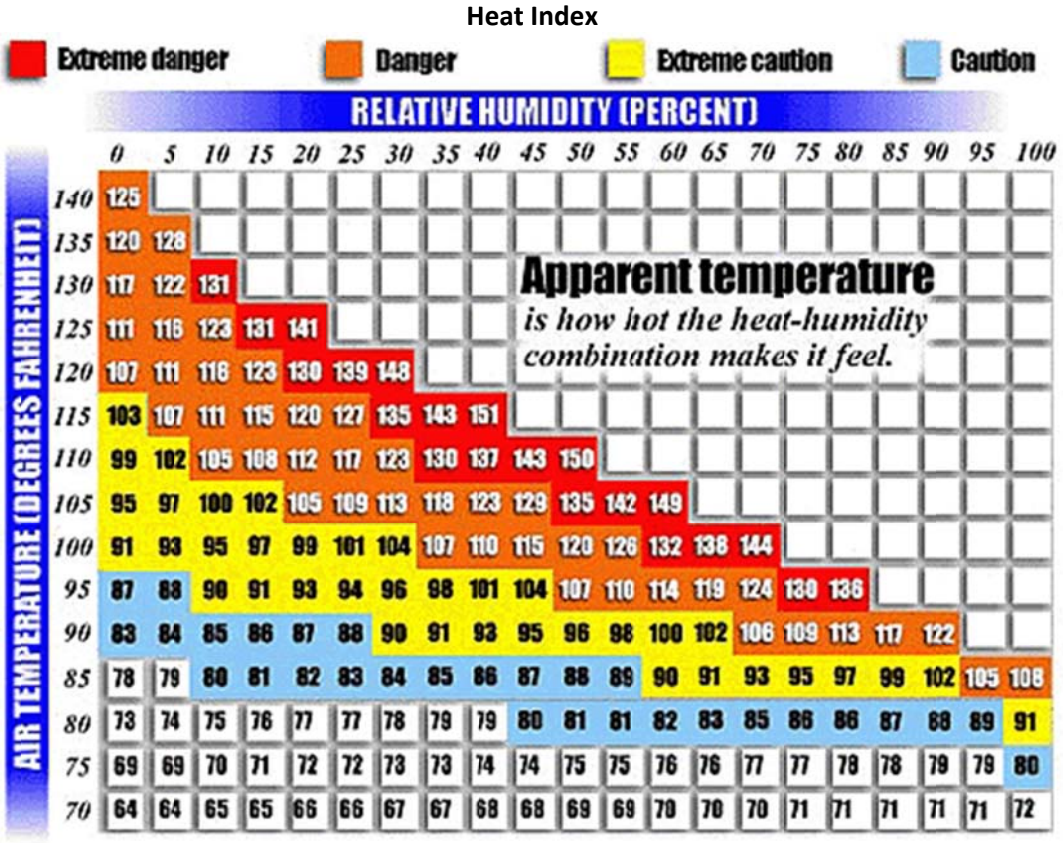
Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating, or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and 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 3-11



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]

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.

Hazard Event History

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. Nine instances of excessive heat were recorded in Maries County between 1996 and 2013. Numerous people were treated for heat-related illnesses and heat related deaths were reported throughout Missouri for most of those events. Statewide, heat wave deaths most often occur in urban areas and people age 65 and older are most susceptible. The summer of 2012 was notable for the duration of excessive heat. There were three separate incidents where temperatures were near or above 100 degrees for multiple days in a row in June, July and August. The heat wave accompanied the worst drought that the area had seen in several years.

Temperatures in Maries County have been recorded at reaching 103 degrees Fahrenheit and heat indices have ranged between 115 and 120 during instances of extreme heat.

Excessive heat is most common in the summer months of June through August. Education is the most preventive warning system available in Maries County. The Maries/Phelps 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.

For these reasons, the CPRI rating assigned was Probable warning time of 24 hours or more (1), Duration of less than one week (3).

Severity/Magnitude

When extreme heat next strikes Maries County the impact will probably have a low impact on the community as a whole. However, due to 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.

Extreme heat has the potential for and has caused death in Maries County – and so could be classified as catastrophic. Historically, heat-related deaths have seldom occurred in Maries County. However, the possibility is one to be considered when heat indices are above 100 degrees Fahrenheit. Because Maries County has had heat related deaths in the past, has a high level of poverty, which increases vulnerability to this hazard, extreme heat is assigned a CPRI rating of Critical – 25 -50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries resulting in permanent disability (3).

Probability

Based on historical evidence, the occurrence of extreme heat is a yearly phenomenon in Maries County. It can be assumed with reasonable security that high temperatures will be seen in the county on an annual or biannual basis. Information from the Department of Health and Senior Services and the NWS for the state of Missouri rates the probability of a heat wave as moderate and severity as moderate, but the probability could be upgraded to severe.[xxix] For these reasons, the CPRI rating assigned is Highly Likely (4) – event is probable within one year—a near 100 percent probability of occurring.

Recommendations

- Working with the Maries 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 Maries 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.[xxxi]

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

closed roads numerous times due to flash flooding. Flash flooding and riverine flooding have both closed some state highways – the most major being Highway 63 at the Gasconade River.

Typical damages caused by Maries 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 roads have experienced severe erosion caused by flash floods.

Hazard Event History

Maries County has several rivers and small tributaries in unincorporated areas that are susceptible to flooding. There is an area in the vicinity of Nagagomi spring where a cluster of weekend cabins and homes are located and a few additional cabins scattered along the Gasconade River that are prone to riverine flooding. Since 1994, the county has experienced 16 separate incidents of riverine flooding resulting in $644,000 in property damage. The most significant flooding events were in July of 1998 and April of 2011.

The city of Belle does not have any designated floodplain zones within the city limit. The city of Vienna has only a small undeveloped area within the city limits designated as flood zone where the wastewater treatment facility is located.

Flash flooding occurs much more frequently than riverine flooding, with 47 separate flash flooding events occurring since 1994 and damages of $571,000. The county, on average, experiences at least two to three flash flooding events nearly every year, however most of these events cause little or no property or crop damages, nor loss of life. One exception was a flash flood that occurred in August 2013 that resulted in $500,000 in damages in Maries County, with some damage done to the Vienna wastewater treatment plant and at least one evacuation required. Over 20 inches of rain fell in some areas of the Ozarks, with other neighboring counties suffering much greater damage and loss of life. Several roads and bridges in the county were damaged from this flash flooding event.

A total of 61 floods and flash floods have affected the county since April 1994. Of the 63 reported events, 12 events caused property damage ranging from $1,000 per event to $500 thousand in August 2013. The remaining 51 flood events caused no property damage or injuries. Table 3.9 illustrates flood events in the county from April 1994 to August 2013.

There are some major roads in the county that have been affected by flooding. Highway 63 between Vichy and Vienna has been closed due to flooding along the Gasconade River several times – most recently in August of 2013. The other state highway that has been affected include Highway 42 east of Vienna where it crosses the Gasconade River. When these highways are shut down due to flooding, detours can take travelers far out of their way to get around the flooding.

Table 3.9 Maries County Flood Events and Locations (1994-2013)

Location or County	Date	Type	Property Damage	Crop Damage
Brinktown	4/10/1994	Flash Flood	0	0
Belle	7/6/1994	Flash Flood	0	0
Maries County	5/17/1995	Flash Flood	0	0
Vienna	5/7/1996	Flash Flood	$15,000	$5,000
Belle	6/6/1996	Flash Flood	$5,000	0
Vienna	6/17/1997	Flash Flood	0	0
Belle	6/22/1997	Flash Flood	0	0
Vienna	6/25/1997	Flash Flood	0	0
Vienna	8/19/1997	Flash Flood	0	0
Brinktown	3/17/1998	Flash Flood	0	0
Maries County	3/19/1998	Flash Flood	0	0
Maries County	6/4/1998	Flash Flood	0	0
Maries County	6/8/1998	Flash Flood	0	0
Maries County	7/26/1998	Flood	$419,000	0
Maries County	1/31/2002-2/1/2002	Flood	0	0
Maries County	4/19/2002	Flash Flood	0	0
Maries County	4/19/2002	Flood	0	0
Maries County	5/8/2002	Flood	$10,000	0
Vichy	5/9/2002	Flash Flood	0	0
Brinktown	5/12/2002	Flash Flood	0	0
Maries County	5/12/2002	Flood	0	0
Maries County	5/17/2002	Flood	0	0
Maries County	7/10/2002	Flash Flood	$20,000	0
Maries County	7/18/2002	Flash Flood	0	0
Vienna	7/18/2003	Flash Flood	0	0
Belle	7/30/2004	Flash Flood	0	0
Maries County	1/5/2005	Flash Flood	0	0
Maries County	1/5/2005	Flood	0	0
Brinktown	4/2/2005	Flash Flood	0	0
Brinktown	6/10/2005	Flash Flood	0	0
Vienna	8/27/2006	Flash Flood	0	0
Vienna	5/10/2007	Flash Flood	0	0
Brinktown	9/25/2007	Flash Flood	0	0
Belle	1/7/2008	Flash Flood	0	0
Belle	2/17/2008	Flash Flood	0	0
Van Cleve	3/18/2008	Flash Flood	$1,000	0
Belle	3/19/2008	Flood	0	0
Belle	4/3/2008	Flash Flood	0	0
Van Cleve	4/10/2008	Flash Flood	0	0
Vichy	8/5/2008	Flash Flood	0	0
Hayden	9/3/2008	Flood	0	0
Van Cleve	9/14/2008	Flash Flood	0	0
Brinktown	5/8/2009	Flash Flood	$25,000	0

Location or County	Date	Type	Property Damage	Crop Damage
Vichy	5/27/2009	Flash Flood	0	0
Yarna	6/10/2009	Flash Flood	0	0
Vichy	10/29/2009	Flood	0	0
Belle	1/24/2010	Flood	0	0
Shantytown	5/20/2010	Flood	$15,000	0
Vienna	3/14/2011	Flood	0	0
Veto	4/25/2011	Flood	$100,000	0
Vienna	4/25/2011	Flood	$100,000	0
Shantytown	5/12/2011	Flash Flood	0	0
Shantytown	7/12/2011	Flash Flood	0	0
Yarna	3/15/2012	Flash Flood	0	0
Vichy	3/17/2012	Flash Flood	$5,000	0
Shantytown	4/14/2012	Flash Flood	0	0
Belle	5/31/2013	Flash Flood	0	0
Vienna	6/1/2013	Flood	0	0
Safe	6/16/2013	Flash Flood	0	0
Shantytown	8/2/2013	Flash Flood	0	0
Vienna	8/7/2913	Flash Flood	0	0
Brinktown	8/7/2013	Flash Flood	0	0
Vienna	8/7/2013	Flash Flood	$500,000	0

Source: National Climactic Data Center

Of the three local government jurisdictions participating in this plan, two are currently participating in the National Flood Insurance Program (NFIP): Maries County and the city of Vienna. The city of Belle does not participate in the NFIP. According to repetitive loss data provided by SEMA, there are 15 repetitive loss properties in Maries County. One property has been mitigated. There were 40 losses attributed to 14 of the properties and the one mitigated property has had two losses. There is one severe repetitive loss (SRL) property with four losses and another SRL property with two losses that is currently pending.

Likely Locations

Of the three participating governmental jurisdictions in the Maries County Hazard Mitigation Plan, two are members of the National Flood Insurance Program (NFIP). Those are Maries County and the city of Vienna. The city of Belle is not currently a member of the NFIP. According to FEMA, there are Flood Insurance Rate Maps (FIRMs) for the unincorporated areas of Maries County but not for the city of Vienna. Digitized FIRM data is currently not available for the county.

The Maries 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

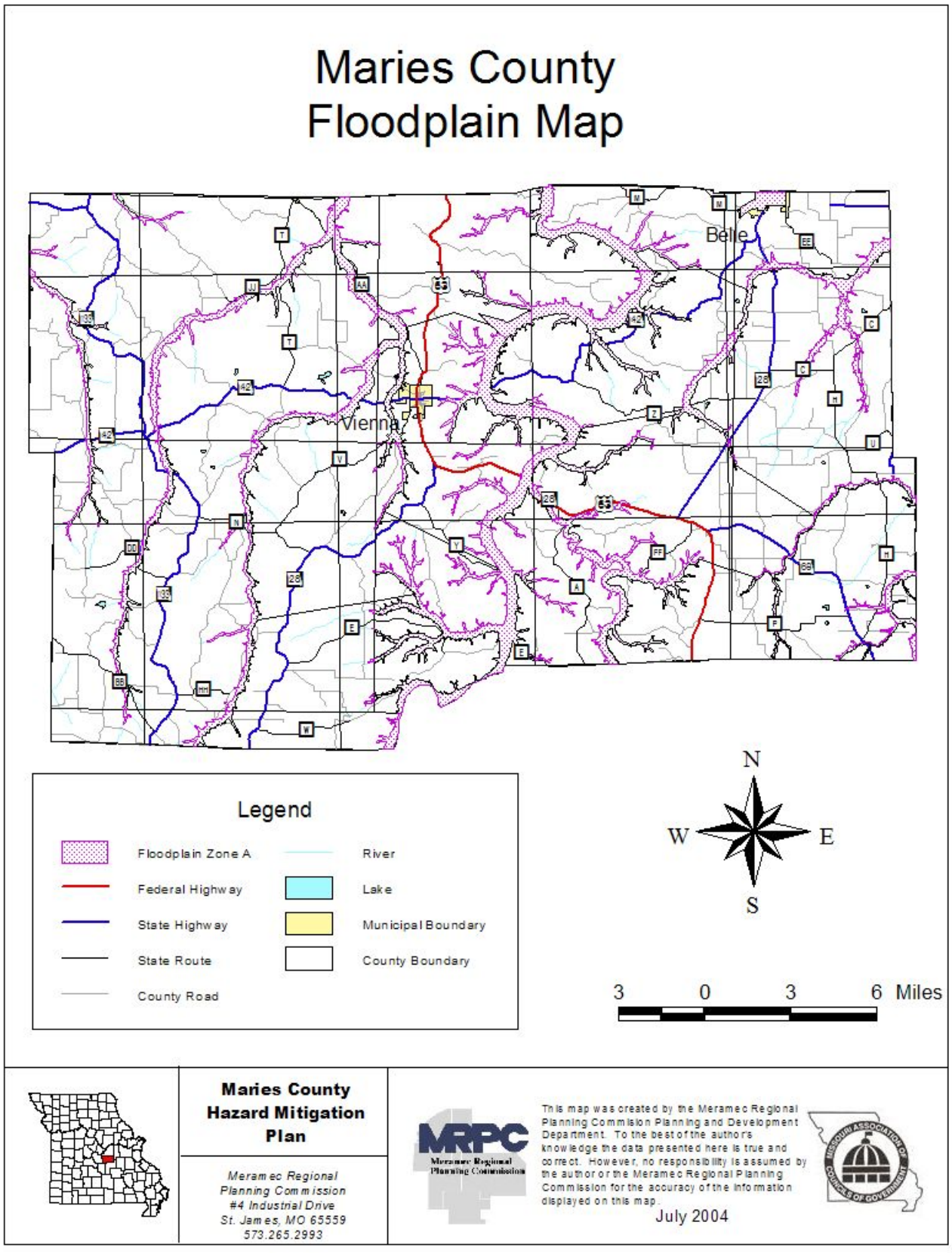
software is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this plan and the actual social and economic losses following a specific flood.

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 Maries County: the Osage River watershed, the Gasconade River watershed and the Bourbeuse River watershed. The river with the potential to cause the most flood damage in the county is the Gasconade River. The river drains 2,806 square miles and flows northward for 271 miles until it reaches the Missouri River. The Osage River watershed covers a significant portion of Maries County, but the river itself lies outside the county boundaries and so does not have a great impact. The Maries River is an Osage River tributary that floods from time to time. A large portion of the eastern part of the county is covered by the Bourbeuse River watershed. Like the Osage River watershed, the river itself lies outside of the county boundary. Various floodplain maps are included at the end of this section for each jurisdiction. Figure 3-12 is a floodplain map for the county.

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

Figure 3-12


Maries County
Floodplain Map
Belle
Vienna
Legend
Floodplain Zone A
Federal Highway
State Highway
State Route
County Road
River
Lake
Municipal Boundary
County Boundary
N
W
E
S
3 0 3 6 Miles
Maries County
Hazard Mitigation
Plan
Meramec Regional
Planning Commission
#4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
Meramec Regional
Planning Commission
This map was created by the Meramec Regional Planning Commision 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.
July 2004

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 Maries 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 and low water crossings 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 primarily from the Gasconade River, but also from tributaries of the Osage and Bourbeuse rivers. The rest of the jurisdictions – the cities of Belle and Vienna and both 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.

Based on historical data discussed in earlier sections, the CPRI rating assigned for Maries County is 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 Belle and Vienna and the Maries County R-I and R-II school districts a CPRI rating is assigned as Probable warning time of less than six hours for most common flash flooding (4). Duration of less than one day (2).

Severity/Magnitude

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 58 flood events reported, four resulted in significant damage in Maries County. In July 1998, there was $419,000 in damages reported for Maries County. In April 2005, a multiple jurisdictional flood event resulted in $200,000 in property damage. In August 2013, in a region-wide flooding event there was $500,000 in damages in Maries County. There are 15 properties listed by the NFIP that have had repetitive losses with the most recent losses in August 2013.

The flooding issue that would have the broadest impact on residents and travelers would be the shutdown of state highways 42 and especially 63. Highway 63 is the main north south route through the region. Detours around the Gasconade River bridge on Highway 63 can be time consuming. Shutdowns typically last two or three days and can have a significant impact on travel in and through the area. 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.

The next flash flood in Maries County will most likely have limited impact on the day-to-day activities of the county overall. Although several have been mitigated in the last few years, many county roads still have low water crossings or can be damaged by flooding. Highway 63 is the most significant state highway in the county and it has been shut down due to flooding on the Gasconade River in the past. There is not a great deal of development along the rivers in the county, with the exception of the Nagogami area and a few other scattered cabins. Temporary road closures will affect some of the jurisdictions.

Based on historical information of flood events and flood damages in Maries County, the CPRI rating for severity of a future flood would be Limited (2) - Injuries and/or illnesses do not result in permanent disability; shutdown of facilities for more than a week; 10-24 percent of property severely damaged. While some county residents may be delayed in their traveling, damages are usually limited to areas along the Gasconade and/or Maries rivers. Loss of life and injuries are also typically limited. Historically, the most impacted areas have been in unincorporated areas of the county.

Probability

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. Since January 1996 through August 2013, flood events have occurred in Maries County in every month of the year with the exceptions of November and December.

All past information regarding flooding in Maries County leads to the assessment that flooding will occur in the Gasconade River, Bourbeuse River and the Osage River basins 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. For these reasons the CPRI rating for probability of future flooding is Highly Likely (4) – Event is probable within one year—a near 100 percent probability of occurring.

Recommendations

- The county has adopted a floodplain management ordinance concerning construction in the floodplain and should rigorously enforce the ordinance in order to reduce flood damages in the future.
- 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 – Maries County

Calculated Priority Risk Index	Planning Priority
3.0	High

Hazard Summary – Flood – Cities of Belle and Vienna, Maries County R-I and R-II School Districts

Calculated Priority Risk Index	Planning Priority
2.9	High

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.[xxxii]

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 3-14 shows areas of the country where excessive pumping of groundwater has resulted in land subsidence and possible permanent damage to the local aquifer.[xxxiii]

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

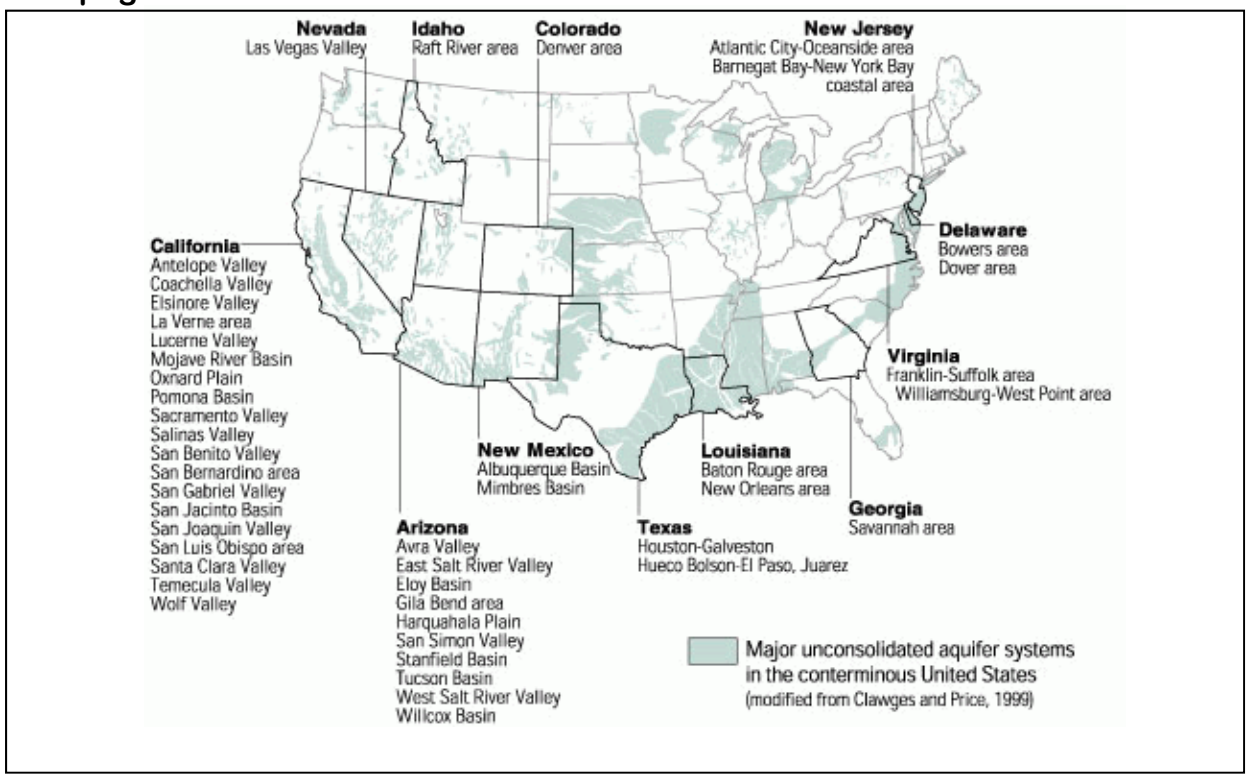
A sinkhole is a surface area usually formed when bedrock slowly dissolves, creating voids below ground that can cause depressions on the surface or even result in openings in the ground when the ceiling of an underlying cave collapses. Typically sinkholes appear as conical depressions in the ground. 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 3-15 shows how sinkholes typically form in the Ozarks region.[xxxiv]

Although there have not been any reported incidents of sinkholes collapsing and causing personal injury or damage to property in Maries 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.”[xxxv]

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 3-14

Areas of United States Affected by Subsidence Caused by Groundwater Pumpage



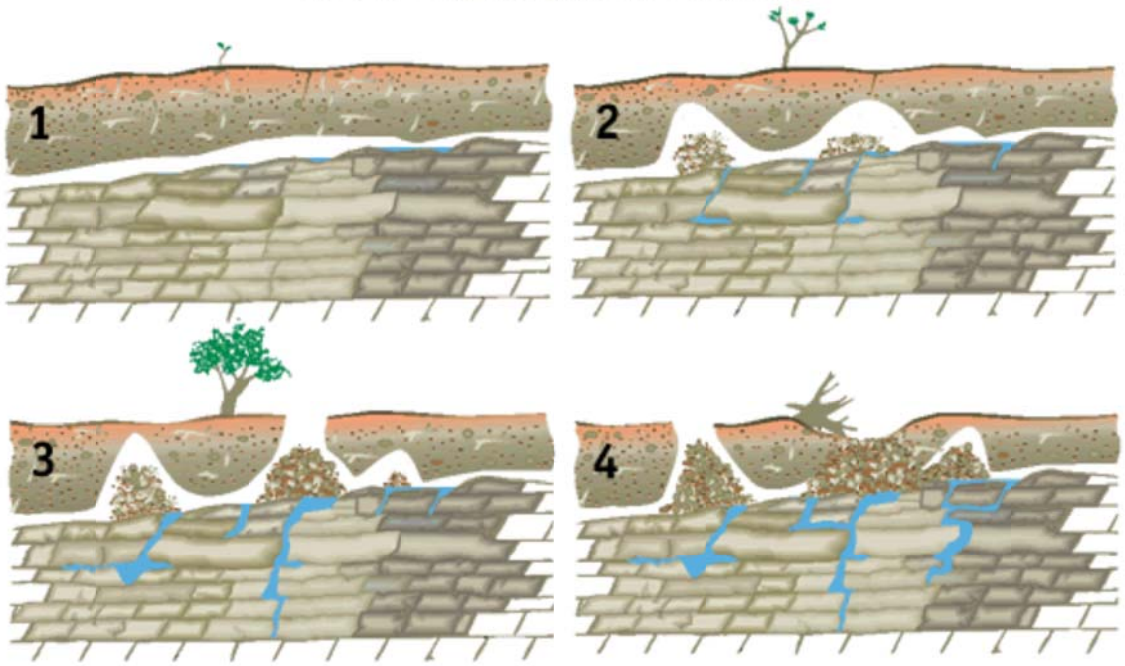
Source: US Geological Survey- http://ga.water.usgs.gov/edu/earthgwlandsubside.html

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.[xxxvi]

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.[xxxvii]

Figure 3-15



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

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

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.[xxxviii]

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.

Hazard Event History

Although there are sinkholes and sinkhole areas in Maries 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 Maries County. Based on the map of sinkholes in Maries County, the incorporated communities appear to lie outside the zone of sinkhole occurrences in the county.

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."[xxxix] As illustrated by Figure 3-16, much of the southern half of Missouri has karst topography and has areas conducive to the development of caves and potential sinkholes.

Figure 3-17 is a map of Maries 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 Maries County – 15 known sinkholes. Fortunately, none of the sinkholes are located near communities or highly developed areas of the county.

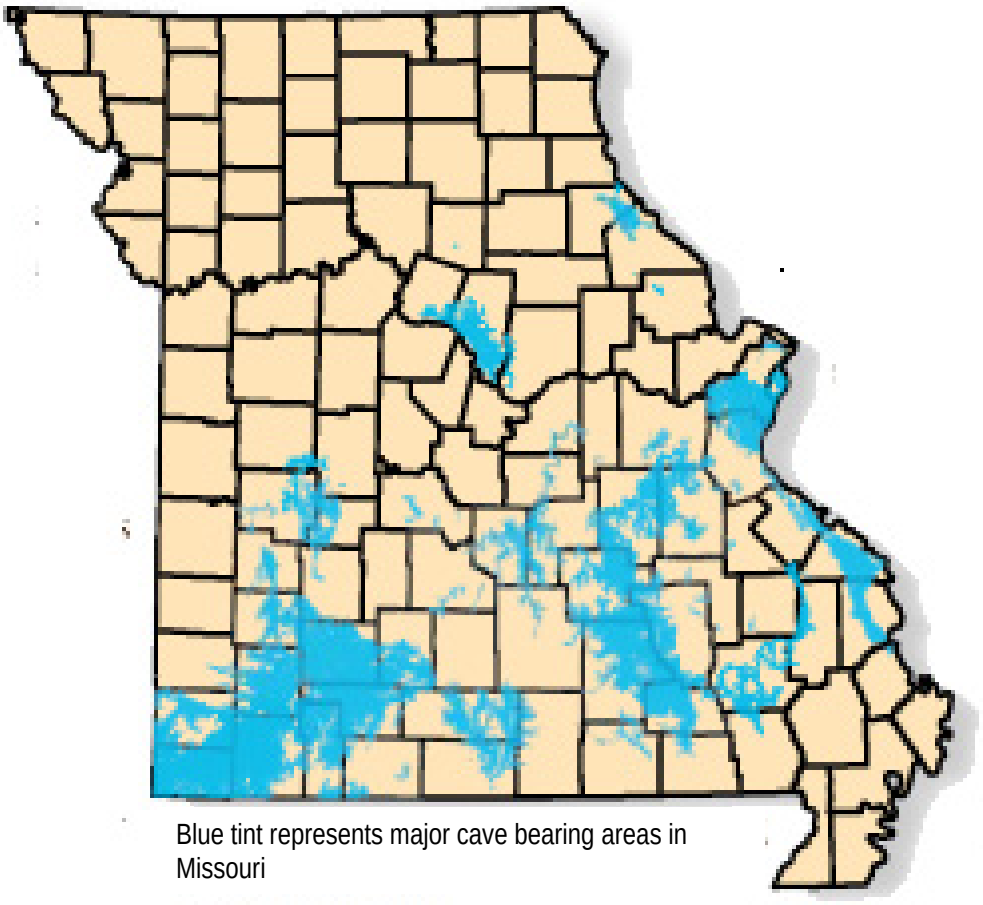
The most likely type of damage to occur in conjunction with a sinkhole collapse is property damage related to foundation disturbance. Signs include cracks in interior and exterior walls; doors and windows that no longer sit square or open and close properly; depressions forming in the yard; cracks in 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.[xl] 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 Maries County.

There have also been deaths and injuries attributed to the sudden formation of sinkholes, fortunately neither has ever occurred in Maries County or in the region.

In regards to unique construction characteristics or other conditions that may differentiate between jurisdictions there appears to be no substantial differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the

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

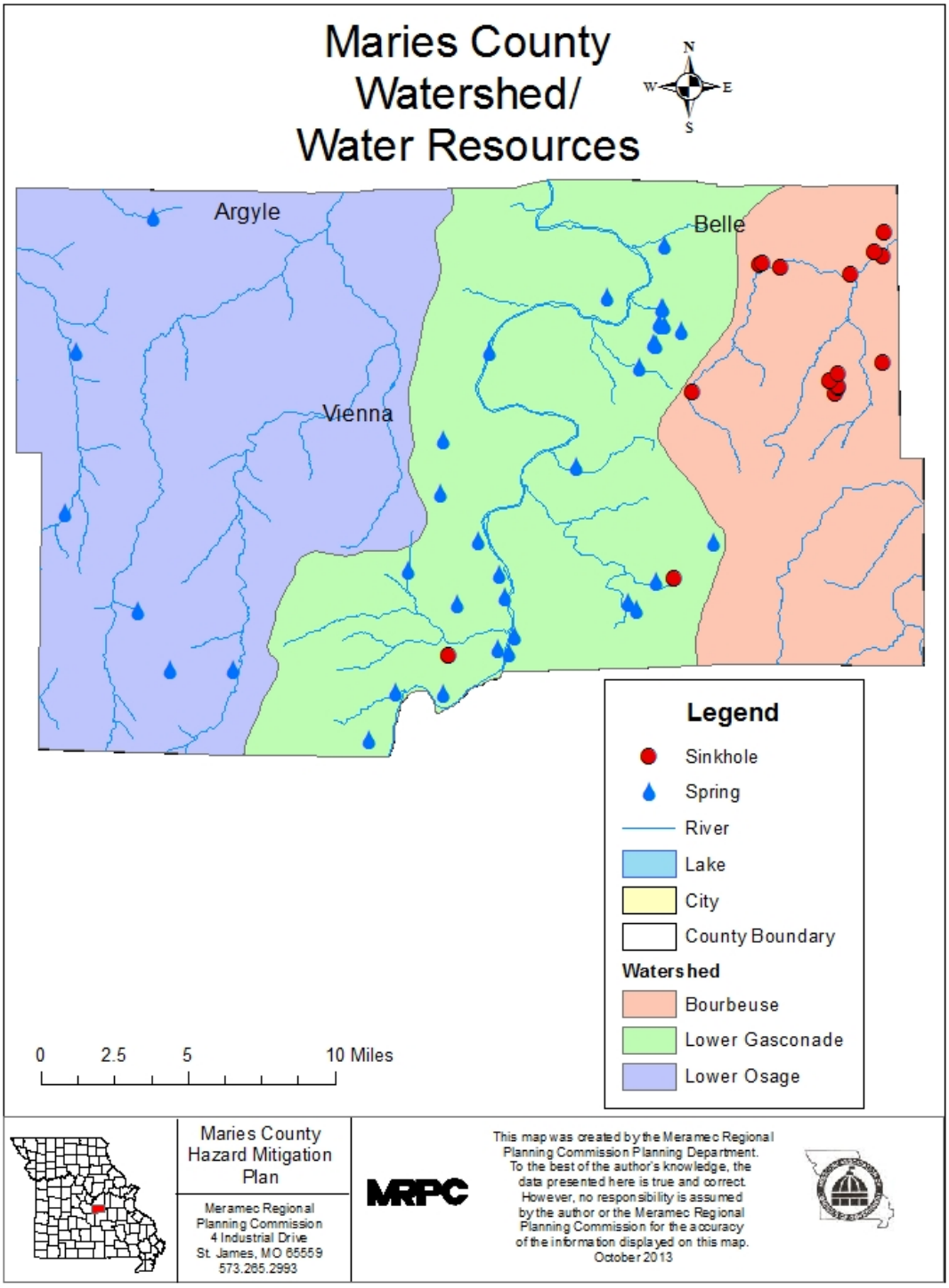
Figure 3-16
Cave Bearing Areas of Missouri



Blue tint represents major cave bearing areas in Missouri

Source: "Geologic Column of Missouri" Volume 2 Issue 2 – publication of the Missouri Department of Natural Resources.

Figure 3-17


Maries County
Watershed/
Water Resources
N
W
E
S
Argyle
Belle
Vienna
Legend
Sinkhole
Spring
River
Lake
City
County Boundary
Watershed
Bourbeuse
Lower Gasconade
Lower Osage
0
2.5
5
10 Miles
Maries County
Hazard Mitigation
Plan
Meramec Regional
Planning Commission
4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
This map was created by the Meramec Regional
Planning Commission Planning 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.
October 2013

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. Based on the historic data available a CPRI rating of Probable warning time of less than six hours for sink hole collapse (4). Duration of less than one week (3).

Severity/Magnitude

If a sinkhole collapse should occur in a developed area of Maries 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.[xli] 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.[xlii]

This hazard does not appear to have varying magnitude for the jurisdictions. Maries 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. For these reasons this hazard has been assigned a CPRI rating of 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.

Probability

There is certainly the possibility of damage occurring in the future from this hazard because sinkholes are a feature in parts of Maries 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. 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. From a historical point of view, Maries County has not had problems with sinkholes and the likeliness of a future occurrence would be considered 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.

Recommendations

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.
- 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 Maries 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.[xliii] 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.[xliv]

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.[xlv]

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.[xlvi]

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. Between 1996 and 2013 there were 234 days where tornado events, sometimes multiple tornadoes, occurred in Missouri. During that timeframe there were 233 deaths and 2,032 injuries attributed to tornadic events, with the most devastating occurring in Jasper County on May 22, 2011. Total property damages for that same period were $3,844,480,000, with $22.231 million in crop damages. Missourians have a high probability that tornados will continue to affect their lives.

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.[xlvii]

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.

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.

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.

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

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

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.

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
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 Event History

Maries County lies along the eastern edge of tornado alley and from 1996 to 2013 the county recorded six tornados from F0 to F2 in strength. One tornado event caused damage of $5 million. Recorded tornados in Maries County since 1957 are shown in Table 3.13. Since 1957, one person has been injured in Maries County due to tornados and there have been no deaths.

Table 3.13 Tornado History – Maries County[xlviii]

Date	Location	Magnitude	Number injured/killed	Property Damage
7/29/1957	Maries County	F1	0 injured, 0 killed	$2,500
11/15/1960*	Maries County	F2	0 injured, 0 killed	$25,000
11/15/1960*	Maries County	F2	0 injured, 0 killed	$25,000
6/1/1999	Brinktown	F1	0 injured, 0 killed	$75,000
5/4/2003	Vienna	F0	0 injured, 0 killed	$0
1/7/2008	Veto	EF0	1 injured, 0 killed	$5,000,000
TOTALS			1 injured, 0 killed	$5,127,500

Source: National Oceanic and Atmospheric Administration - http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms
**Separate storm events.*

Historical data furnished by the National Climatic Data Center show tornados have touched down in unincorporated parts of the county as well as Vienna. The January 7, 2008 tornado was the most damaging in the last 57 years, costing an estimated $5 million. The tornado struck the Rolla Regional Airport near Vichy and destroyed several buildings as well as airplanes.

Thunderstorm winds, while not as powerful as tornados, are still a cause for concern in Maries 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.[xlix]

The National Oceanic and Atmospheric Administration reports 61 incidences of thunderstorms with high winds and high wind events in Maries County since 1955, typically occurring two to three times per year. These thunderstorm winds often result in the uprooting of trees, which may cause damage to nearby power lines, buildings or homes. Twelve incidents resulted in reported property damage ranging from $1,000 to $35,000. Since 1955, the county has suffered $122,000 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. According to the National Oceanic and Atmospheric Administration's National Climatic Data Center, no deaths in Maries County have been attributed to lightening.

Hail is a fairly common weather activity in Maries County, having occurred 72 times in the last 57 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 Maries County has been recorded as large as 4.5 inches in diameter in 2004, but typically hail stones are much smaller. While hail can be damaging, it has typically been mild in Maries County and only caused $5,000 in property damages since 1957.[l]

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

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

Location	Date	Type	Magnitude	Property Damage
County	7/10/1955	Thunderstorm Wind	65 kts.	0
County	4/17/1957	Thunderstorm Wind	53 kts.	0
County	4/17/1957	Hail	Unknown	0
County	6/10/1958	Thunderstorm Wind	71 kts.	0
County	6/10/1958	Hail	Unknown	0

Location	Date	Type	Magnitude	Property Damage
County	3/29/1960	Hail	Unknown	0
County	7/18/1961	Thunderstorm Wind	70 kts.	0
County	9/24/1961	Hail	Unknown	0
County	8/18/1965	Thunderstorm Wind	65 kts.	0
County	5/21/1969	Thunderstorm Wind	52 kts.	0
County	5/21/1969	Hail	Unknown	0
County	4/12/1970	Hail	Unknown	0
County	5/4/1974	Thunderstorm Wind	50 kts.	0
County	6/9/1974	Thunderstorm Wind	Unknown	0
County	8/31/1974	Thunderstorm Wind	Unknown	0
County	5/11/1975	Hail	Unknown	0
County	5/20/1975	Thunderstorm Wind	Unknown	0
County	6/21/1977	Thunderstorm Wind	Unknown	0
County	7/14/1978	Thunderstorm Wind	50 kts.	0
County	7/2/1980	Thunderstorm Wind	50 kts.	0
County	4/16/1982	Hail	Unknown	0
County	5/28/1982	Thunderstorm Wind	Unknown	0
County	5/28/1982	Hail	Unknown	0
County	5/25/1984	Hail	Unknown	0
County	6/2/1985	Hail	Unknown	0
County	6/3/1985	Hail	Unknown	0
County	5/18/1986	Thunderstorm Wind	Unknown	0
County	5/8/1988	Thunderstorm Wind	55 kts.	0
County	6/23/1988	Thunderstorm Wind	50 kts.	0
County	6/17/1992	Hail	Unknown	0
Vienna	4/19/1993	Hail	Unknown	0
Dixon Area	6/8/1994	Hail	Unknown	0
Hayden	5/12/1995	Hail	Unknown	0
Vienna	5/18/1995	Hail	Unknown	0
Vienna	10/10/1995	Hail	Unknown	0
Vichy	2/26/1996	Hail	.88 in.	0
Hayden	2/26/1996	Thunderstorm Wind	52 kts.	0
Brinktown	9/23/1996	Hail	.75 in.	0
Belle	10/17/1996	Hail	.75 in.	0
Vichy	5/2/1997	Hail	.75 in.	0
Vienna	5/17/1997	Hail	.75 in.	0
Vichy	3/27/1998	Thunderstorm Wind		$30,000
Belle	4/15/1998	Hail	1.00 in.	$5,000
Vichy	4/15/1998	Thunderstorm Wind		$1,000
Brinktown	6/18/1998	Hail	.88 in.	0
Belle	4/21/1999	Hail	.75 in.	0
Vichy	6/27/1999	Thunderstorm Wind	50 kts.	0
Brinktown	8/7/1999	Thunderstorm Wind		0
Vienna	4/19/2000	Thunderstorm Wind		0
Vichy	4/20/2000	Thunderstorm Wind	57 kts.	0
County	2/25/2001	High Wind		$100,000
Vienna	4/3/2001	Hail	.75 in.	0

Location	Date	Type	Magnitude	Property Damage
Vienna	4/9/2001	Hail	1.00 in.	0
County	4/11/2001	High Wind	50 kts.	0
Belle	8/29/2001	Hail	1.00 in.	0
Vienna	10/23/2001	Hail	1.00 in.	0
County	5/7/2002	Thunderstorm Wind	55 kts.	0
Brinktown	5/12/2002	Thunderstorm Wind	52 kts.	0
Belle	6/11/2002	Thunderstorm Wind	62 kts.	$5,000
Belle	7/10/2002	Thunderstorm Wind	52 kts.	$10,000
Vichy	7/18/2002	Hail	.75	0
Hayden	12/17/2002	Hail	.75	0
Brinktown	3/12/2003	Hail	1.00 in.	0
Brinktown	3/25/2003	Hail	.75 in.	0
Brinktown	5/4/2003	Hail	1.00 in.	0
Vichy	6/10/2003	Hail	.75 in.	0
Brinktown	6/10/2003	Thunderstorm Wind	65 kts.	0
Vienna	6/10/2003	Thunderstorm Wind	65 kts.	0
Brinktown	7/11/2003	Thunderstorm Wind	65 kts.	0
High Gate	8/19/2003	Hail	.75 in.	0
Belle	8/21/2003	Hail	1.00 in.	0
Belle	8/21/2003	Thunderstorm Wind	65 kts.	0
Belle	8/28/2003	Thunderstorm Wind	65 kts.	0
Brinktown	5/25/2004	Hail	.75 in.	0
Vienna	5/25/2004	Hail	.75in.	0
Brinktown	5/26/2004	Hail	.75 in.	0
Vichy	5/26/2004	Hail	.75 in.	0
Belle	5/30/2004	Hail	4.50 in.	0
Vichy	5/30/2004	Hail	1.75 in.	0
Hayden	7/5/2004	Thunderstorm Wind	55 kts.	0
Brinktown	7/5/2004	Thunderstorm Wind	50 kts.	0
Brinktown	4/20/2005	Hail	.88 in.	0
Hayden	4/20/2005	Hail	1.00 in.	0
Vienna	4/21/2005	Hail	1.00 in.	0
Vichy Airport	4/21/2005	Hail	1.25 in.	0
Vichy	6/9/2005	Thunderstorm Wind	60 kts.	$2,000
Brinktown	6/9/2005	Thunderstorm Wind	55 kts.	0
Vichy Airport	6/13/2005	Hail	.88 in.	0
Belle	6/13/2005	Thunderstorm Wind	50 kts.	0
Vichy	8/13/2005	Thunderstorm Wind	50 kts.	0
Brinktown	9/13/2005	Thunderstorm Wind	50 kts.	0
Vienna	3/30/2006	Hail	.88 in.	0
Vienna	4/2/2006	Hail	1.00 in.	0
Belle	4/2/2006	Thunderstorm Wind	50 kts.	0
Belle	4/18/2006	Hail	1.00 in.	0
Vichy	9/22/2006	Hail	.88 in.	0
Vichy	4/3/2007	Hail	.75 in.	0
Vienna	6/22/2007	Thunderstorm Wind	50 kts.	$20,000
Vichy Airport	10/17/2007	Thunderstorm Wind	54 kts.	0

Location	Date	Type	Magnitude	Property Damage
Vienna	3/26/2008	Hail	1.50 in.	0
Belle	3/26/2008	Hail	.75 in.	0
Veto	3/27/2008	Hail	1.00 in.	0
Safe	3/27/2008	Hail	1.75 in.	0
Brinktown	3/27/2008	Thunderstorm Wind	55 kts.	$4,000
Vienna	7/8/2008	Thunderstorm Wind	50 kts.	0
Veto	8/5/2008	Thunderstorm Wind	50 kts.	0
Belle	6/2/2009	Thunderstorm Wind	50 kts.	$2,000
Brinktown	7/11/1009	Thunderstorm Wind	50 kts.	$10,000
Vichy	6/27/2010	Thunderstorm Wind	61 kts.	$35,000
Vichy Airport	10/26/2010	Thunderstorm Wind	59 kts.	0
Vichy	4/10/2011	Thunderstorm Wind	52 kts.	$2,000
Vienna	4/19/2011	Hail	.88 in.	0
Vichy	4/19/2011	Hail	1.00 in.	0
Lane's Prairie	4/19/2011	Thunderstorm Wind	50 kts.	$1,000
Vienna	4/22/2011	Hail	1.00 in.	0
Vienna	5/25/2011	Hail	1.25 in.	0
Veto	7/22/2011	Thunderstorm Wind	52 kts.	0
Brinktown	8/20/2011	Thunderstorm Wind	52 kts.	0
Lanes Prairie	1/17/2012	Hail	1.00 in.	0
Vienna	3/2/3012	Hail	1.75 in.	0
Belle	3/15/2012	Hail	1.50 in.	0
Yarna	3/15/2012	Hail	1.00 in.	0
Vichy	3/17/2012	Hail	1.75 in.	0
Vichy	7/2/2012	Thunderstorm Wind	50 kts.	0
Vienna	8/4/2012	Hail	.88 in.	0
Vienna	8/4/2012	Thunderstorm Wind	52 kts.	0
Vienna	8/8/2012	Hail	.88 in.	0
Yarna	8/8/2012	Hail	0.88 in.	0
Van Cleve	1/29/2013	Thunderstorm Wind	52 kts.	0
Vienna	5/20/2013	Hail	1.50 in.	0
Belle	5/20/2013	Hail	1.75 in.	0
Vienna	6/23/2013	Hail	1.00 in.	0
Vienna	7/5/2013	Hail	1.00 in.	0
Veto	9/1/2013	Thunderstorm Wind	52 kts.	0

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

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 Vienna and Belle. Several radio stations and television stations in the region provide updates when severe weather threatens Maries County. Weather radios also provide an early warning. Based on the technology available and nature of this hazard, it has been assigned a CPRI rating of Probable warning time of less than six hours (4). Duration of less than six hours (1).

Severity/Magnitude

It is likely that the next disaster's impact on Maries County will be limited based on data for previous severe thunderstorms and tornados. While there is a possibility of strong winds, there has been little damage done to commercial or residential structures in the past, with the exception of the 2008 tornado that struck the Rolla Regional Airport in Vichy and caused $5 million in damages. The county has had a total of $5,075,000 in damages from six tornados. No lives have been lost in the past 57 years from tornados or severe storms. Mitigation activities may provide a more secure prediction that loss of life will be negligible in the future.

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. 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 (since 1957) available through the National Climatic Data Center, there has been one injury and no deaths in Maries County due to tornados. Out of six tornados, one was rated as an F1, one was rated as F0 and one was rated as EF0. Data is not available for the other three tornados which occurred prior to 1961. Since 1957, the county has experienced $5.1275 million in damages from tornados, with $5 million of that figure attributed to one EF0 tornado that struck the airport. With a history of $5.1275 million dollars in losses over 57 years, the average damages are estimated at $89,956.14 per year. As can be evidenced by tornados like the one that struck Joplin, Mo., tornados have the potential to exact catastrophic damage and this knowledge should be factored into the assessment. Based on historical data and the potential magnitude of damage that tornados can inflict, the CPRI rating is Limited (2) - Injuries and/or illnesses do not result in permanent disability; complete shutdown of critical facilities for more than one week; 10-24 percent of property is severely damaged.

Severe Storms. Despite the frequency of severe thunderstorms in Maries County, storms causing damage in regards to high winds and hail have been relatively few. Since 1955 the county has sustained a total of $505,000 in property damage from thunder and hail storms. For these reasons, severe storms are assigned a CPRI rating of 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.

Probability

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. Historical data is discussed in earlier sections of this document. The probability of tornados is low, with tornados occurring in the county on an average of every nine to ten years. Based on the available data, tornados have been assigned a CPRI rating of Unlikely (1) – Event is probable within the next ten years; a 10 percent probability of occurring per year.

Severe Storms. Severe thunderstorms are virtually guaranteed to occur in the future in Maries 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. For these reasons, severe storms have been assigned a CPRI rating of Highly Likely (4) – event is probable within one year—a near 100 percent probability of occurring.

Recommendations

- 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 adequate warning systems should plan to purchase a system or upgrade an existing 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 Maries County

Calculated Priority Risk Index	Planning Priority
1.75	Low

Hazard Summary – Thunderstorm/High Wind/Hail for all Jurisdictions in Maries 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. Severe winter weather can cause injuries, deaths and property damage in a variety of ways.[li] 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. The most significant being a historic winter storm that occurred on January 31 through February 2 in 2011. This storm affected the nation's midsection from the southern Plains through the middle and upper Mississippi Valley into the Great Lakes. Portions of Interstate 70 and 44 were closed across Missouri. The storm included freezing rain, sleet and heavy snow and high winds produced blizzard like conditions with near zero visibility at times. Snow accumulations in mid-Missouri ranged from 14 to 22 inches.[lii]

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.

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.[liii] In regards to unique construction characteristics or other conditions which may differentiate between jurisdictions, there appears to be no substantial

differences between each of the participating jurisdictions. Construction and development trends are fairly uniform across the county. Mobile homes are found in every community and throughout the county. The county would benefit from collecting data on these issues to improve future planning efforts.

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

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

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

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

Figure 3-18

Wind Chill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

Source: National Oceanic and Atmospheric Administration

Hazard Event History

Severe winter weather typically strikes Missouri more than once every year. Maries 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 Maries County. However, icy conditions often make roads hazardous and automobile accidents are frequent occurrences. Since 1996, more than $3.905 million in property damage has been reported from winter storms and extreme cold weather that affected Maries County.

A major winter storm on November 30, 2006, caused a combination of freezing rain, sleet, and heavy snow to fall over sections of southwest and central Missouri. The frozen precipitation began on the 30th and fell as freezing rain and sleet, with ice accumulations up to four inches in some areas. The second wave of precipitation occurred overnight causing large amounts of snow to accumulate over the ice. Maries County was one of several counties affected. Downed power lines resulted in widespread power outages. Many residents went without power for several days. A few weeks later, starting on January 12, 2007, an ice storm swept through the state and caused $3.3 million in damages from downed trees, and power lines in Maries County alone. The statewide damage estimate was almost $353 million.

According to the National Climatic Data Center, there have been a total of 23 extreme cold, snow or ice events reported in Maries County since 1996. 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 Maries County 1996-2013

Location	Date	Type	Magnitude	Property Damage
Multi-County	11/24/1996	Ice Storm	0 Deaths, 0 Injuries	$50,000
Multi-County	1/8/1997	Heavy Snow	0 Deaths, 0 Injuries	$5,000
Multi-County	12/20/1998	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/1/1999	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/12/2000	Extreme Cold/Wind Chill	0 Deaths, 0 Injuries	0
Multi-County	12/15/2000	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	1/1/2001	Extreme Cold/Wind Chill	0 Deaths, 0 Injuries	0
Multi-County	2/21/2001	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	3/2/2002	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	3/5/2003	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	1/25/2004	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	11/30/2006	Winter Storm	0 Deaths, 0 Injuries	$500,000
Multi-County	1/12/2007	Ice Storm	0 Deaths, 0 Injuries	$3,300,000
Multi-County	1/20/2007	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	12/9/2007	Ice Storm	0 Deaths, 0 Injuries	$50,000
Multi-County	2/11/2008	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	2/21/2008	Ice Storm	0 Deaths, 0 Injuries	0
Multi-County	1/26/2009	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	2/28/2009	Winter Storm	0 Deaths, 0 Injuries	0
Multi-County	2/1/2011	Blizzard	0 Deaths, 0 Injuries	0
Multi-County	2/21/2013	Winter Storm	0 Deaths, 0 Injuries	0
TOTALS			0 Deaths, 0 Injuries	$3,905,000

Source: NOAA, National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Likely Locations

While severe winter weather is more prevalent north of the Missouri River, it frequently strikes all of Maries 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. Winter storms typically occur from November through February. However, winter weather can occur as late as May or as early as October in Maries 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. Based on the prediction technology available, the CPRI rating assigned is Probable warning time of more than 24 hours (1). Duration of less than one week (3).

Severity/Magnitude

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 seven 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. For these reasons, the CPRI rating assigned is 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.

Probability

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. For these reasons, the CPRI rating assigned is Highly Likely (4) – Event is probable within one year—a near 100 percent probability of occurring.

Recommendations

- 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 Maries 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.

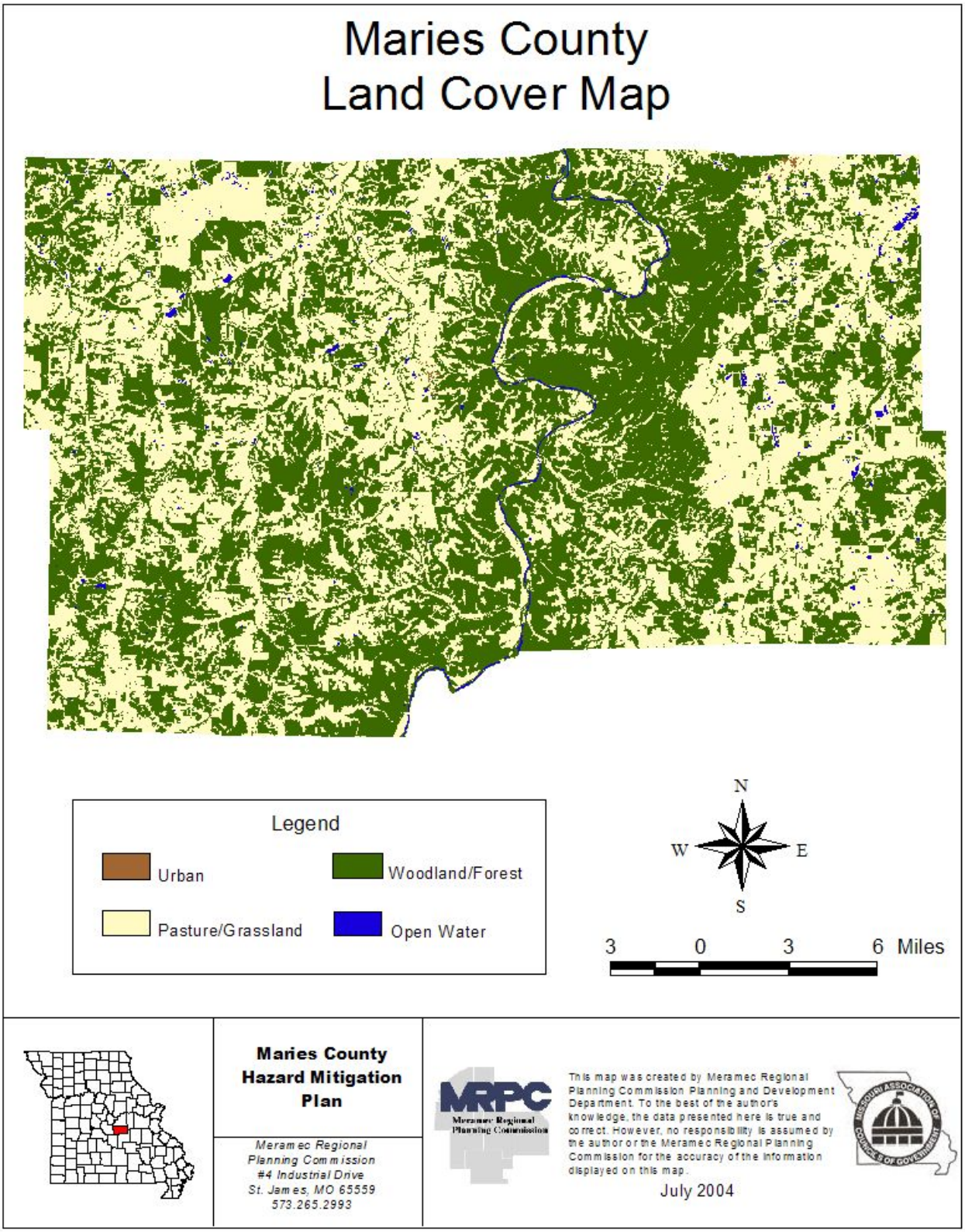
Forest fires have had a major impact on Missouri's forests. Burning the woods was a deep-rooted tradition in the Ozarks. It took many years of education to reduce the annual spring burning. Even now, some areas of the state still experience problems with fires deliberately set by arsonists. Humans cause 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 of damage to forests, wildlife habitat, watersheds, and property. The Department of Conservation and Forest Service rely on lookout towers, airplane petrol, and telephone reports to locate wildfires. Rural fire departments help these agencies suppress forest and grass fires in many parts of the state.[liv]

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. Maries County is primarily comprised of wooded, rural areas. There are several conservation areas within the county, with the largest being Spring Creek Gap. All of these tree-filled areas are significant possibilities for wildfire disasters. Figure 3-19 is a land cover map for Maries 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.

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 3-19


Maries County
Land Cover Map
Legend
Urban
Woodland/Forest
Pasture/Grassland
Open Water
N
W
E
S
3 0 3 6 Miles
Maries County
Hazard Mitigation
Plan
Meramec Regional
Planning Commission
#4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
Meramec Regional
Planning Commission
This map was created by 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.
July 2004

Hazard Event 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. During the 2012 fiscal year, there were more than 850 fires in the Ozarks region alone, which destroyed over 9,000 acres.[lv]

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.[lvi]

According to the Missouri Department of Conservation Forest Fire Reporting, there have been approximately 853 fires reported in Maries County between January 1, 1990 and January 1, 2014. The total acreage burned from those incidents was 3,328.75 acres. Two outbuildings were damaged and one outbuilding was destroyed by these fires.

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.[lvii]

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 CPRI ratings assigned for all jurisdictions in Maries County are Probable warning time of less than six hours (4). Duration of less than one day (2).

Severity/Magnitude

As long as drought conditions are not seriously inflamed, future wildfires in Maries County should have a negligible adverse impact on the county and its jurisdictions, as this hazard would affect a small percentage of the population. The history of the severity of wildfire in Maries County and all of its jurisdictions has been discussed earlier in this document. Based on the available historic data, the CPRI rating assigned is 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.

Probability

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 3-20 is a map showing the urban/wildland interface for Maries County. The city of Vienna shows a low density/no vegetation interface on the north, south and west portions of the community. On the east side of Vienna, the area would be classified as low density/intermixed. In the city of Belle, the southeast portion of the community is classified as low density interface. The north and south portions of the city are in an area classified as with the rest of the community being in an area considered medium density interface. The east side of Belle is considered very low density with no vegetation. The vast majority of the unincorporated areas of the county are considered very low density in population with and without vegetation. According to this map, there are no areas of Maries County or its jurisdictions which would be considered to have a high density

wildland/urban interface. The probability of wild fires is considered likely, but may increase to high during certain periods, such as spring, late fall, or under conditions of excessive heat, dryness, and/or drought. The likelihood of wildfire in unincorporated areas of Maries County has been assigned a CPRI rating of Highly Likely (4) – Event is probable within one year—a near 100 percent probability of occurring.

The probability of wildfire affecting the communities of Belle and Vienna has been assigned a CPRI rating of 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/likeliness for future occurrence would be less than that for communities in general. The probability of wildfire affecting the Maries County R-I and R-II school districts has been assigned a CPRI rating of Unlikely (1) - An event is probable within the next ten years—a 10 percent probability of occurring.

Recommendations

- 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.
- Prepare local fire departments for wildfire scenarios through training and education.
- 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 – Maries County

Calculated Priority Risk Index	Planning Priority
2.9	High

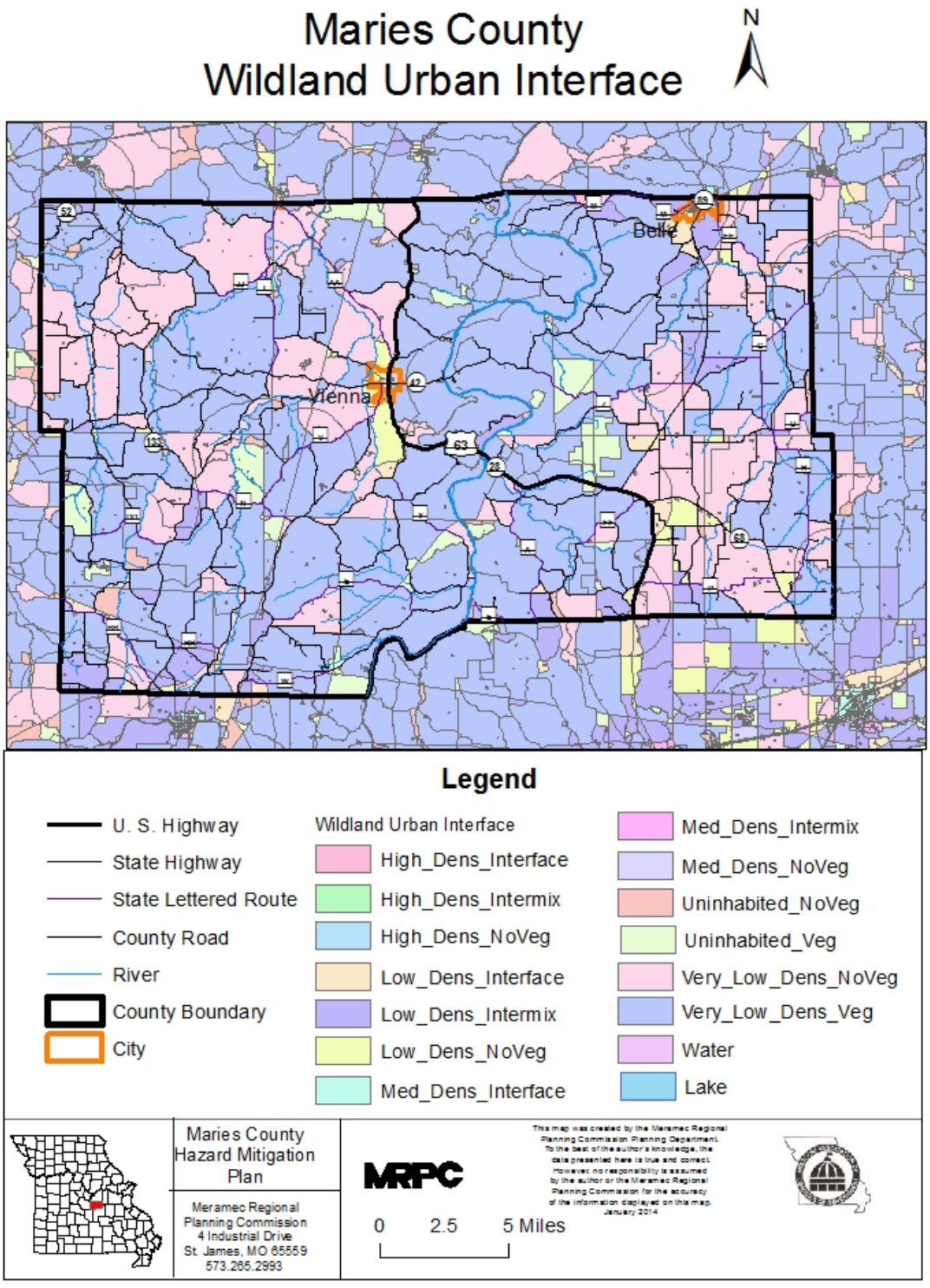
Hazard Summary – Wildfire – Belle and Vienna

Calculated Priority Risk Index	Planning Priority
2.45	Moderate

Hazard Summary – Wildfire – Maries County R-I and R-II School Districts

Calculated Priority Risk Index	Planning Priority
1.55	Low

Figure 3-20


Maries County
Wildland Urban Interface
N
Belle
Vienna
63
28
Legend
U. S. Highway
State Highway
State Lettered Route
County Road
River
County Boundary
City
Wildland Urban Interface
High_Dens_Interface
High_Dens_Intermix
High_Dens_NoVeg
Low_Dens_Interface
Low_Dens_Intermix
Low_Dens_NoVeg
Med_Dens_Interface
Med_Dens_Intermix
Med_Dens_NoVeg
Uninhabited_NoVeg
Uninhabited_Veg
Very_Low_Dens_NoVeg
Very_Low_Dens_Veg
Water
Lake
Maries County
Hazard Mitigation
Plan
Meramec Regional
Planning Commission
4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
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January 2014
0
2.5
5 Miles

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	Maries County	Belle	Vienna	Maries Co R-I	Maries Co R-II
Dam Failure	Low	Low	Low	Low	Low
Drought	Low	Low	Low	Low	Low
Earthquake	Moderate	Moderate	Moderate	Moderate	Moderate
Extreme Heat	High	High	High	High	High
Flood	High	High	High	High	High
Land Subsidence/ Sinkhole	Low	Low	Low	Low	Low
Severe Storms Hail/Wind	High	High	High	High	High
Tornado	Low	Low	Low	Low	Low
Severe Winter Weather	High	High	High	High	High
Wildfire	High	Moderate	Moderate	Low	Low

3.3 Vulnerability Assessment for Maries 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 $480,131,000 for Maries County. Residential housing makes up 74.6 percent of the total building value for Maries County, approximately $358,216,000. Non-residential building stock is valued at $121,915,000. 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 Maries County Building Stock

Occupancy	Exposure	Percent of Total
Residential	$358,216,000	74.6%
Commercial	$40,426,000	8.4%
Industrial	$36,513,000	7.7%
Agricultural	$9,317,000	1.9%
Religion	$9,565,000	2.0%
Government	$9,687,000	2.0%
Education	$16,407,000	3.4%
Total	$480,131,000	100.0%

Source: HAZUS-MH

Table 3.18 Unincorporated Maries County Building Stock

Occupancy	Building Count	Percent of Total
Residential	3,565	96.05%
Commercial	74	2.0%
Industrial	28	0.75%
Agricultural	31	0.84%
Religion	7	0.2%
Government	6	0.16%
Education	0	0%
Total	3,711	100.0%

Source: HAZUS-MH

Table 3.19 City of Belle Building Stock

Occupancy	Building Count	Percent of Total
Residential	733	92.78%
Commercial	38	4.81%
Industrial	6	0.76%
Agricultural	2	0.25%
Religion	6	0.76%
Government	3	0.39%
Education	2	0.25%
Total	790	100.0%

Source: HAZUS-MH

Table 3.20 City of Vienna Building Stock

Occupancy	Building Count	Percent of Total
Residential	224	82.35%
Commercial	28	10.3%
Industrial	4	1.5%
Agricultural	4	1.5%
Religion	2	.75%
Government	7	2.5%
Education	3	1.1%
Total	245	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 3.21 has a more comprehensive list of potential critical facilities. Not all of these examples may exist in Maries County.

Table 3.21 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 3.22 is an inventory of critical facilities and infrastructure in Maries 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 3.22 Critical Facilities and Infrastructure by Jurisdiction - Maries County

Facility	Maries County	Belle	Vienna	Total
Airports	1	0	0	1
Bridges	28	0	0	28
Communications Centers	1	0	0	1
Dams	30	0	0	30
Licensed Daycare Centers[lviii]	0	2	3	5
Elder Care/ Long Term Care Facilities[lixlx]	0	1	2	3
Health Care Facility	0	0	0	0
Fire Stations	4	1	1	6
EMS Stations	0	1	1	2
Emergency Operations Centers	0	0	0	0
Government Facilities	6	26	10	43
Law Enforcement Facilities	1	1	1	3
Major Interstate Highways	0	0	0	0
Military Installations	0	0	0	0
Railroads	0	0	0	0
Pipelines	3	0	0	3
Schools[lxi]	0	2	2	4
Emergency Shelters[lxii]	Not Available	Not Available	Not Available	Not Available
Wastewater Treatment Facilities	1	1	0	5
Public Wells	0	1	2	13

Source: Maries County Hazard Mitigation Planning Committee

There are 3 long term care facilities for the elderly and disabled in Maries County. They are located in Belle and Vienna. Table 3.23 provides specific information on the long term care facilities in Maries County.

Table 3.23 Long Term Elder Care and Elder Day Care Centers in Maries County

Elder Care Facility Name	Location	Capacity	Level of Licensure
Arbor Ridge Estates	Belle	30	RCF
Maries Manor	Vienna	98	SNF
Victorian Place of Vienna	Vienna	48	RCF

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

There are five licensed child daycare facilities in Maries County. Smaller daycares that do not have enough children to require licensing are not included as data is not available on these facilities. Table 3.24 provides information on the licensed daycare facilities in Maries County.

Table 3.24 Licensed Child Care Facilities in Maries County

Facility Name	Location	Facility Type
Missouri Ozarks Community Action, Inc.	Belle	Child Care Center
Reeves, Rata Lynn	Vienna	Family Home
Smith, Beth	Vienna	Family Home
Vineyard, Beverly	Vienna	Child Care Center
Walters, Jeana Rae	Belle	Group Home

Source: Missouri Department of Health and Senior Services

Other Assets

Vulnerability assessment involves more than just an inventory of critical infrastructure. It is also important to include assets of historic, cultural, natural and economic importance. Reasons for including these types of assets in the assessment are varied. The county may place priority on certain assets due to their uniqueness or irreplaceable nature. Having a list of these assets before a disaster can aid in their protection and restoration following an incident. In the case of historic structures, the rules for rebuilding or restoring them may be different or more restrictive than for ordinary buildings. Maries 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 wetlands 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 Maries County:

- Endangered, threatened, species of concern:
  - Mussels: Black Sandshell , Ebonyshell, Elephatear, Elktoe, Pink Mucket, Scaleshell and Spectaclecase;

- Fish: Alabama Shad, Crystal Darter, highfin Carpsucker and Niangua Darter
- Amphibians: Eastern Hellbender
- Insects: Frison's Seratellan Mayfly and the Ozark Stone (stonefly)
- Plants: Running Buffalo Clover

- Historic and Cultural Resources: Maries County Jail and Sheriff's Residence at Fifth and Mill streets in Vienna are listed as state historic sites.
- Economic Resources: Kingsford Charcoal near Belle, Maries County R-I School District in Vienna, Maries County R-II School District in Belle; Maries County Government; Maries Manor Nursing Home; Maries County Bank; Belle State Bank; South Central Regional Stockyards
- Natural Resources: there are seven state public use areas and conservation areas in Maries County; four significant springs; and three major watersheds.

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 3.25 Specific Community Assets in Maries County by Jurisdiction

Name of Asset	Replacement Value ($)	Occupancy/Capacity
Unincorporated Area (Including County Government Assets)		
County buildings (including courthouse, jail, county offices)	$4,211,783.00	N/A
Maintenance Building (1)	$115,763.00	N/A
Airport (1)	$2,828,305.00	N/A
County Highway Department Sheds (2)	$256,502.00	N/A
911 Dispatch Center in courthouse (1)	$128,610.00	N/A
Dams (30)	Information not available	N/A
Machine Shed (1)	$46,305.00	N/A
Transmission Tower (1)	$31,907	N/A
Belle		
Government Buildings - includes city hall, and other buildings owned by city (13)	$452,944.00	N/A
Fire Department	$512,400.00	N/A
Waste Water Facilities (9)	$41,221.00	N/A
City Wells and Water Towers (3)	$547,050.00	N/A
Community Center	$525,000.00	N/A
City Park Facilities (16)	$491,931.00	N/A
Vienna		
Government Buildings – includes city hall, and public works buildings/sheds (3)	$397,117.00	N/A

Name of Asset	Replacement Value ($)	Occupancy/Capacity
Senior Center (1)	$270,000.00	N/A
Park Facilities (7)	$346,000.00	N/A
Wells and Water Towers (3)	$641,800.00	N/A
Waste Water Facilities (4)	$929,486.00	N/A
Maries County R-I School District – Assessed Valuation $47,911,180		
Vienna Elementary		266
Vienna High School		270
Maries R-II School District – Assessed Valuation $60,288,646		
Belle Elementary School		356
Maries County Middle School		253
Belle High School		226

3.3.3 Vulnerability by Hazard

This section describes the overall vulnerability of Maries 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. 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 Maries County and Jurisdictions

Overview

Planning Significance: High. Overall vulnerability to flooding is highest in developed areas of the floodplains of the Gasconade 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 Maries 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 Maries County. There was a problem with the building damage county by general occupancy report generated by HAZUS. Although damage was reflected in other reports generated at the same time, this report indicated that there were no structures that would be damaged in a 100-year flood. Instead, aerial photographs of the 100-year floodplain were reviewed. 24 structures were identified as being

located in the floodplain and likely to be damaged in the event of a 100-year flood. All of these structures were in unincorporated areas of the county. No other jurisdictions were found to have structures located in the floodplain. The HAZUS report Building Damage by General Occupancy showed that there were religious, commercial, industrial and agricultural structures located in the floodplain, but review of aerial photos of the floodplain showed residential structures only. The breakdown of percentage of damage was used to determine the level of damage done to these 24 structures. Twenty percent (two structures) of these structures would not be affected; .4 (0 structures) percent would have 1-10 percent damage; three percent (one structure) would have 11-20 percent damage; 4.6 percent (one structure) would have 21 to 30 percent damage; nine percent (two structures) would have 31-50 percent damage; 17 percent (four structures) would have 41 – 50 percent damage and 46 percent (11 structures) would be substantially damaged by a 100-year flood.

According to HAZUS data, 85.3 percent of the structures in Maries 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 and review of aerial maps of the floodplain, 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, capital related loss, rental income loss and wage loss. As mentioned earlier, there were some anomalies in the flood data provided. The information in Table 3.26 is based on the data provided and may have some insufficiencies. Based on the data available and analysis, the unincorporated portions of Maries County are the most vulnerable to flood losses.

Table 3.26 Estimated Direct Economic Flood Losses by Jurisdiction

Jurisdiction	Building Damage	Contents Damage	Inven-tory Damage	Reloca-tion Loss	Capital Related Loss	Rental Income Loss	Wage Loss	Total	% of Total
Unincorp. Maries Co	$3,735,000	$2,973,000	$86,000	-0-	$2,000	-0-	$2,000	$6,798,000	100%
Belle	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Vienna	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL	$3,735,000	$2,973,000	$86,000	-0-	-0-	-0-	$2,000	$6,798,000	100%

Source: HAZUS-MH MR3

Total economic losses for Maries County in the 100 year flood scenario are estimated at $6.798 million. The total building related losses were $6.794 million (building damage, contents damage, inventory damage and rental income loss) –1.4 percent of the total value of the county's structures.

Tables 3.27 through 3.29 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 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. It was determined that the structures showing in the floodplain were residential, with no other types of buildings located in flood hazard areas. This method provided an estimate of the number and type of buildings that would be damaged in a 100-year flood.

Table 3.27 Estimated Damaged Building Count for Belle- Flood

Occupancy	Total Building Count	Number of Buildings in the 100-Year Floodplain	Estimated Number of Buildings Damaged
Residential	733	0	0
Commercial	38	0	0
Industrial	6	0	0
Agricultural	2	0	0
Religion	6	0	0
Government	3	0	0
Education	2	0	0
Total	790	0	0

Source: HAZUS-MH

Table 3.28 Estimated Damaged Building Count for Vienna - Flood

Occupancy	Total Building Count	Number of Buildings in the 100-Year Floodplain	Estimated Number of Buildings Damaged
Residential	224	0	0
Commercial	28	0	0
Industrial	4	0	0
Agricultural	4	0	0
Religion	2	0	0
Government	7	0	0
Education	3	0	0
Total	272	0	0

Source: HAZUS-MH

Table 3.29 Estimated Damaged Building Count for Maries County

Occupancy	Total Building Count	Estimated Number of Buildings Damaged IN 100-Year Flood
Residential	3,565	24
Commercial	74	0
Industrial	28	0
Agricultural	31	0
Religion	7	0
Government	6	0
Education	0	0
Total	3,711	24

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 9,176, approximately 177 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 eight will seek temporary shelter in public shelters.

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 3-21 shows critical facilities in relation to the 100-year floodplain. Figure 3-22 shows transportation infrastructure in relation to the 100-year floodplain, including highways, bridges, bus stations, airports and railroads. Past history shows that Maries County secondary roads, low water crossings and bridges have sustained damage in past flood incidents. Figure 3-23 shows the pipelines in the county in relation to the 100-year floodplain.

Flood Vulnerability: Critical Facility Locations by City

Figures 3-21 and 3-25 map the locations of critical facilities in relation to the 100-year floodplain for the incorporated cities of Maries 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 or in any unincorporated areas of the county.

National Flood Insurance Program and Repetitive Loss Properties

Of the three local government jurisdictions participating in this plan, two are currently participating in the National Flood Insurance Program (NFIP): Maries County and the City of Vienna. The City of Belle does not participate in the NFIP. According to repetitive loss data provided by SEMA, there are 15 repetitive loss properties located in unincorporated Maries

County. One of the 15 properties has been mitigated. There are also two severe repetitive loss properties - one that has had four losses and one that has had two losses.

Figure 3-21

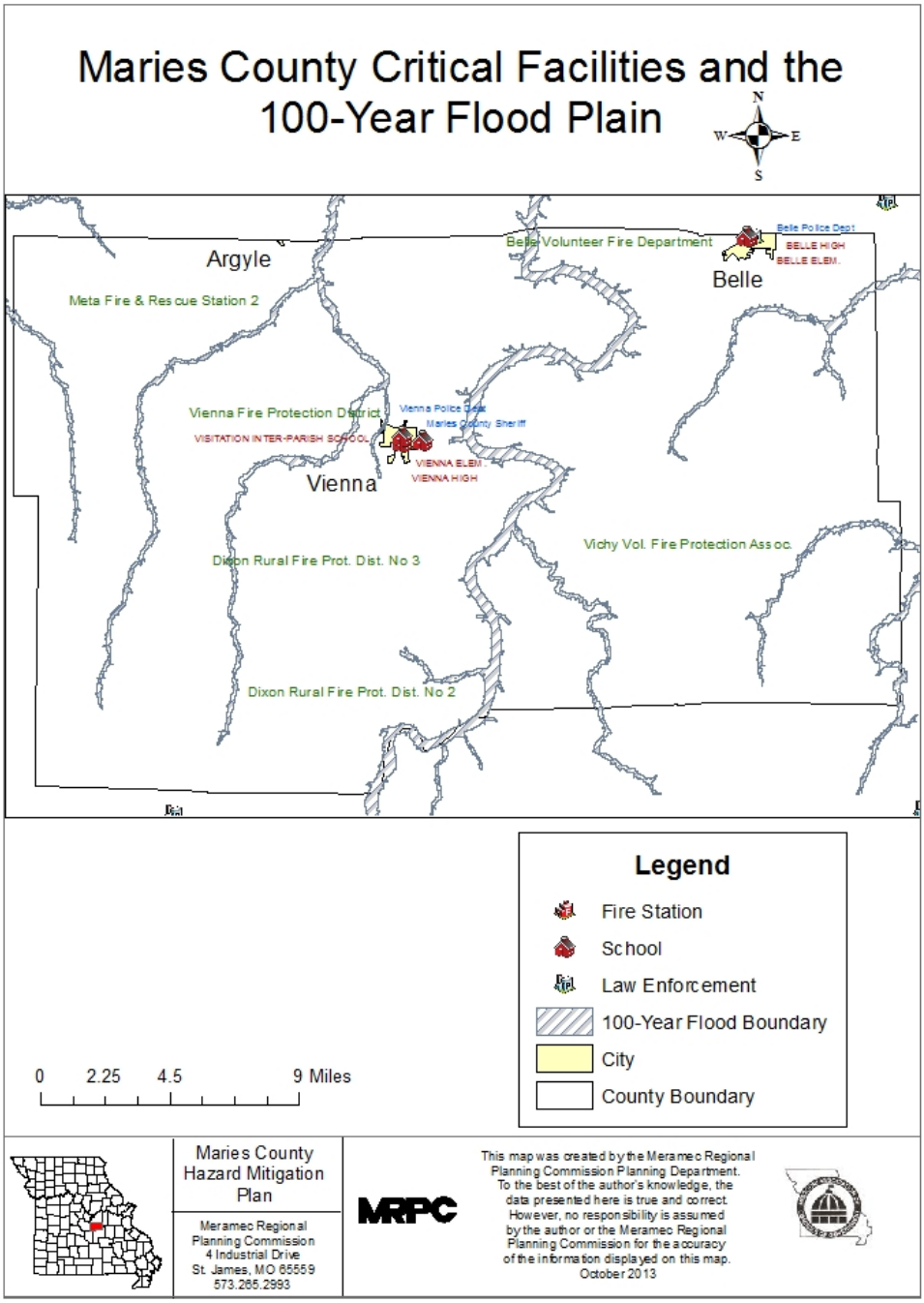


Figure 3-22

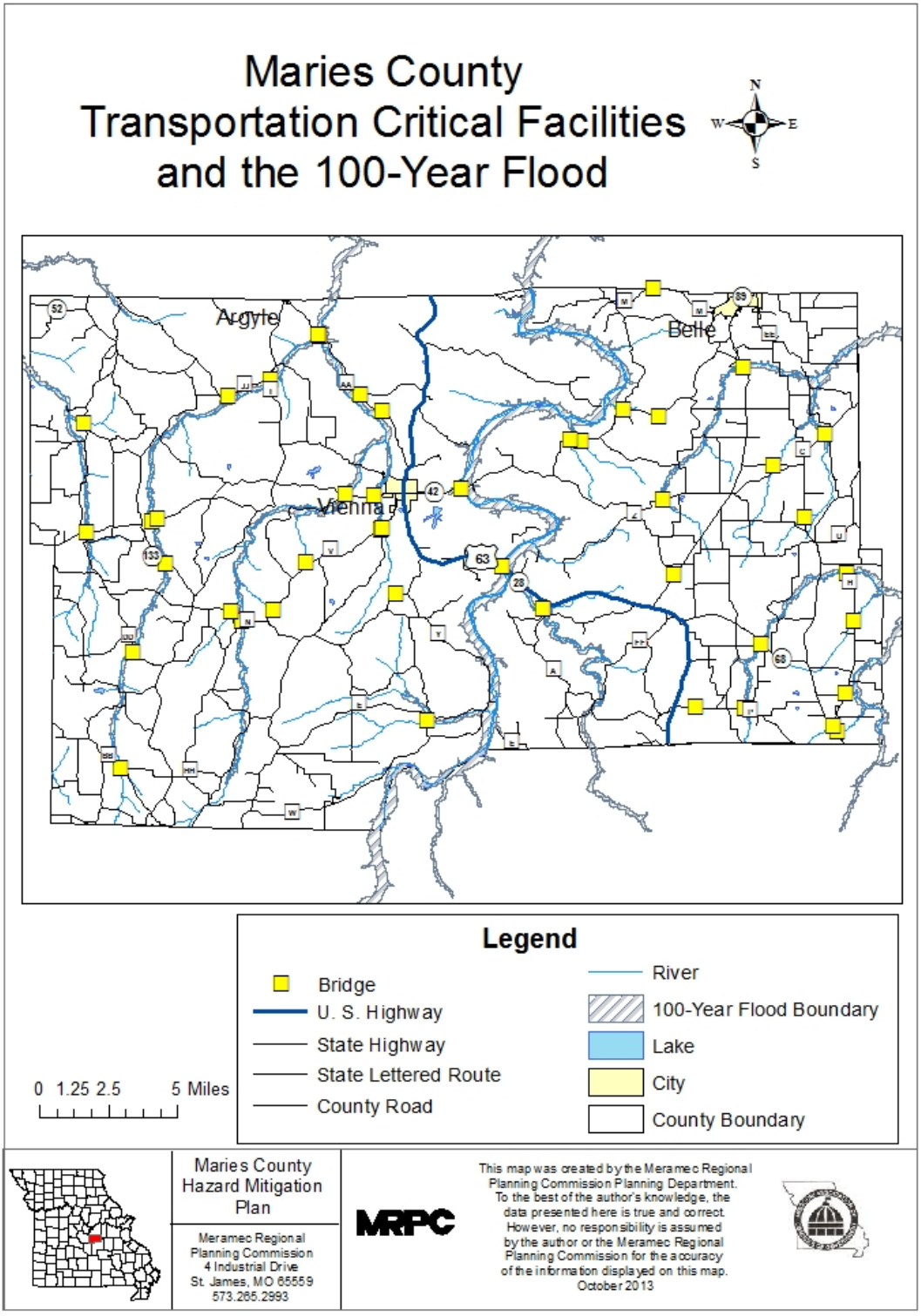
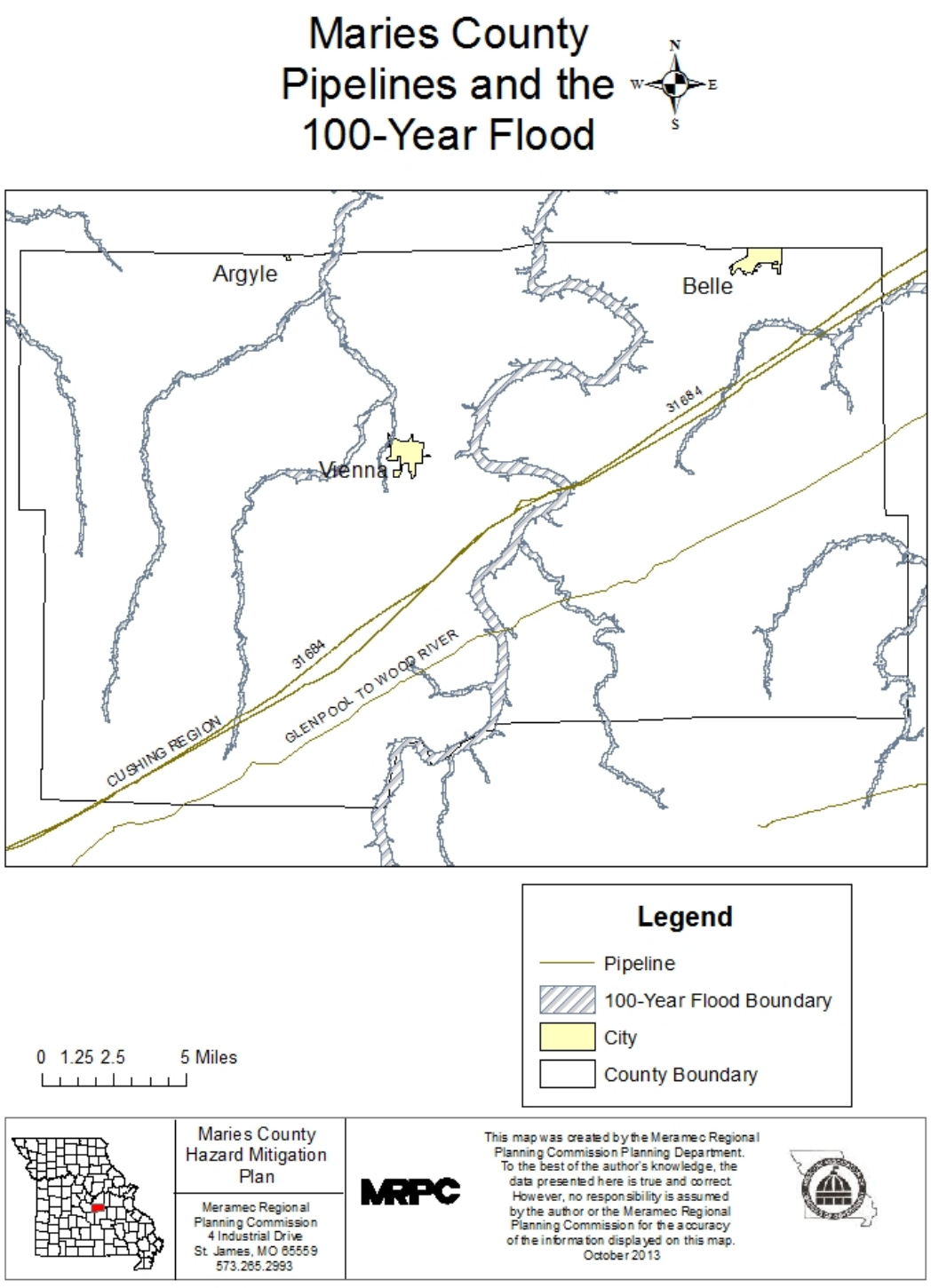

Maries County
Transportation Critical Facilities
and the 100-Year Flood
N
W
E
S
Argyle
Belle
Vienna
52
89
42
133
63
28
68
Legend
Bridge
U. S. Highway
State Highway
State Lettered Route
County Road
River
100-Year Flood Boundary
Lake
City
County Boundary
0 1.25 2.5 5 Miles
Maries County
Hazard Mitigation
Plan
Meramec Regional
Planning Commission
4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
This map was created by the Meramec Regional
Planning Commission Planning 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.
October 2013

Figure 3-23


Maries County
Pipelines and the
100-Year Flood
N
W
E
S
Argyle
Belle
Vienna
31684
31684
CUSHING REGION
GLENPOOL TO WOOD RIVER
Legend
Pipeline
100-Year Flood Boundary
City
County Boundary
0 1.25 2.5 5 Miles
Maries County
Hazard Mitigation
Plan
Meramec Regional
Planning Commission
4 Industrial Drive
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Planning Commission for the accuracy
of the information displayed on this map.
October 2013

Figure 3-24

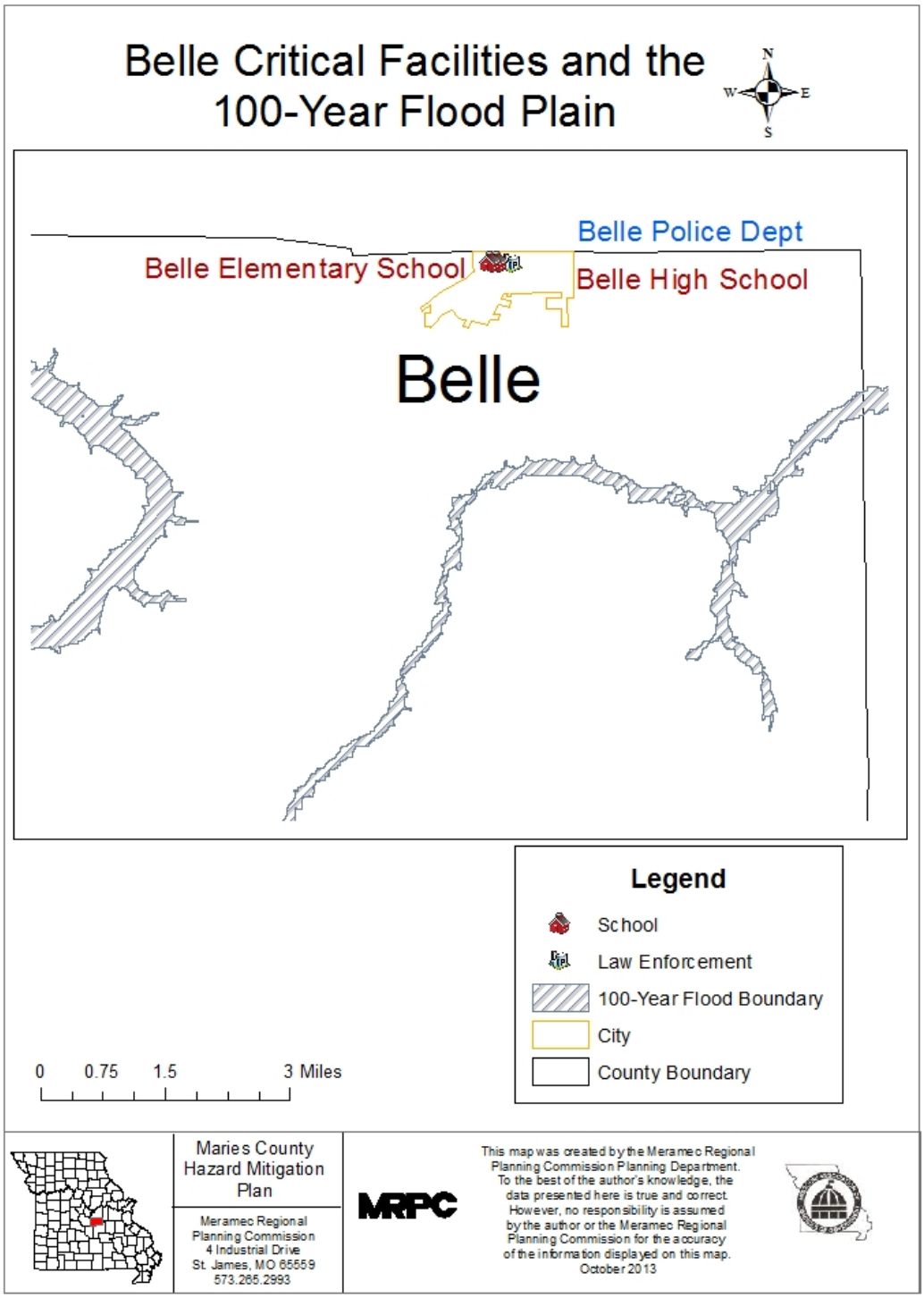
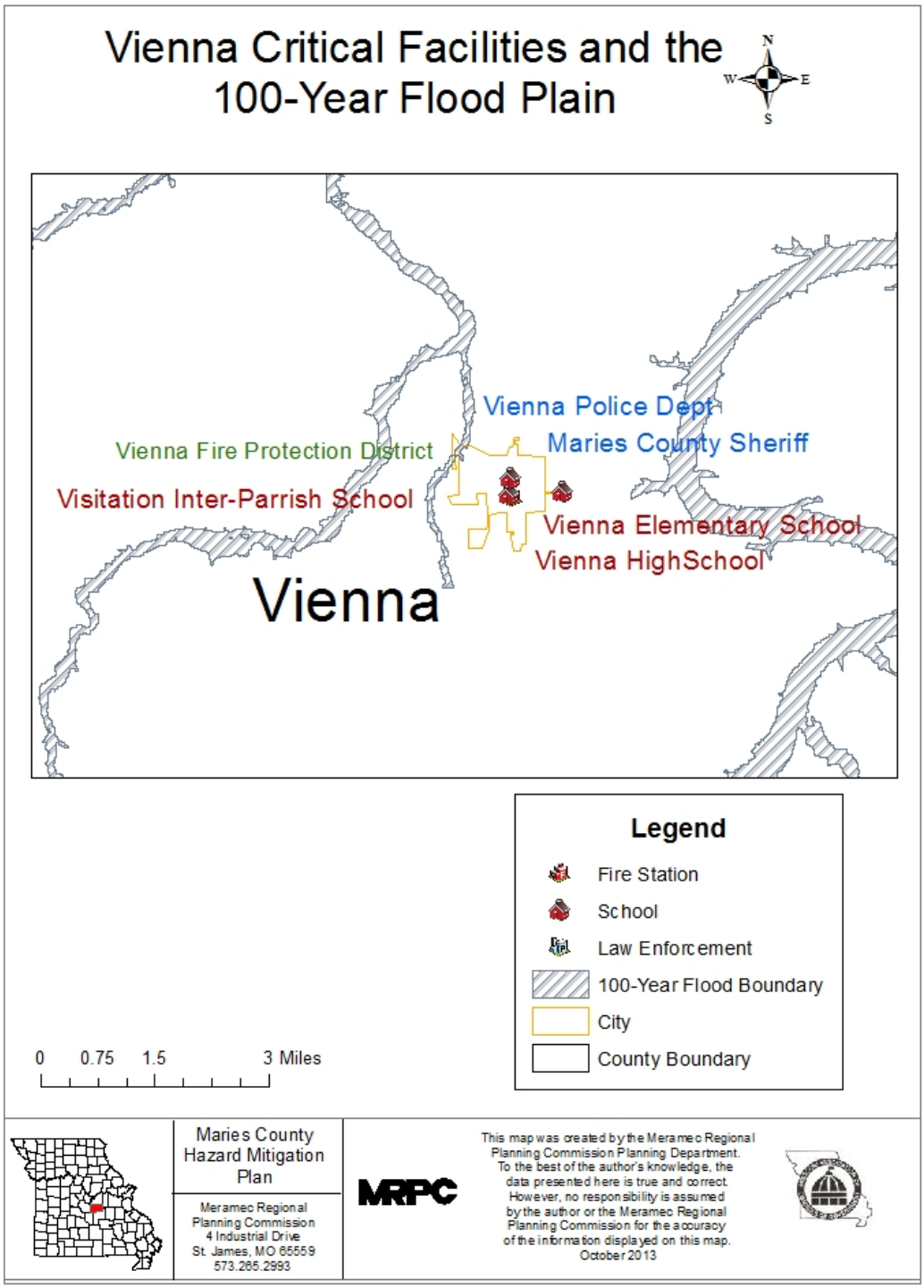

Belle Critical Facilities and the 100-Year Flood Plain
N
W
E
S
Belle Police Dept
Belle Elementary School
Belle High School
Belle
Legend
School
Law Enforcement
100-Year Flood Boundary
City
County Boundary
0 0.75 1.5 3 Miles
Maries County Hazard Mitigation Plan
Meramec Regional Planning Commission
4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
This map was created by the Meramec Regional Planning Commission Planning 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.
October 2013

Figure 3-25


Vienna Critical Facilities and the 100-Year Flood Plain
N
W
E
S
Vienna Police Dept
Maries County Sheriff
Vienna Fire Protection District
Visitation Inter-Parrish School
Vienna Elementary School
Vienna HighSchool
Vienna
Legend
Fire Station
School
Law Enforcement
100-Year Flood Boundary
City
County Boundary
0 0.75 1.5 3 Miles
Maries County Hazard Mitigation Plan
Meramec Regional Planning Commission
4 Industrial Drive
St. James, MO 65559
573.265.2993
MRPC
This map was created by the Meramec Regional Planning Commission Planning 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.
October 2013

Dam Failure Vulnerability of Maries 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. Although there are six dams in the county rated as high hazard by the Missouri Department of Natural Resources, there has never been a dam failure in the county and there is very little development that would be affected if a dam should fail. During the vulnerability assessment it was determined that the city of Vienna was slightly more vulnerable to damage from dam failure than other jurisdictions due to the location of a dam just outside of the city limits Failure of this dam could cause damage to one or more streets, and nearby properties– but because a dam failure would still affect less than 10 percent of the communities buildings and infrastructure – it was scored the same as the rest of the jurisdictions. There have been no incidents of dam failure, nor of injuries or property damage. 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 Maries 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 city of Vienna has 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 the dam located just outside of the community.

Drought Vulnerability of Maries 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 Maries County or the jurisdictions located in the county. Drought is not a hazard that would typically result in damage to structures or infrastructure. The probability for drought in the area is low due to geographic location and historic weather patterns and due to high quality groundwater resources drought is not considered a significant threat to the area. The threat of drought would have no effect on future development in Maries 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 scenario provided by SEMA uses a 7.7 magnitude earthquake – which is significant. Although the HAZUS scenario shows damage to buildings in Maries County, there will be little impact to critical infrastructure and no effect on the functionality of critical services. Damage will impact less than 10 percent of building stock. 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.

Methodology

FEMA's software programs for estimating potential losses from disasters, HAZUS-MH was used to generate a scenario of a magnitude 7.7 earthquake occurring on the New Madrid Fault. Once the earthquake scenario was generated, the software uses census-block level population and building and infrastructure inventory data to estimate damage and the number of people potentially displaced by the event. Although the damage estimates created seem significant, when compared to building stock values, the damage is still less than 10 percent and so considered negligible.

Estimated Potential Losses to Existing Development

It is highly unlikely that even a major earthquake in southeast Missouri would cause more than negligible damage in Maries County. According to the Modified Mercalli Scale, the earthquake would likely be felt by most residents and they might experience the movement of some heavy furniture and fallen plaster. Damage to existing development would be slight.

HAZUS data was the best available data, but the reports generated for Maries County were strikingly different from the reports generated for surrounding counties and so there may be a problem with the data. 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. The

The HAZUS generated reports estimated that 920 structures in the county could have up to moderate damage, with 39 buildings damaged beyond repair. The expected damage by occupancy is illustrated in Table 3.26.

According to HAZUS, a 7.7 magnitude quake would result in $8.8 million in structural building damages, or a little over one percent of the total building stock value for the county ($851 million). HAZUS does not provide a breakdown of estimated building losses by jurisdiction. Table 3.27 provides an estimate of building losses by jurisdiction assuming that losses would be equal across the county and two cities.

Table 3.26 Estimated Building Damage Count by Occupancy

Building Type	No Damage	Slight Damage	Moderate Damage	Extensive Damage	Complete Damage	Totals
Agriculture	13	8	10	5	1	37
Commercial	51	34	35	15	4	139
Education	2	1	1	0	0	4
Government	6	4	4	1	0	15
Industrial	13	9	10	5	1	38
Residential	2618	1,125	621	170	32	4,566
Religion	7	3	3	1	0	14
Total	2,710	1,184	685	198	39	4,816

Source: HAZUS-MH

Table 3.27 Estimated Earthquake Losses by Jurisdiction *(Millions of Dollars)*

Jurisdiction	Building Damage (structural and non-structural)	Contents Damage	Inventory Damage	Relocation Damage	Capital Related Loss	Rental Income Loss	Wage Loss	Total	% of Total
Unincorporated Maries County	$27.24	$6.92	$.26	$4.23	$0.71	$1.30	$1.15	$41.81	78%
Belle	$5.93	$1.51	$0.06	$0.92	$0.15	$0.28	$0.25	$9.10	17%
Vienna	$1.76	$0.45	$0.01	$0.27	$0.05	$0.09	$0.08	$2.71	5%
TOTAL	$34.93	$8.88	$0.33	$5.42	$0.91	$1.67	$1.48	$53.62	100%

Source: HAZUS-MH

Total economic losses for Maries County in the 7.7 magnitude earthquake scenario are estimated at $53.62 million, with $4.06 million in losses related to income, wage and rental income losses.

Based on the HAZUS reports, critical facilities would not be heavily damaged and there would be little if any interruption of critical services. The report estimated that three bridges in the county might sustain damage but would remain functional. In regards to potential population displacement, the report indicated that as many as 22 households might be displaced and of this number, 13 might seek temporary shelter in public shelters.

Future Development

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

Extreme Heat Vulnerability of Maries 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, estimates shown in Table 3.28 compares the percentage of persons over age 65 and the percentage of persons below the federal poverty line living in Maries County and its jurisdictions to averages for Missouri and the United States.

Table 3.28 Maries 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
Maries County	9,176	18.0	14.3
Belle	1,545	21.5	32.4
Vienna	610	12.4	12.6

**Source: 2010 U. S. Census*
***Source: www.city-data.com (2009 estimates)*

The City of Belle has a higher than average percentage of people over the age of 65 as well as as individuals living below the poverty level. According to the 2010 U.S. Census, the average rate of poverty in Missouri is 15 percent, with a national average of 14.9 percent. The City of Vienna's poverty rate is slightly below the average, as is the County overall, while Belle's poverty rate is considerably higher. Both of these populations are vulnerable to the effects of heat waves. The power grid in Maries 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 3.23 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 Maries County. It is anticipated that growth will continue at a slow but steady level into the future.

Landslide Vulnerability of Maries 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 Maries 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 has been only one recorded landslide in the county or its communities, and it resulted in negligible damage and no injuries, 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 Maries County.

Land Subsidence/Sinkhole Vulnerability of Maries 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 Maries 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 Maries County.

Severe Storms Hail/Wind Vulnerability of Maries 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 Maries 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 1957 through 2013, Maries County reported a total of $122,000 in property damage from severe storm winds. There was $5,000 in damages reported attributed to hail. Most of the property damage caused from storms is covered by private insurance and data is not available. As stated earlier, most damage from these types of storms occurs to vehicles, roofs, siding and windows and cost data is not available for property damage covered by private insurance.

Based on CPRI scores and the rating system used 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 3.29 Estimated Damaged Building Count for Belle - 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	733	66	7
Commercial	38	3	0
Industrial	6	1	0
Agricultural	2	0	0
Religion	6	1	0
Government	3	0	0
Education	2	0	0
Total	790	71	7

Source: HAZUS-MH

Table 3.30 Estimated Damaged Building Count for Vienna - 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	224	20	2
Commercial	28	3	0
Industrial	4	0	0
Agricultural	4	0	0
Religion	2	0	0
Government	7	1	0
Education	3	0	0
Total	272	24	2

Source: HAZUS-MH

Table 3.31 Estimated Damaged Building Count for Maries 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	3,565	321	36
Commercial	74	7	1
Industrial	28	3	0
Agricultural	31	3	0
Religion	7	1	0
Government	6	1	0
Education	0	0	0
Total	3,711	336	36

Source: HAZUS-MH

Table 3.32 Estimated Damaged Building Count for Maries County R-I 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
2	.18	.02

Source: www.dese.mo.gov/directory

Table 3.33 Estimated Damaged Building Count for Maries County R-I 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
3	.27	.03

Source: www.dese.mo.gov/directory

Future Development

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

Severe Winter Storm Vulnerability of Maries County and Jurisdictions

Overview

Planning Significance: High. All of Maries 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 3.34 Estimated Damaged Building Count for Belle – 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	733	66	7
Commercial	38	3	0
Industrial	6	1	0
Agricultural	2	0	0
Religion	6	1	0
Government	3	0	0
Education	2	0	0
Total	790	71	7

Source: HAZUS-MH

Table 3.35 Estimated Damaged Building Count for Vienna – 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	224	20	2
Commercial	28	3	0
Industrial	4	0	0
Agricultural	4	0	0
Religion	2	0	0
Government	7	1	0
Education	3	0	0
Total	272	24	2

Source: HAZUS-MH

Table 3.36 Estimated Damaged Building Count for Maries 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	3,565	321	36
Commercial	74	7	1
Industrial	28	3	0
Agricultural	31	3	0
Religion	7	1	0
Government	6	1	0
Education	0	0	0
Total	3,711	336	36

Source: HAZUS-MH

Table 3.37 Estimated Damaged Building Count for Maries County R-I 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
2	.18	.02

Source: www.dese.mo.gov/directory

Table 3.38 Estimated Damaged Building Count for Maries County R-I 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
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 Maries County and Jurisdictions

Overview

Planning Significance: Low. Based on the history of frequency and severity of tornados in Maries County, this hazard was ranked as a low risk due to the few number of tornados that have occurred in the last 50 plus years; relative low cost of damages caused; and no deaths. 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 six tornados have occurred in Maries County between 1957 and 2014. Total damages were $5.1275 million during the 57 year period. Of that total, $5 million was caused by one tornado event in July of 2008 when it caused damage at the Rolla Regional Airport. No one has been killed by a tornado and there has been one tornado related injury 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 Maries 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

Maries County has never experienced a tornado greater than an F2. Two tornados were classified as F1 and two were F0. Historical data statewide 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 six recorded events, three resulted in damages costing $25,000 or less. One had damages of $75,000. One tornado caused $5 million in damages and one resulted in no damage in the county. If the total losses are averaged over the 57 year period, the annual cost of tornados in Maries County is $89,956.00.

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 negligible – less than 10 percent of property severely damaged. All damage estimates have been figured using one percent and nine percent. School district properties are included in the city and county tables, however, separate tables were developed for each school district based on one percent and nine 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 3.39 Estimated Damaged Building Count for Belle - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	733	66	7
Commercial	38	3	0
Industrial	6	1	0
Agricultural	2	0	0
Religion	6	1	0
Government	3	0	0
Education	2	0	0
Total	790	71	7

Source: HAZUS-MH

Table 3.40 Estimated Damaged Building Count for Vienna - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	224	20	2
Commercial	28	3	0
Industrial	4	0	0
Agricultural	4	0	0
Religion	2	0	0
Government	7	1	0
Education	3	0	0
Total	272	24	2

Source: HAZUS-MH

Table 3.41 Estimated Damaged Building Count for Maries County - Tornado

Occupancy	Total Building Count	Estimated Number of Buildings Damaged With 9% Worst Case Damage	Estimated Number of Buildings Damaged With 1% Minimal Damage
Residential	3,565	321	36
Commercial	74	7	1
Industrial	28	3	0
Agricultural	31	3	0
Religion	7	1	0
Government	6	1	0
Education	0	0	0
Total	3,711	336	36

Source: HAZUS-MH

Table 3.42 Estimated Damaged Building Count for Maries County R-I School District - Tornado

Total Building Count	Estimated Number/Percentage of Buildings Damaged With 9% Worst Case Damage	Estimated Number/Percentage of Buildings Damaged With 1% Minimal Damage
2	.18	.02

Source: www.dese.mo.gov/directory

Table 3.43 Estimated Damaged Building Count for Maries County R-I School District - Tornado

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

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 Maries County and Jurisdictions

Overview

Planning significance: High for unincorporated areas of Maries 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 3.2.11), historically there have been 853 fires reported between January 1, 1990 and January 1, 2014. The total acreage burned from those incidents was 3,328.75 acres. Two outbuildings were damaged and one outbuilding was destroyed by 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 Missouri Department of Conservation lands, 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 Maries 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, Maries County has had little 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 3.44 Estimated Damaged Building Count for Belle - 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	733	66	7
Commercial	38	3	0
Industrial	6	1	0
Agricultural	2	0	0
Religion	6	1	0
Government	3	0	0
Education	2	0	0
Total	790	71	7

Source: HAZUS-MH

Table 3.45 Estimated Damaged Building Count for Vienna - 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	224	20	2
Commercial	28	3	0
Industrial	4	0	0
Agricultural	4	0	0
Religion	2	0	0
Government	7	1	0
Education	3	0	0
Total	272	24	2

Source: HAZUS-MH

Table 3.46 Estimated Damaged Building Count for Maries 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	3,565	321	36
Commercial	74	7	1
Industrial	28	3	0
Agricultural	31	3	0
Religion	7	1	0
Government	6	1	0
Education	0	0	0
Total	3,711	336	36

Source: HAZUS-MH

Table 3.47 Estimated Damaged Building Count for Maries County R-I 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
2	.18	.02

Source: www.dese.mo.gov/directory

Table 3.48 Estimated Damaged Building Count for Maries County R-I 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
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 3.49 shows the changes in population for Maries County and its jurisdictions.

Table 3.49 Historic Population Trends for Maries County and Jurisdictions

Jurisdiction	Maries County	Belle	Vienna
2010 Population	9,176	1,545	610
% Change	3.1	15	-2.9
2000 Population	8,903	1,344	628
% Change	11.6	10.3	2.8
1990 Population	7,976	1,218	611
% Change	5.6	-1.2	18.9
1980 Population	7,551	1,099	514
% Change	10.2	-3	1.8
1970 Population	6,851	1,133	505
% Change	-5.9	11.5	-5.8
1960 Population	7,282	1,016	536
% Change	-1.9	12.1	13.8
1950 Population	7,423	906	471
% Change	-14.1	45.9	-8.7

Source: U.S. Census Bureau

According to the Missouri Office of Administration, Division of Budget and Planning, the population for Maries County is projected to grow slightly over the next 20 years at a rate of 2.7 to 3.0 per decade. Much of the growth since 1970 can be attributed to growth in adjacent Phelps County and the nearby state capitol of Jefferson City. Belle has seen significant growth over the past two decades – 10.3 percent in the 2000 Census and 15 percent in the 2010 Census. Vienna's population has remained fairly constant since 1990. Maries County is the smallest county by population in the Meramec Region, but overall the county continues to see steady, though slow growth.

3.3.5 Summary of Key Issues

In comparison to the 2006 Hazard Mitigation plan, no significant changes have been made to the vulnerability assessment other than providing a more in-depth study, analysis and incorporating additional data and hazards. The general premise and outcomes remain largely the same with additional and updated information and clarification provided for all hazards. A more in-depth method of scoring and ranking the hazards was used in the plan revision. Table 3.50 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 3.50 Maries County Hazard Ranking High to Low Planning Significance

Hazard Type	Probability	Magnitude	Warning Time	Duration	CPRI	Planning Priority
Dam Failure	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 -Maries Co. -Belle Vienna Maries R-I Maries R-II	 4 4	 2 2	 4 4	 3 2	 3.0 2.9	 High High
Land Subsidence/ Sinkholes	1	1	4	3	1.45	Low
Severe Storm (Hail storm/Wind storm)	4	1	4	1	3.0	High
Tornado	1	2	4	1	1.75	Low
Severe Winter Storm	4	1	1	3	2.55	High
Wildfire – County Cities Schools	4 3 1	1 1 1	4 4 4	2 2 2	2.9 2.45 1.55	High Moderate Low

Sources: Maries 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

- The City of Belle does not currently participate in the National Flood Insurance Program.
- 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, including state highways 42 and 63. Highway 63 is the main north south

route through the region. Detours around the Gasconade River bridge on Highway 63 can be time consuming. Shutdowns typically last two or three days and can have a significant impact on travel in and through the area.
- A number of homes that flooded in the past did not have flood insurance.
- There are a number of low water bridges in the county that could be mitigated
- There are a number of vulnerable properties 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 Maries County is not located in an area that will likely see catastrophic 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 Maries 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

- Maries County has had an average cost of approximately $90,000 per year from tornado events and one documented injury.
- 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

- Maries County has frequent wildfires and is considered high risk for wildfire. Those areas of the county where population and vegetation densities are greater are at higher risk of property damage and potential for injuries should a wildfire occur.
- Belle and Vienna 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.

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[vi] United States Geological Survey Fact Sheet 131-02. October 2002
[vii] Ibid.
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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 Maries 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 Maries 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 Maries 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 Maries County and reduce hazards by the greatest amount. During the 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 Maries 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 Maries 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 Maries 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. The following categories of mitigation were considered when developing the mitigation actions:

1. Prevention tools: regulatory methods such as planning and zoning, building regulations, land development regulations and storm water management.
2. Property protection measures: acquisition of land, relocation of buildings, modifying at-risk structures and flood-proofing at-risk structures.
3. Natural resource protection: erosion and sediment control or wetlands protection.
4. Emergency services measures: warning systems, response capacity, critical facilities protection and health and safety maintenance.
5. Structural mitigation: reservoirs, levees, diversions, channel modifications and storm sewers.
6. Public information – providing hazard maps and information, outreach programs, real estate disclosure, technical assistance and education.

No changes were made to the overarching goals established in 2005. 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 he 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 2006 Plan Action Items

Action Item Number	Mitigation Action	Assessment for Update	Hazard(s) Addressed
1	Implement building codes in all cities.	**Modified** – The city of Belle has building codes. The city of Vienna does not have codes but does have an ordinance that allows the city council to conduct inspections. Modified as follows*: "Encourage the adoption of minimal standards for building codes in all cities."*	Earthquake Wildfire Tornado/Wind Flood
2	Keep trees trimmed around utility lines.	**Completed** – Addressed. Electric coops have initiated aggressive tree trimming programs throughout the county.	Winter Storm Tornado/Wind Thunderstorm
3	Trees trimmed/ removed near roads.	**Modified** – The county and cities have tree trimming programs in place but this is an on-going action item. Modified as follows: *"Encourage the cities' and county's tree trimming programs that reduce damages during high winds and severe winter storms while also encouraging dead tree removal."*	Winter Storm Tornado/Wind Thunderstorm
4	Alternative/temporary housing shelters.	**Modified** and combined with #23 – The county EMD has established a list of local shelters that can be opened during times of need. These shelters can be used as warming or cooling shelters and/or to temporarily house people who have been displaced during an event. However, this is an ongoing activity that requires regular review and update. Modified as follows*: "Continue to maintain a list of locations that can serve as shelters and establish MOUs with the appropriate organizations responsible for those facilities.*"	Winter Storm Tornado/Wind Extreme Heat Earthquake Flood
5	Expand/upgrade early warning systems.	**Modified** – *"Continue to encourage local jurisdictions to obtain early warning systems and improved communications systems and encourage citizens to purchase weather radios."* Local governments should continue to explore methods of providing early warning to the citizens of the county.	Tornado/Wind
6	Development of CERT program.	**Modified**– The county has had CERT trainings for both adults and teens, coordinated by the Region I HSOC, but will continue to promote and expand this program. Modified as follows*: "Continue to promote the development of CERTs throughout the county through training opportunities and public awareness."*	All Hazards
7	Citizen preparedness program.	**Modified** – The county EMD and local fire departments currently distribute "Ready-in-3" brochures and other preparedness materials, but this is an on-going program. Modified as follows: *"Implement an education/ awareness program on personal emergency preparedness that encourages residents to prepare emergency kits that include water, blankets, flashlights, etc.; shut down utilities; and that will allow individuals to be self-sufficient for one to three days in the event of a*	All Hazards

Action Item Number	Mitigation Action	Assessment for Update	Hazard(s) Addressed
		disaster."	
8	County-wide disaster drill.	Modified - The county currently participates in local and regional emergency drills coordinated by SEMA and/or the MREPC. These drills have been both tabletop and full-scale. As this is an on-going activity, the action item has been left in the plan and modified as follows: *"Continue to participate in local, county-wide, regional and state-wide drills and exercises."*	All Hazards
9	More training (evacuation drills, etc.)	Modified – The county EMD and local emergency response agencies continue to work to provide additional training for emergency responders, schools and local governments. Modified as follows: *"Continue to encourage and facilitate training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and businesses)."*	All Hazards
10	Business/government disaster plans.	Modified – *"Promote the development of emergency plans by businesses and local governments."*	All Hazards
11	Address flood-prone areas.	Modified – *"Educate residents about the dangers of floodplain development and benefits of the National Flood Insurance Program."* [See additions.]	Flood
12	Storm water management plans.	Modified – *"Encourage the development of storm water management plans to help address flash flooding in Belle and Vienna. "*	Flood
13	Water height gauges for bridges.	Deleted – County commissioners stated that these gauges are impractical and too expensive to maintain at low water crossings.	Flood
14	Make residents aware of fire hazards.	Modified – Local fire department conduct awareness programs at schools on fire safety. Need more education on wildfire. Modified as follows: *"Provide information on fire hazards and wildfire to area residents to encourage personal mitigation actions."*	Wildfire
15	Educate how to shut down utilities.	Combined with #7 and #8.	
16	Secure propane tanks in flood areas.	Modified – "*Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds."*	Flood Tornado/Wind
17	Improve interagency communication.	Retained – although progress has been made through interagency agreements, upgraded equipment and revised SOPs, there continues to be a need to improve and enhance communications.	All Hazards
18	Improve public media communication.	Modified – *"Partner whenever possible with local media to assure that appropriate warning of impending disasters is provided to all residents in the countywide listening area."*	Tornado/Wind Thunderstorm Winter Storm Flood

Action Item Number	Mitigation Action	Assessment for Update	Hazard(s) Addressed
			Extreme Heat
19	Emergency backup generators.	Deleted – The county has acquired three emergency backup generators: one for the courthouse/sheriff's department/ emergency communications and two mobile generators that can be moved around the county.	
20	Cooling locations/ stations.	Combined with #4.	
21	Home shelter construction education.	Modified – "Provide through local media and make available at local government buildings information on how to construct or purchase a tornado safe room/ shelter."	Tornado/Wind
22	Update Mutual Aid Agreements.	Deleted – This action has been achieved region-wide with assistance from the state and regional mutual aid coordinator.	All Hazards
23	Security alarms in public buildings.	Deleted – Expense too great – not really a mitigation action item.	

The following mitigation actions were added for the 2014 update of the plan:

- Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.
- Encourage Belle to become a member of the NFIP.
- Encourage buyouts of properties in the floodplain as funds become available.
- Examine potential road and bridge upgrades that would reduce danger to residents during occurrences of natural disasters.
- Encourage cities to require contractor storm water management plans in all new development – both residential and commercial properties.
- Encourage a self-inspection program at critical facilities to assure that the building infrastructure is earthquake and tornado resistant.
- Encourage county health department to use publicity campaigns that make residents aware of proper measure to take during times of threatening conditions such as drought and severe heat.
- Continue to evaluate and update emergency operation plans.
- 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).
- Distribute regular press releases from county and city EMD offices concerning hazards, where they strike, frequency and preparation.

- Encourage meetings between EMD, city/county officials, schools and SEMA to familiarize officials with mitigation planning, implementation, budgeting for mitigation projects and potential mitigation funding opportunities.
- Whenever possible, pool different agency resources to achieve widespread mitigation results.
- Re-evaluate the hazard mitigation plan, merge with other community planning and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.
- Work with local, state and federal agencies to include mitigation in all economic and community development projects.
- Distribute press releases by cities/county regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
- Implement public awareness program about the benefits of hazard mitigation projects, both public and private.
- Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.
- Encourage local governments to consider implementing cost share programs with private property owners for hazard mitigation projects that benefit the jurisdiction as a whole.
- Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries 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 Maries County Multi-Hazard Mitigation Plan (2014) follows. The mitigation actions listed are for the entire planning area and participating jurisdictions differ in the specific actions undertaken in their jurisdictions. 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 kits that include water, blankets, flashlights, etc.; learn how to shut off their home utilities in times

of emergency; and be self-sufficient for one to three days in the event of a disaster. (Existing)

1.1.2 **Action Item:** Continue to educate residents about precautions that should be taken during threats of natural disasters such as severe weather and heat waves.

1.1.3 **Action Item:** Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such a building personal shelters and assuring that propane tanks are appropriately tied down. (Both)

1.1.4 **Action Item:** Promote the development and/or update of emergency plans by businesses, local governments and schools.

1.1.5 **Action Item:** Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.

1.1.6 **Action Item:** Educate school staff on natural hazards and make sure all staff are familiar with school emergency plan including evacuation and safety procedures.

1.1.7 **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 Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Both)

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

1.3.1 **Action Item:** Continue to encourage tree trimming and dead tree removal by utility companies and local governments. (Both)

1.3.2 **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)

1.3.3 **Action Item:** Continue to maintain a list of locations that can serve as shelters for storms, cooling/warming shelters, etc. and establish MOUs with the appropriate organizations responsible for those facilities.

1.3.4 **Action Item:** Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms.

1.3.5 Action Item: Regularly review and update school emergency plans.

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 the development and implementation of minimum building codes in all communities. (New)

2.1.3 Action Item: Encourage businesses, local governments and schools to develop and implement emergency plans. (Both)

2.1.4 Action Item: Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Both)

2.1.5 Action Item: Continue to evaluate and update emergency operation plans. (Both)

2.1.6 Action Item: Encourage cities to require contractor storm water management plans in all new development – both residential and commercial properties. (New)

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 and enforce restrictions on development in the floodplain. (Both)

2.2.2 Action Item: Encourage the development of storm water management plans. (Both)

2.2.3 Action Item: Actively promote the county's floodplain program and disseminate information to inform prospective builders and current property owners on the floodplain building requirements. (Both)

2.2.4 Action Item: Encourage buyouts of properties in the floodplain as funds become available. (Both)

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

2.3.4 Action Item: Encourage the City of Belle to become a member of the NFIP.

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)

3.1.3 Action Item: Provide information on fire hazards and wildfire to area residents to encourage personal mitigation actions. (Both)

3.1.4 Action Item: Implement public awareness program about the benefits of hazard mitigation projects, both public and private. (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 and potential funding sources. (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 local, regional and/or statewide drills/exercises.

3.4.3 Action Item: Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.

3.4.4 Action Item: Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.

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 and facilitate training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint trainings/drills between agencies, public and private entities (including schools and businesses).

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

4.1.4 Action item: Improve interagency communication through joint meetings and trainings.

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)

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

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

Objectives

5.1.1 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 Increase the availability of storm shelters for individual families and large groups.

5.2.1 Action Item: Encourage the construction of storm shelters, especially tornado safe rooms near schools and large employment centers that currently do not have access to safe rooms.

5.2.2 Action Item: Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.

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

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

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, schools and SEMA to familiarize officials with mitigation planning, implementation, budgeting for mitigation projects and potential funding sources.

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)

6.1.5 Action Item: Whenever possible, pool different agency resources to achieve widespread mitigation results. (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

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
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.; learn how to shut off their home utilities in times of emergency; and be self-sufficient for one to three days in the event of a disaster.	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 threats of natural disasters such as severe weather and heat waves.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.3	Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such as building personal shelters and assuring that propane tanks are appropriately tied down.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.4	Promote the development and/or update of emergency plans by businesses, local governments and schools.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.5	Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.6	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
1.1.7	Schools need to continue to conduct emergency preparedness exercises on a regular basis.	X		X		X			X	X	X	X				X	X

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
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				
1.2.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.	X						X		X		X	X	X	X	X	X
1.3.1	Continue to encourage tree trimming and dead tree removal by utility companies and local government.								X	X	X		X	X	X	X	X
1.3.2	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	X		
1.3.3	Continue to maintain a list of locations that can serve as shelters for storms, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.	X		X	X	X			X	X	X	X	X	X	X		
1.3.4	Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms.								X	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
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

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
2.1.2	Encourage the development and implementation of minimum building codes in all communities.			X		X			X	X	X		X	X	X		
2.1.3	Encourage businesses/government/schools to develop and implement emergency plans.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.1.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning.	X						X		X		X	X	X	X	X	X
2.1.5	Continue to evaluate and update emergency operation plans.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.1.6	Encourage cities to require contractor storm water management plans in all new development – both residential and commercial properties.					X								X	X		
2.2.1	Educate residents about the dangers of floodplain development and the benefits of the National Flood Insurance Program and enforce restrictions on development in the floodplain.					X							X		X		
2.2.2	Encourage the development of storm water management plans.					X							X	X	X		
2.2.3	Actively promote the county's floodplain program and disseminate information to inform prospective builders and current property owners on the floodplain building requirements.					X							X		X		
2.2.4	Encourage buyouts of properties in the floodplain as funds become available.					X							X		X		
2.3.1	Encourage minimum standards for building codes in all cities.			X		X			X	X	X			X	X		
2.3.2	Encourage local governments to develop and implement regulations for the securing of hazardous materials tanks and mobile homes to reduce					X			X	X			X	X	X		

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
	hazards during flooding and high winds.																
2.3.3	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.					X							X		X		
2.3.4	Encourage the City of Belle to become a member of the NFIP					X							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		
3.1.3	Provide information on fire hazards and wildfire to area residents to encourage personal mitigation actions.											X	X	X	X	X	X
3.1.4	Implement public awareness program about the benefits of hazard mitigation projects, both public and private.	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	X	X		
3.2.2	Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects and potential funding sources.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
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
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		

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
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	X				
3.4.2	Publicize local, regional and/or statewide drills/exercises.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.4.3	Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.4.4	Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.					X			X	X			X	X	X		
4.1.1	Continue to encourage joint meetings of different organizations/ agencies for mitigation planning.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.1.2	Continue to encourage and facilitate training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint trainings/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
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
4.1.4	Improve interagency communication through joint meetings and trainings.	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
4.2.2	Encourage meetings between EMD, city and county government and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
5.1.1	Encourage communities to budget for enhanced warning systems.					X			X	X	X		X		X	X	

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
5.1.2	Encourage all communities to develop storm water management plans.					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
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		
5.2.1	Encourage the construction of storm shelters, especially tornado safe rooms near schools and large employment centers that currently do not have access to safe rooms.									X			X	X	X	X	X
5.2.2	Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.								X	X			X	X	X	X	X
5.3.1	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		
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 and potential funding sources.	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

		Hazards											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	Maries County	Belle	Vienna	Maries County R-I Schools	Maries County R-II Schools
6.1.5	Whenever possible, 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
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		
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
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

4.3 NFIP Participation and Action Items Supporting NFIP

44 CFR Requirement 201.6l(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 Maries County Jurisdictions Participation in NFIP

Jurisdictions Participating in NFIP
Maries County
Vienna
Jurisdiction NOT Participating in NFIP
Belle

Source: SEMA

Maries County and Vienna are members of the NFIP. The emergency management director serves as the floodplain manager for the county. The public works superintendent serves as floodplain manager for the City of Vienna. 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, and enforce restrictions on development in the floodplain..

2.2.3 Actively promote the county's floodplain program and disseminate information to inform prospective builders and current property owners on the floodplain building requirements.

2.2.4 Encourage buyouts of properties in the floodplain as funds become available.

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.

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

2.3.4 Encourage the city of Belle to become a member of the NFIP.

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

3.4.4 Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.

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

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 Maries 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 2 = Maybe YES 1 = Prob NO 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.; learn how to shut off their home utilities in times of emergency; and be self-sufficient for one to three days in the event of a disaster.	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 threats of natural disasters such as severe weather and heat waves.	3	3	3	3	3	2	3	20	IC, LF, EMCC	6	-1	5	25	H
1.1.3	Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such as building personal shelters and assuring that propane tanks are appropriately tied down.	3	2	2	3	3	2	3	18	IC, PD, LF EMCC	8	-1	7	25	H
1.1.4	Promote the development and/or update of emergency plans by businesses, local governments and schools.	3	2	2	3	3	2	3	18	IC, PD, LF, EMCC	8	-3	5	23	H
1.1.5	Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.	3	3	3	3	3	2	3	20	IC, PD, LF, EMCC	8	-1	7	27	H
1.1.6	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
1.1.7	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 Maries 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	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

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
1.3.2	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
1.3.3	Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.	3	3	3	3	3	3	3	21	IC, LF, EMCC	6	-1	5	26	H
1.3.4	Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms.	3	3	2	3	3	1	3	18	IC, LF, EMCC	6	-5	1	19	M
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
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	Encourage the development and implementation of minimum building codes in all communities.	2	2	2	2	3	1	2	14	PD, LF, EMCC	6	-3	3	17	M
2.1.3	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
2.1.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries 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
2.1.5	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
2.1.6	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, LF	4	-3	1	17	M
2.2.1	Educate residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program and enforce restrictions on development in the floodplain..	2	3	3	2	3	2	3	18	IC, PD, LF, EMCC	8	-1	7	25	H
2.2.2	Encourage the development of storm water management plans.	2	2	2	2	3	2	3	16	PD, LF	4	-3	1	17	M

Figure 4.4 Prioritization of Mitigation Actions		3 = Def YES 2 = Maybe YES			1 = Prob NO 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
2.3.1	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, EMCC	8	-3	5	18	M
2.3.3	Continue to enforce flood damage prevention/floodplain management ordinances in compliance with NFIP requirements.	3	2	2	2	3	3	3	18	IC, PD, LF, EMCC	8	-3	5	23	H
2.3.4	Encourage the City of Belle to become a member of the NFIP.	2	3	2	2	3	2	3	17	IC, PD, LF, EMCC	8	-1	7	24	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/schools regarding 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 local, regional and/or statewide drills/exercises.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	H
3.4.3	Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.	3	3	2	3	3	3	3	20	IC, PD, LF, EMCC	8	-1	7	27	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
3.4.4	Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.	2	2	2	2	3	2	3	16	IC, PD,LF, EMCC	8	-3	5	21	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 training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and 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
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
4.2.2	Encourage meetings between EMD, city and county government and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	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 storm water 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 the construction of storm shelters, especially tornado safe rooms near schools and large employment centers that currently do not have access to safe rooms.	3	3	2	3	3	2	3	19	IC, EMCC	4	-5	-1	18	M
5.2.2	Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.	3	3	2	2	3	3	3	19	IC, EMCC	4	-1	3	22	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
5.3.1	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.	2	2	2	2	3	1	3	15	IC, PD, LF, EMCC	8	-5	3	18	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
6.1.5	Whenever possible, pool different agency resources to achieve widespread mitigation results.	3	3	3	3	3	3	3	21	IC, PD, LF, EMCC	8	-1	7	28	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 jurisdiction 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
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	3	3	3	3	20	IC, PD, LF, EMCC	8	-1	7	27	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 panning 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.

Maries County

The following are mitigation actions for which Maries 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 Maries 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.; learn how to shut off their home utilities in times of emergency; and be self-sufficient for one to three days in the event of a disaster.
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 Phelps -Maries County Health Department website – www.phelpscountyhealth.com
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 threats of natural disasters such as severe weather and heat waves.
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 Maries County Health Department website – www.phelpscountyhealth.com
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, severe weather, tornados, floods
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, LF, EMCC
1.1.3	Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such as building personal shelters and assuring that propane tanks are appropriately tied down.
Priority	High
Plan for Implementation & Administration	Information on home tornado shelters, methods for securing tanks, etc. will be provided at public buildings such as the courthouse, city halls, etc., and at public events such as fairs and festivals.
Lead	County Commission, County EMD
Partners	City governments
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards addressed	Tornado, flood
Applicable Jurisdictions	All jurisdictions

Benefits (Losses Avoided)	IC, LF, PD, EMCC
1.1.4	Promote development of emergency plans by businesses, local governments and 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
1.1.5	Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness..
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, Region I Homeland Security Oversight Committee
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 to find ways to improve the county's current warning systems. This will be part of the annual review of the county LEOP.
Lead	City and County EMDs, County Commission
Partners	City governments, schools, sheriff's department
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	Maries County
Benefits (Losses Avoided)	IC, EMCC
1.2.4, 2.1.4	Monitor developments in data availability concerning the impact of dam failure, tornados, sinkholes, land subsidence and wildfire upon Maries 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
Partners	SEMA, FEMA, MRPC, MDC, MDNR, cities, schools
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Dam failure, tornados, sinkholes, land subsidence, wildfire
Applicable Jurisdictions	All jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.1	Continue to encourage tree trimming and dead tree removal programs by utility companies and local government.
Priority	High
Plan for Implementation & Administration	County Commission, EMDs and city governments need to continue tree trimming and dead tree removal programs in their jurisdictions and encourage electric cooperatives serving the county to aggressively trim trees away from power lines to avoid outages during severe storms.
Lead	County Commission, City Governments
Partners	Electric cooperatives, private contractors, public and private utilities
Projected Cost/Funding	Moderate/likely workable into budget

Criterion for Completion	Ongoing
Hazards Addressed	Tornado, Severe Storm, Severe Winter Storm
Applicable Jurisdictions	Maries County, Belle, Vienna
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.2	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	Maries County, Belle, Vienna
Benefits (Losses Avoided)	IC, PD, LF, EMCC
1.3.3	Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.
Priority	High
Plan for Implementation & Administration	EMD will continue to establish and publicize the location and availability of shelters for different types of events. MOUs will be developed and put in place for each facility to insure that all parties understand the procedures that need to be followed in opening and operating the shelters.
Lead	EMD, County Health Department
Partners	Local governments, schools, churches
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Severe Heat, Severe Storms, Tornado
Applicable Jurisdictions	Maries County, Belle, Vienna
Benefits (Losses Avoided)	IC, LF, EMCC
1.3.4, 5.2.1	Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms.
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	Maries County, Belle, 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 the development and implementation of minimum building codes in all communities.
Priority	Medium
Plan for Implementation & Administration	County EMD, with assistance from local emergency response agencies, and city EMDs will encourage the development and implementation of minimum building codes in all communities.
Lead	County EMD
Partners	Local response agencies, city EMDs
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Ongoing until all communities have at least minimal building codes in place.
Hazards Addressed	Tornado, Severe Storm, Wildfire, Flood
Applicable Jurisdictions	Maries County, Vienna
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.1.3	Encourage businesses, local governments and 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
2.1.5	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 Maries 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 residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program and enforce restrictions on development in the floodplain.
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, MRPC
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, Vienna
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 & Administration	County EMD currently enforces regulations in the floodplain in regards to securing 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	Maries County, Belle, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD
2.3.3	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	Maries County, Irondale, Mineral Point, Potosi
Benefits (Losses Avoided)	IC, PD, LF, EMCC
2.3.4	Encourage the City of Belle to become a member of the NFIP.

Priority	High
Plan for Implementation & Administration	County EMD and SEMA representatives will visit with Belle elected officials and explain the benefits of joining the NFIP.
Lead	County Commission
Partners	MTNF, MDC, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Initial meeting completed by 6/2015
Hazards Addressed	Flood
Applicable Jurisdictions	Belle
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 Phelps-Maries County Department of Health website – www.phelpscountyhealth.com .
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, in cooperation with SEMA and County Health Department 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.phelpscountyhealth.com and coordinate these efforts with SEMA's statewide drills, awareness activities.
Lead	County EMD, County Commission, City EMDs
Partners	SEMA, city EMDs, local emergency response agencies
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All hazards
Applicable Jurisdictions	Maries County, Vienna, Belle
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/schools regarding adopted mitigation measures to keep public abreast of changes and/or new regulations.
Priority	High
Plan for Implementation & Administration	County EMD will provide updates on mitigation activities in the county to local media to keep the public informed. Changes in regulations, particularly in floodplain management will also be publicized through media.
Lead	County EMD, County Commission, Floodplain Manager, School Superintendents
Partners	Local jurisdictions, SEMA, FEMA, city floodplain managers
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

3.4.1	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	Maries County, Belle, Vienna
Benefits (Losses Avoided)	IC, PD, LF, EMCC
3.4.2	Publicize local, regional and/or statewide 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.Mariescountyhealthdepartment.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
3.4.3	Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.
Priority	High
Plan for Implementation & Administration	County EMD has helped coordinate some CERT training in the county. Needs to continue to work with training providers to provide additional training and assist potential teams with getting organized and self-sustaining.
Lead	County EMD
Partners	Local jurisdictions, local response agencies, Region I HSOC, 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
3.4.4	Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.
Priority	High
Plan for Implementation & Administration	County EMD will develop informational materials to share with local propane dealers and residents on the dangers of unsecured tanks during natural disasters and the

	methods for securing tanks.
Lead	County EMD
Partners	SEMA, propane dealers
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	Flood, Tornado, Severe Storm
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, City EMDs
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 training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and 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, Region I HSOC, 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, 6.1.5	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 I 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
4.2.2	Encourage meetings between EMDs, city and county government, schools and SEMA to familiarize officials with mitigation planning and implementation and budgeting for mitigation projects.
Priority	High
Plan for Implementation & Administration	County Commission and County EMD will work with SEMA, MRPC and local jurisdictions to coordinate meetings and/or presentations that will help inform and familiarize local decision-makers with planning for, prioritizing, budgeting for and implementing local projects that will make the county less vulnerable to natural disasters. These actions should include providing information on potential sources of funding for mitigation projects
Lead	County Commission, County and City EMDs
Partners	Maries County Commission, Cities of Belle and Vienna, Maries County R-I and R-II School districts, FEMA, 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
5.2.1	Encourage the construction of storm shelters, especially tornado safe rooms near schools and large employment centers that currently do not have access to safe rooms.
Priority	Medium
Plan for Implementation & Administration	County Commission and County EMD should meet with city governments, schools and large employers in the county to encourage them to consider including tornado safe rooms in any future remodel or construction projects.
Lead	County Commission, County EMD
Partners	Maries County Commission, Belle, Vienna, Maries County R-I and R-II School districts, SEMA, FEMA, MRPC, local chambers of commerce and economic developers
Projected Cost/Funding	High/Grants
Criterion for Completion	Ongoing until tornado safe rooms exist in each city and/or school and any other high population areas identified.
Hazards Addressed	Tornado, Severe Storm
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, PD, LF, EMCC
5.2.2	Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.
Priority	High
Plan for Implementation & Administration	County and City EMDs will work with SEMA representatives and local governments to determine which buildings are suitable to serve as storm shelters and establish MOUs and procedures for opening, operating and closing the shelters.
Lead	County and City EMDs

Partners	Maries County Commission, cities of Belle and Vienna, Maries County R-I and R-II school districts, SEMA
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	All public buildings assessed and determinations made by 12/2018
Hazards Addressed	Tornado, Severe Storm
Applicable Jurisdictions	All Jurisdictions
Benefits (Losses Avoided)	IC, EMCC
5.3.1	Encourage local governments to purchase properties in the floodplain as funds become available and convert that land into public space/recreation area.
Priority	Medium
Plan for Implementation & Administration	County Commission will direct the floodplain manager to make property owners aware of the possibility of buyouts following flood events and encourage them to consider participating in buyouts or flood proofing their property.
Lead	County floodplain manager
Partners	Local governments, SEMA, FEMA
Projected Cost/Funding	High/Grants
Criterion for Completion	Ongoing, with progress marked as properties are purchased.
Hazards Addressed	Flood
Applicable Jurisdictions	Maries County, City of Vienna
Benefits (Losses Avoided)	IC, PD, LF, 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, 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
6.1.2	Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.
Priority	High
Plan for Implementation & Administration	Maries County Commission will include hazard mitigation issues in grant applications for upgrades to or replacements of roads and bridges. The county recently participated 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	Maries 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	Maries County, Cities of Belle and Vienna
Benefits (Losses Avoided)	IC, PD, LF, EMCC
6.1.3	Work with local/state/federal agencies to include mitigation in all economic and community development projects.
Priority	High
Plan for Implementation & Administration	Local officials 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 Maries County.
Lead	County Commission
Partners	SEMA, FEMA, MRPC, DED, RD
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	Ongoing
Hazards Addressed	All Hazards
Applicable Jurisdictions	Maries County, Cities of Belle and Vienna
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 & Administration	County EMD will include discussions on these types of programs with all jurisdictions at meetings held on related issues (floodplain, emergency planning, etc.)
Lead	County EMD, County Commission
Partners	Cities of Belle and Vienna, SEMA, FEMA
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Dam Failure, Earthquake, Flood, Land Subsidence/Sinkhole, Severe Storm, Tornado, Severe Winter Weather, Wildfire
Applicable Jurisdictions	Maries County, Cities of Belle and Vienna
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 for review and update of hazard mitigation plan.
Lead	County EMD, County Commission
Partners	All Jurisdictions
Projected Cost/Funding	Minimal/operating budget
Criterion for Completion	2017, repeat in 2019
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 Maries 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 Maries County Hazard Mitigation Plan will be integrated into the LEOP as applicable.

Any other planning efforts such as updating the regional Community Economic Development Strategy (CEDS) plan, or any comprehensive or strategic planning conducted by the county will include review and inclusion of hazard mitigation goals, action items and priorities.

Belle

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

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 City of Belle

1.2.1	Continue to encourage cities to obtain early warning systems and improved communications systems.
Priority	High
Plan for Implementation & Administration	Mayor and Board of Aldermen should meet and assess the existing early warning and emergency communications systems in their communities on an annual basis to determine the needs and consider ways to fund upgrades and additions.
Lead	Mayor, Board of Alderman
Partners	Local emergency response agencies, county dispatch, MRPC, SEMA, Rural Development.
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Ongoing with upgrades and additions noted as milestones for improvement.
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, LF, PD, EMCC
2.1.6, 5.1.4	Encourage cities to require contractor storm water management plans in all new development – both residential and commercial properties.
Priority	Low
Plan for Implementation & Administration	The public works department, Mayor 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 employees, Mayor, Board of Aldermen
Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
2.2.2, 5.1.2	Encourage the development of storm water management plans.
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	Mayor, Board of Aldermen, Public Works Department

Partners	Local builders associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Plan for Implementation & Administration	Mayor and Board of Aldermen should review community needs and the cost of enhanced warning systems within the community and search for the means of funding such improvements.
Lead	Mayor and Board of Aldermen
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
Benefits (Losses Avoided)	IC, LF, 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	Mayor, 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 Belle.
Lead	Mayor, 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 Belle is the lead, Maries County will be the lead on the following actions which also serve as mitigation actions for the City of Belle:

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 threats of natural disasters such as severe weather and heat waves.

1.1.3 Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such as building personal shelters and assuring that propane tanks are appropriately tied down.

1.1.4 Promote the development of emergency plans by businesses, local governments and schools.

1.1.5 Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.

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 Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Also 2.1.4)

1.3.1 Continue to encourage tree trimming and dead tree removal programs by utility companies and local governments.

1.3.2 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.

1.3.3 Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.

1.3.4 Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms. (Also 5.2.1)

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 Encourage the development and implementation of minimum building codes in all communities.

2.1.3 Encourage businesses, local governments and schools to develop emergency plans.

2.1.5 Continue to evaluate and update emergency operation plans.

2.2.1 Educate residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program and enforce restrictions on development in the floodplain.

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.

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

2.3.4 Encourage the City of Belle to become a member of the NFIP.

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. (Also 4.2.2, 6.1.1)

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.

3.4.3 Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.

3.4.4 Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.

4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.

4.1.2 Continue to encourage training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and businesses.)

4.1.3 Pool different agency resources to achieve widespread mitigation planning results. (Also 6.1.5)

5.2.2 Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.

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

6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.

6.1.3 Work with local/state/federal agencies to include mitigation in all economic and community development projects.

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 jurisdiction as a whole.

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

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 Maries County in this section.

Integration of Hazard Mitigation Actions into Current Planning Processes

The City of Belle is a small community of approximately 1,545 people. The community has a minimal budget with which to work and little funding for planning activities. Planning is carried out by the Mayor and Board of Aldermen with recommendations from city employees/volunteers or as part of larger, county or regional planning activities. The hazard mitigation actions will be carried out on a volunteer basis by the Mayor and Board of Aldermen and where applicable, the city public works department.

Vienna

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

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 Vienna

1.2.1	Continue to encourage cities to obtain early warning systems and improved communications systems.
Priority	High
Plan for Implementation & Administration	Mayor and Board of Aldermen should meet and assess the existing early warning and emergency communications systems in their communities on an annual basis to determine the needs and consider ways to fund upgrades and additions.
Lead	Mayor, Board of Alderman
Partners	Local emergency response agencies, county dispatch, MRPC, SEMA, Rural Development.
Projected Cost/Funding	Moderate/Operating budget
Criterion for Completion	Ongoing with upgrades and additions noted as milestones for improvement.
Hazards Addressed	All Hazards
Benefits (Losses Avoided)	IC, LF, PD, EMCC
2.1.6, 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	Mayor, Board of Aldermen, Public Works Department
Partners	Local builders associations
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	2015
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
2.2.2, 5.1.2	Encourage all communities to develop storm water management plans.
Priority	Low
Plan for Implementation & Administration	The public works department, Mayor 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 employees, Mayor, Board of Aldermen

Partners	MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Ongoing
Hazards Addressed	Flood
Benefits (Losses Avoided)	PD
2.3.1	Encourage minimum standards for building codes in all cities.
Priority	Medium
Plan for Implementation & Administration	Mayor, Board of Aldermen and public works employees will research the benefits, requirements and costs of enacting building codes.
Lead	Mayor, Board of Aldermen
Partners	Public works department
Projected Cost/Funding	Moderate/operating budget
Criterion for Completion	Research and discussion completed by Dec. 2015.
Hazards Addressed	Tornado, Wind, Wildfire, Earthquake
Benefits (Losses Avoided)	PD, LF, EMCC
5.1.1	Encourage communities to budget for enhanced warning systems.
Priority	High
Plan for Implementation & Administration	Mayor and Board of Aldermen should review community needs and the cost of enhanced warning systems within the community and search for the means of funding such improvements.
Lead	Mayor and Board of Aldermen
Partners	County EMD, SEMA, USDA Rural Development, MRPC
Projected Cost/Funding	Significant/Grants
Criterion for Completion	Schedule meetings by 2014
Hazards Addressed	Flood, Severe Storm, Tornado, Severe Winter Storm
Benefits (Losses Avoided)	IC, LF, 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	Mayor, 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 Belle.
Lead	Mayor, 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 Vienna is the lead, Maries County will be the lead on the following actions which also serve as mitigation actions for the City of Vienna:

1.1.6 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.

1.1.7 Continue to educate residents about precautions that should be taken during threats of natural disasters such as severe weather and heat waves.

1.1.8 Provide to citizens through local media and make available at local government buildings, information on individual mitigation activities such as building personal shelters and assuring that propane tanks are appropriately tied down.

1.1.9 Promote the development of emergency plans by businesses, local governments and schools.

1.1.10 Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.

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 Maries County and all jurisdictions through local, state and federal agencies for use in hazard mitigation planning. (Also 2.1.4)

1.3.1 Continue to encourage tree trimming and dead tree removal programs by utility companies and local governments.

1.3.2 Continue to review and consider road and bridge upgrades to improve drainage and reduce flooding and the risk to residents and property.

1.3.3 Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.

1.3.4 Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms. (Also 5.2.1)

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 Encourage the development and implementation of minimum building codes in all communities.

2.1.3 Encourage businesses, local governments and schools to develop emergency plans.

2.1.5 Continue to evaluate and update emergency operation plans.

2.2.1 Educate residents on the dangers of floodplain development and the benefits of the National Flood Insurance Program and enforce restrictions on development in the floodplain.

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.

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

2.3.4 Encourage the City of Belle to become a member of the NFIP.

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. (Also 4.2.2, 6.1.1)

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.

3.4.3 Encourage the development of a county-wide CERT program and educate the public on how they can benefit from this type of program.

3.4.4 Raise awareness of the need to secure propane tanks to reduce the risk from dislodged tanks during flooding, tornados and high winds.

4.1.1 Continue to encourage joint meetings of different organizations/ agencies for mitigation related planning.

4.1.2 Continue to encourage training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and businesses.)

4.1.3 Pool different agency resources to achieve widespread mitigation planning results. (Also 6.1.5)

5.2.2 Encourage the assessment of public buildings as potential storm shelters; designate those that are suitable as safe shelters; and develop accessibility plans for the public during times of need.

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

6.1.2 Structure grant proposals for road/bridge upgrades so that hazard mitigation concerns are also met.

6.1.3 Work with local/state/federal agencies to include mitigation in all economic and community development projects.

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 jurisdiction as a whole.

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

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 Maries County in this section.

Integration of Hazard Mitigation Actions into Current Planning Processes

The City of Vienna is a small community of approximately 610 people. The community has a minimal budget with which to work and little funding for planning activities. Planning is carried out by the Mayor and Board of Aldermen with recommendations from city employees/volunteers or as part of larger, county or regional planning activities. The hazard mitigation actions will be carried out on a volunteer basis by the Mayor and Board of Aldermen and where applicable, the city Public Works Superintendent.

Maries County R-I School District

Mitigation actions for the Maries County R-I 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 Maries County R-I 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 4.8 Action Items Assigned to Maries County R-I School District

1.1.6	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
1.1.7	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

In addition to the above mitigation actions for which Maries R-I School District is the lead, Maries 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 threats of natural disasters such as severe weather and heat waves.

1.1.4 Promote the development of emergency plans by businesses/government/schools.

1.1.5 Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.

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. (also 3.2.1)

1.3.3 Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.

1.3.4 Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms. (also 5.2.1)

2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.

2.1.3 Continue to encourage businesses, governments and schools to develop and implement emergency plans.

2.1.5 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.

3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects. (also 4.2.2, 6.1.1)

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 local, regional and/or statewide drills/exercises.

4.1.1 Continue to encourage joint meetings of different organizations/agencies for mitigation related planning.

4.1.2 Continue to encourage training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and businesses).

4.1.3 Pool different agency resources to achieve widespread mitigation planning results. (also 6.1.5)

6.1.3 Work with state/local/federal agencies to include mitigation in all economic and community development 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 Maries 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 Maries 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.

Maries County R-II School District

Mitigation actions for the Maries County R-II School District are shown in Table 4.9 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 Maries County R-II 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 4.9 Action Items Assigned to Maries County R-II School District

1.1.6	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
1.1.7	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

In addition to the above mitigation actions for which Maries R-II School District is the lead, Maries 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 threats of natural disasters such as severe weather and heat waves.

1.1.4 Promote the development of emergency plans by businesses/government/schools.

1.1.5 Continue to provide CERT training and encourage the development of CERTs throughout the county through training opportunities and public awareness.

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. (also 3.2.1)

1.3.3 Continue to maintain a list of locations that can serve as shelters for storm, cooling/warming shelters and establish MOUs with the appropriate organizations responsible for those facilities.

1.3.4 Encourage the designation of storm shelters and the construction of tornado safe rooms in or near schools and large employment centers that currently do not have access to safe rooms. (also 5.2.1)

2.1.1 Continue to encourage a self-inspection program at critical facilities to assure that building infrastructure is earthquake and tornado resistant.

2.1.3 Continue to encourage businesses, governments and schools to develop and implement emergency plans.

2.1.5 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.

3.2.2 Encourage meetings between EMD, city/county officials and SEMA to familiarize officials with mitigation planning, implementation and budgeting for mitigation projects. (also 4.2.2, 6.1.1)

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 local, regional and/or statewide drills/exercises.

4.1.1 Continue to encourage joint meetings of different organizations/agencies for mitigation related planning.

4.1.2 Continue to encourage training opportunities in all areas of preparedness and response to insure the capabilities and safety of citizens and responders and encourage joint training/drills between agencies, public and private entities (including schools and businesses).

4.1.3 Pool different agency resources to achieve widespread mitigation planning results. (also 6.1.5)

6.1.3 Work with state/local/federal agencies to include mitigation in all economic and community development 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 Maries 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 Maries 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 4.10. Any projects submitted for funding must match the goals and objectives of the Maries County Hazard Mitigation Plan in order to be eligible for funding.

Table 4.10 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			

Activity	HMGP	PDM	FMA	RFC	SRL
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 4.11. 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 4.11 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": • 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/hmgp/.

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 sever 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 Maries 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 Maries 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 Maries 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 Maries 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 Maries 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 Maries 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 Maries 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
- Maries 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, Maries 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. Maries County will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

Upon adoption, the Maries 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.

Maries 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 Maries County Multi-Hazard Mitigation Plan underwent a number of changes from the plan approved in 2005 and the plan revision that was approved in 2014. Essentially, the plan was completely reformatted to meet more stringent requirements and guidelines provided by FEMA. Although the 2005 plan was used as the starting point for the revision process, the revised plan bears little resemblance to the plan completed in 2005.

A summary of those changes are outlined in the table below:

Table 5.1 Maries 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 into local planning; prioritization; cost-effectiveness; funding options; recommendations; policies and development trends; worksheets	Mitigation Strategy including goals; identification and analysis of mitigation actions; implementation of mitigation actions; mitigation actions supporting NFIP 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	Plan implementation & maintenance including monitoring, evaluating & updating; incorporating hazard mitigation into existing plans; public involvement Changes made to the plan document were

Chapter/Section	2004 Plan Document	2013 Revised Plan
	program development; actions by jurisdiction; 5 year matrix	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 Documentation

MEMORANDUM

TO: Maries County Hazard Mitigation Planning Committee

FROM: Tammy Snodgrass, Assistant Director/Environmental Programs Manager

DATE: August 23, 2011

SUBJECT: Hazard mitigation planning meeting scheduled for September 8, 2011

The Maries County Multi-Jurisdiction Natural Hazard Mitigation Plan is due to be updated. The Meramec Regional Planning Commission (MRPC) has been contracted by the Missouri State Emergency Management Agency (SEMA) to carry out the plan review and update. The plan provides guidance on the risks of natural hazards and how local governments, businesses and citizens can address and mitigate those risks. The project is being funded by state and federal dollars with matching funds from Maries County. We need your help to successfully complete this project.

Counties and cities that do not have an approved hazard mitigation plan are not eligible for hazard mitigation funding from the federal government, so it is in every jurisdiction's best interest to participate in the review and update of this plan. Hazard mitigation funds are used for such projects as floodplain buyouts, burying electrical lines, tornado safe rooms, etc. Previously, participating jurisdictions were limited to local governments. However, FEMA is now *requiring* school districts to participate in the hazard mitigation planning process in order to be eligible for future grant opportunities. School districts, as well as local governments must participate at some level in the planning process in order to be considered eligible for future grant funding opportunities.

A meeting of the Maries County hazard mitigation planning committee is scheduled for Thursday, September 8 at 10:30 p.m. in the County Commission Offices of the Maries County courthouse in Vienna. We will be reviewing the old plan document and discussing goals, objectives and what progress has been made on hazard mitigation in the county during the past five years.

As the county and each city will be asked to formally approve and adopt the Maries County Hazard Mitigation Plan, we strongly encourage you to participate in this committee or to send a representative who will convey your jurisdiction or department's needs for hazard mitigation. It is important to include representatives from emergency management offices, law enforcement, city/county officials, school officials, fire protection, local health services, disaster relief volunteer services and other appropriate groups.

If we can accomplish everything we need to at this meeting, it will not be necessary to schedule another one. We will use correspondence and email for additional information gathering. Please make an effort to attend this meeting. If you cannot attend the meeting but would like to actively participate through other means, you may e-mail me at tsnodgrass@meramecregion.org. Once a draft of the plan has been completed, it will be made available on the MRPC website – www.meramecregion.org.

Thank you for your assistance in addressing hazard mitigation for Maries County. If you have any questions, contact me at (573) 265-2993, or via e-mail: tsnodgrass@merameregion.org. I look forward to seeing you at the meeting.

TS

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Jayne Helton, Collector
Maries County Courthouse
P. O. Box 205
Vienna, MO 65582

Rhonda Slone, Treasurer
Maries County Courthouse
P. O. Box 205
Vienna, MO 65582

Sheriff Chris Heitman
P. O. Box 23
Vienna, MO 65582

Ken Ramsey, EMD
15285 Maries Co. Rd. 440
Vichy, MO 65580

Mayor Tony Gieck
City of Belle
P. O. Drawer 813
Belle, MO 65013

Donna Stough, Office Mgr.
City of Belle
P. O. Drawer 813
Belle, MO 65013

Carla Butler, Treasurer
City of Belle
P. O. Drawer 813
Belle, MO 65013

Frankie Hicks, City Clerk
City of Belle
P. O. Drawer 813
Belle, MO 65013

Steve Vogt, Alderman
City of Belle
P. O. Drawer 813
Belle, MO 65013

Steve Honse, Alderman
City of Belle
P. O. Drawer 813
Belle, MO 65013

Dave Grubbs, Alderman
City of Belle
P. O. Drawer 813
Belle, MO 65013

Joe Lockard, Alderman
City of Belle
P. O. Drawer 813
Belle, MO 65013

Michael Dixon, Jr., Police Chief
P. O. Box 813
Belle, MO 65013

Dwight Francis, Fire Chief
Belle Volunteer Fire Dept.
P. O. Box 869
Belle, MO 65013

Darryl Jenkins, Public Work
City of Belle
P. O. Drawer 813
Belle, MO 65013

Mayor Jamie Jones
City of Vienna
P. O. Box 196
Vienna, MO 65582

Sherry James, Clerk
City of Vienna
P. O. Box 196
Vienna, MO 65582

Brenda Davis, Alderman
City of Vienna
P. O. Box 196
Vienna, MO 65582

Carol Miller, Alderman
City of Vienna
P. O. Box 196
Vienna, MO 65582

Christine Robertson
City of Vienna
P. O. Box 196
Vienna, MO 65582

Laura Stratman, Alderman
City of Vienna
P. O. Box 196
Vienna, MO 65582

Shannon Thompson, Chief of Police
City of Vienna
P. O. Box 196
Vienna, MO 65582

Shon Westart, Public Works Supt.
City of Vienna
P. O. Box 196
Vienna, MO 65582

Mark Pottorff, Superintende
Vienna R-I
P. O. Box 218
Vienna, MO 65582

Dr. Zach Templeton, Superintendent
Maries County R-II
P. O. Box 819
Belle, MO 65013

Albert Crump,
Maries County IDA
P. O. Box 397
Vienna, MO 65582

Intercounty Electric Cooper
P. O. Box 477
Rolla, MO 65402-0477

Gascosage Electric Cooperative
P. O. Box G
Dixon, MO 65459

Janet Driscoll
Dixon Ambulance District
305 S. Ellen St. / P. O. Box 399
Dixon, MO 65459

Craig Faith
Maries/Osage Ambulance D
P. O. Box 515
Vienna, MO 65582

Andy Littrell
Ozark Central Ambulance District
P. O. Box 666
Belle, MO 65013

Chief Mark Honse
Vienna Fire Protection District
P. O. Box 386
Vienna, MO 65013

Ameren

Chief Don Chambers
Vichy Volunteer Fire Protection As.
P. O. Box 486
Vichy, MO 65580

Darrin Bacon, Manager
Rolla Regional Airport
P. O. Box 505
Vichy, MO 65580

Nathan Abel, Public Works
City of Belle
P. O. Drawer 813
Belle, MO 65013

Jodie Waltman
Maries/Phelps County Health
200 N. Main, Suite G51
Rolla, MO 65401

Chief Dennis Lachowicz
Dixon Rural Fire Protection District
P. O. Box 92
Dixon, MO 65459

Advisory Committee Meetings

Advisory Committee Meeting

Maries County Hazard Mitigation Plan Update

AGENDA

10:30 a.m. ~ September 8, 2011

Maries County Courthouse

I. Welcome and Introductions – Tammy Snodgrass

II. Review of Current Maries 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

III. 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.

IV. Discussion of Possible Changes to Goals and Objectives for Next Five Years

V. Setting of Date and Time for Next Meeting

VI. Adjourn

Sign In Sheet
Maries Co Hazmit
9/8/11

NAME	REPRESENTING	EMAIL
Tony Floyd	Intercounty Elec.	Tony.floyd@ieca.coop
Leisa Stilley	Intercounty	leisa.stilley@ieca.coop
STEPHEN BROWN	EMERGENCY MGMT	StephenBrown@Email.Com
DAVE Clifton	EMD - Maries Co.	DClifton EMD 2 @ yahoo.com
Ken Ramsey	MARIES CO. EMD - VVFD	KRAMSEY EMD @ G.MAIL.Com
Rhonda Brewer	Maries County	rhonda@mariesco.org
Ray Schwartz	Maries County	rayschwartze @ G-Mail. Com
[illegible]	Maries County	578-5857
[illegible]	Maries County	573-619-4170
Steve Vogt	City of Belle	573-680-9968
Dwight Francis	Belle Fire	firefighter 2403 @ Yahoo.Com
NATHAN ABEL	City of Belle	nathan.abel @ yahoo.com
Laura Schiermeier	Maries County Gazette	tricountynewspapers@yahoo.com 573-422-9997

Advisory Committee Meeting

Maries County Hazard Mitigation Plan Update

AGENDA

10:00 a.m. ~ September 26, 2011

Maries County Courthouse

I. Welcome and Introductions – Tammy Snodgrass

II. Discussion of Hazard Mitigation Programs/Strategies and Progress Made in Past Five Years

Staff will lead the discussion on what actions have been taken over the past five years on hazard mitigation projects/programs.

III. Discussion of Possible Changes to Goals and Objectives for Next Five Years

IV. Setting of Date and Time for Next Meeting if Necessary

V. Adjourn

SIGN IN SHEET

Hazard Mitigation Planning Meeting

Date: 9/26/11 **Time:** 10:00

Location: Maries Courthouse

Name	Title	Representing	Phone/email	Address
Ray Schmitz	Pres Comm	Maries County	573 728-6487	5796 S Maries Rd 506 Meta, MO 65058
[illegible]	Assoc Comm	MARIES county	573-619-1170	30572 MARIES Rd 222 Meta MO 65058
[illegible]	Commissioner	Maries County	573-578-5157	25796 Maries RD [illegible] Bland MO [illegible]
[illegible]	Reporter	Maries Co Gazette	573-422-5597	[illegible]@gmail.com

Advisory Committee Meeting

Maries County Hazard Mitigation Plan Update

AGENDA

10:00 a.m. ~ Thursday, July 25, 2013

Maries County Courthouse

I. Welcome and Introductions – Tammy Snodgrass

II. Overview and Update of Planning Process

III. Review of Action Items and Prioritization

IV. Plan for Administering and Implementing Action Items

V. Setting of Date and Time for Next Meeting if Necessary

VI. Adjourn

Maries County Hazard Planning

July 25, 2013

NAME	Representing	Email / Phone
Laura Schiermeier	Maries Co. Gazette	769laura@gmail.com 573-422-9997
Ed Fagre	Maries Co Commission	
Doug Drewel	Commission Road #2	573-578-5253
Ray Schwartze	Pres Commissioner	573 465-0768
Rhonda Brewer	County Clerk	rhonda@mariesco.org 573/422-33 ext 111
Ken Ramsey	LEMD	KRAMSEYLEMD@GMAIL 573-263-05

Public Notices

For immediate release
Feb. 5, 2014

For more information, contact
Tammy Snodgrass at (573)265-2993

Maries County Hazard Mitigation Plan available online

ST. JAMES—The recently completed Natural Hazard Mitigation Plan for Maries County is available to residents online. Click here to review.

The purpose of the plan is to reduce or eliminate long-term risk to people and property from natural hazards. It is required that the county have this plan in place in order to be eligible for several Federal Emergency Management Agency grant programs in the case of a natural disaster.

Several entities participated in the planning process to build the plan, including the Maries County Commission, City of Belle, City of Vienna, Maries R-I School District and Maries R-II School District. The Meramec Regional Planning Commission (MRPC) assisted these entities in drafting the plan.

Interested parties may find the plan online at meramecregion.org. Those wishing to obtain a paper copy may contact MRPC Assistant Director Tammy Snodgrass at 573-265-2993 or tsnodgrass@meramecregion.org.

Comments, concerns and questions about the plan should be directed to Snodgrass. The plan will be submitted to the State Emergency Management Agency and FEMA wiin the next few weeks.

Formed in 1969, MRPC is a voluntary council of governments serving Crawford, Dent, Gasconade, Maries, Osage, Phelps, Pulaski and Washington counties and their respective cities. A professional staff of 23, directed by the MRPC board, offers technical assistance and services, such as grant preparation and administration, housing assistance, transportation planning, environmental planning, ordinance codification, business loans and other services to member communities.

To keep up with the latest MRPC news and events, visit the MRPC website at meramecregion.org or find us on Facebook at facebook.com/meramecregion.

5/29/14

Attention Members of the Maries County Hazard Mitigation Planning Committee, County Jurisdictions and Neighboring Jurisdictions:

The final draft of the Maries County Hazard Mitigation Plan is now available for review on the Meramec Regional Planning Commission website – www.meramecregion.org . A hard copy of the draft document is available at the Maries County Courthouse for public viewing as well. Please take some time to review the planning document, especially sections that have specifics regarding your jurisdiction. Please notify me no later than June 25, 2014 with any recommended changes or corrections. Maries 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.

List of jurisdictions receiving postcard notice

Appendix B

References

From: Carver, Heidi [mailto:Heidi.Carver@sema.dps.mo.gov]
Sent: Friday, December 20, 2013 1:40 PM
To: Tammy Snodgrass
Cc: Weyrauch, Elizabeth; Weber, Gayla
Subject: RE: repetitive loss data

Good afternoon Tammy,

Elizabeth pulled the information you needed.
Here is the info from Bureau Net:

15 RLC properties (1 mitigated; 14 unmitigated). There were 40 involving 14 properties and 2 losses involving the one mitigated property.
1 SRL property with 4 losses. There's another SRL property with 2 losses that's currently pending.

Have a great weekend!
Heidi

Heidi Carver, Planner
State Hazard Mitigation Specialist
State Emergency Management Agency (SEMA)
2302 Militia Drive
PO Box 116
Jefferson City, MO 65102
heidi.carver@sema.dps.mo.gov
Wk: 573.526.9116
Fax: 573.526.9198

Federal Emergency Management Agency
NFIP Policy and Claims Report
MISSOURI

CID	Community	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
	** MARIES COUNTY **					
0647	VIENNA, CITY OF	0	$ 0	$ 0	2	$ 18,310
0916	MARIES COUNTY*	33	$ 3,779,700	$ 21,302	47	$ 975,650
	County Total :	33	$ 3,779,700	$ 21,302	49	$ 993,960
	State Total :	24,697	$ 3,655,692,200	$ 18,318,322	39,850	$ 531,732,135

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