

# Montgomery County, Missouri

## *Natural Hazard Mitigation Plan 2015*



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## ***Executive Summary***

The purpose of natural hazard mitigation is to reduce loss of life and property by lessening the impact of natural disasters. Hazard Mitigation Plan forms the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. The Boonslick Regional Planning Commission on behalf of Montgomery County and participating jurisdictions developed a Multi-Jurisdictional Hazard Mitigation Plan that was initially approved by the Federal Emergency Management Agency (FEMA) in 2004. The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000). In accordance with DMA 2000 requirements, Montgomery County and participating jurisdictions must update the plan every 5 years. The plan was updated in 2009, and in 2014, the Multi-Jurisdictional Hazard Mitigation Plan for Montgomery County was again updated ensuring the continuity of federal mitigation project grant funding through 2019.

The Montgomery County Hazard Mitigation Plan is a multi-jurisdictional plan that represents several local governments within the county. The participating jurisdictions from the 2009 plan remain the same. Hence, ten jurisdictions and three school districts have participated in the planning process of this updated plan.

The following communities participated in plan development and are represented by the plan through formal adoption:

- Montgomery County
- City of Bellflower
- City of High Hill
- City of Jonesburg
- City of Middletown
- Montgomery City
- City of New Florence
- City of Wellsville
- Town of McKittrick
- Village of Rhineland

- Montgomery County R-II School District
- Wellsville - Middletown R-I School District
- Gasconade County R-I School District (serves southern part of Montgomery County)

In addition to the local governments and school districts, several other entities have been contacted to provide support and contribute to the mitigation strategy:

- American Red Cross
- Ameren UE
- Consolidated Electric Cooperative
- Callaway Electric Cooperative
- University of Missouri Extension Center
- Montgomery County PWSD #1
- Monroe County PWSD #2 (serves northern part of Montgomery County)
- Montgomery County Planning and Zoning Commission
- Various local churches of different faiths
- Montgomery County Economic Board
- Herman Area Hospital
- Emergency Management Agencies from Gasconade, Audrain, Callaway, Lincoln, and Warren Counties

The planning process followed the methodology prescribed in the *Local Multi-Hazard Mitigation Planning Guidance* published by FEMA on October 1, 2011 beginning with the formation of a Hazard Mitigation Planning Committee (HMPC) comprised of key stakeholders from Montgomery County, participating jurisdictions, state agencies, and other several private non-profit entities. The HMPC reviewed each section of the draft plan to include the planning process, risk assessment, mitigation strategy, and plan maintenance. Revisions were made as appropriate to ensure the plan reflects current vulnerability within each jurisdiction.

The goals of the Montgomery County multi-jurisdictional hazard mitigation plan are to:

GOAL 1: Protect the lives and livelihoods of all citizens

GOAL 2: Manage growth through sustainable principles and practices

GOAL 3: Ensure continued operation of government and emergency functions in a disaster

**Table 1.1; Goals, Objectives, and Action Plans**

<b>Goals, Objectives, and Action Plans</b>
<p><b>Goal #1: Protect the lives and livelihoods of all citizens.</b></p> <p><b>1.1 Provide sufficient warning systems.</b></p> <ul style="list-style-type: none"> <li>- Identify geographic areas and develop a plan to implement needed systems</li> <li>- Develop emergency warning systems</li> <li>- Improve NOAA All Hazards radio communication</li> </ul>
<p><b>1.2 Decrease the occurrence and impact of flooding.</b></p> <ul style="list-style-type: none"> <li>- Promote environmentally-sound watershed and storm water practices to decrease flash flooding</li> <li>- Review and revise flood-fighting plans</li> <li>- Strengthen floodplain regulations</li> <li>- Improve drainage of roadways in flashflood areas</li> <li>- Encourage local communities to include stormwater controls in their subdivision regulations</li> </ul>
<p><b>1.3 Increase knowledge of safety measures among employers and the public.</b></p> <ul style="list-style-type: none"> <li>- Develop hazard area maps and promote their use by the public</li> <li>- Consider additional training for emergency management personnel</li> <li>- Provide earthquake preparedness and safety literature each year</li> <li>- Identify ways to promote FEMA safety tips and mitigation techniques</li> <li>- Monitor development in special flood hazard areas to ensure compliance with local flood plain management ordinances</li> </ul>
<p><b>1.4 Increase and maintain appropriate emergency equipment.</b></p> <ul style="list-style-type: none"> <li>- Review and upgrade policies for identifying and budgeting additional emergency equipment</li> <li>- Review and upgrade critical infrastructure backup equipment</li> <li>- Promote fire-resistant construction materials</li> </ul>
<p><b>1.5 Protect residential structures.</b></p> <ul style="list-style-type: none"> <li>- Identify and use existing mechanisms to promote NFIP policies and earthquake/seismic insurance</li> <li>- Encourage all building owners to invest in retrofit techniques by providing FEMA articles via local newspapers &amp; Chamber of Commerce</li> </ul>
<p><b>1.6 Protect large employment and commercial facilities.</b></p> <ul style="list-style-type: none"> <li>- Consider known hazards when identifying a site for new facilities and systems</li> <li>- Encourage tornado safe rooms</li> <li>- Encourage up-to-date commercial and industrial disaster plans that are coordinated with community disaster plans</li> <li>- Encourage operation and infrastructure backup systems for commercial and industrial businesses</li> <li>- Use the Disaster-Resistant Jobs Plan to assist with disaster planning</li> </ul>
<p><b>1.7 Identify populations with special needs or those who may be more vulnerable to the impacts of disasters or hazard events.</b></p> <ul style="list-style-type: none"> <li>- Maintain inventory of special needs and vulnerable populations</li> <li>- Enhance warning systems and notifications for special populations</li> <li>- Provide shelter homes in case of emergency</li> </ul>

<b>Goals, Objectives, and Action Plans</b>
<p><b>1.8 Reduce the disruption to transportation infrastructure from hazard events, by reducing the vulnerability of transportation infrastructure to hazard events.</b></p> <ul style="list-style-type: none"> <li>- Maintain inventory of vulnerable infrastructure</li> </ul>
<p><b>Goal #2: Manage growth through sustainable principles and practices.</b></p> <p><b>2.1 Reduce and prevent degradation of, or conflicts with, natural resources.</b></p> <ul style="list-style-type: none"> <li>- Upgrade rural water/sewer systems to DNR standards</li> <li>- Resolve any existing environmental conflicts and take steps to prevent future conflicts</li> </ul>
<p><b>2.2 Promote sustainable planning, development and construction practices.</b></p> <ul style="list-style-type: none"> <li>- Promote building codes in incorporated areas that currently do not have such regulations</li> <li>- Implement measures to increase the county’s CRS status</li> <li>- Facilitate rainwater percolation in the groundwater supply</li> </ul>
<p><b>Goal #3: Ensure continued operation of government and emergency functions in a disaster.</b></p> <p><b>3.1 Strengthen critical structures and infrastructures.</b></p> <ul style="list-style-type: none"> <li>- Review and upgrade appropriate emergency backup systems</li> <li>- Maintain essential public services</li> <li>- Ensure all Class C dams have an Emergency operations plan and support periodic inspections of the dams</li> <li>- Maintain an inventory of levees in the County</li> </ul>
<p><b>3.2 Strengthen multi-jurisdictional cooperation among emergency agencies.</b></p> <ul style="list-style-type: none"> <li>- Identify, review, and implement mechanisms to foster collaboration among jurisdictions, agencies and special districts</li> <li>- Improve planning, funding, and response coordination</li> </ul>

## Prerequisites

**Requirement § 201.6(c)(5): 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 A. A model resolution for both the cities and school districts is provided in this Section.*

Montgomery County’s Multi-Jurisdictional Hazard Mitigation Plan has been formally adopted by the following participating jurisdictions.

- Montgomery County
- City of Bellflower

- City of High Hill
- City of Jonesburg
- City of Middletown
- Montgomery City
- City of New Florence
- City of Wellsville
- Town of McKittrick
- Village of Rhineland
- Montgomery County R-II School District
- Wellsville - Middletown R-I School District
- Gasconade County R-I School District (serves southern part of Montgomery County)

**Requirement §201.6(c)(5): Multi-Jurisdictional plans may be accepted, as appropriate, and as long as each jurisdiction has participated in the process**

The Boonslick Regional Planning Commission on behalf of Montgomery County invited incorporated cities and school districts, state agencies, and other non-profit entities in the County to participate in the Montgomery County Multi-Jurisdictional Hazard Mitigation Plan update. DMA 2000 requires that jurisdictions represented by a multi-jurisdictional plan participate in the planning process and formally adopt the plan. Each participating jurisdiction was required to meet plan participation requirements as defined by Boonslick Regional Planning Commission at the beginning of the planning process.

**Sample Resolution for Cities, Towns, and County**

RESOLUTION NO. \_\_\_\_\_

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

WHEREAS, the (Jurisdiction) 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 or wildfire and recognizes the importance enhancing its ability to withstand natural hazards as

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 (Jurisdiction) may have previously pursued measures such as building codes, fire codes, floodplain management regulations, zoning ordinances, and stormwater 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 (Jurisdiction) will be eligible to apply for post-disaster mitigation funds; and

WHEREAS, the (Jurisdiction) desires to commit to working with government partners and community partners to implement the Natural Hazard Mitigation Plan; and

WHEREAS, the (Jurisdiction) will implement pertinent precepts of the mitigation plan by incorporation into other community plans and mechanisms where appropriate; and

WHEREAS, the (Jurisdiction) 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 (Jurisdiction) as follows:

The (Jurisdiction) hereby adopts the 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 \_\_\_\_\_, 2015.

\_\_\_\_\_

ATTEST: \_\_\_\_\_

Certifying Official(s)

(Name, Title)

\_\_\_\_\_

## ***SECTION 1 - Introduction and Planning Process***

### **1.1 Purpose**

Montgomery County along with nine other jurisdictions and three school districts updated this multi-jurisdictional hazard mitigation plan in order to sustain actions designed to reduce or eliminate long-term risk to people and their property from natural disaster hazards. The planning process is as important as the plan itself and creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters. This updated plan ensures the continuity of mitigation project grant funding through 2019.

### **1.2 Background & Scope**

Hazard mitigation is defined by FEMA as any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards. In 2005, the National Institute of Building Science's Multi-Hazard Mitigation Council, in response to a congressional mandate, conducted an independent study on savings generated through mitigation activities. The study concluded that mitigation grant funded projects have an overall societal benefit / cost ratio of 4.0 (i.e., for every \$1 spent on mitigation activities, \$4 are saved through loss avoidance). Almost ten years later these numbers are still valid although today additional emphasis is placed on preparedness, sustainability, and community resilience.

Since the initial plan approval in 2004, Montgomery County has been impacted by 105 hazard events. Out of these 105 events, five were included as federally declared natural disasters and 23 were included as USDA (United States Department of Agriculture) declared disasters. The consequences of such events have impacted the citizens of Montgomery County economically, socially and emotionally. Because Montgomery County is subject to multiple natural hazards, hazard mitigation is of great importance to the county and its residents.

Through mitigation planning, Montgomery County has identified areas throughout the county that are vulnerable to natural hazards and developed actions to reduce such vulnerability the next time a disaster strikes. The updated Montgomery County hazard mitigation plan documents the progress made on established mitigation actions and proposes new actions designed to increase the county's resistance to natural hazards. The updated plan for Montgomery County is the result of a collaborative effort by the following participating jurisdictions:

- Montgomery County
- City of Bellflower
- City of High Hill
- City of Jonesburg
- City of Middletown
- Montgomery City
- City of New Florence
- City of Wellsville
- Town of Mc Kittrick
- Village of Rhineland
- Montgomery County R-II School District
- Wellsville - Middletown R-I School District
- Gasconade County R-I School District (serves southern part of Montgomery County)

In addition to the local governments and school districts, several other entities have been contacted to provide support and contribute to the mitigation strategy:

- American Red Cross
- Ameren UE
- Consolidated Electric Cooperative
- Callaway Electric Cooperative
- University of Missouri Extension Center
- Montgomery County PWSD #1
- Monroe County PWSD #2 (serves northern part of Montgomery County)
- Montgomery County Planning and Zoning Commission
- Various local churches of different faiths
- Montgomery County Economic Board
- Herman Area Hospital
- Emergency Management Agencies from Gasconade, Audrain, Callaway, Lincoln, and Warren Counties

The updated Montgomery County Multi-Jurisdictional Hazard Mitigation Plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and regulations set forth in 44 CFR §201.6, *Local Mitigation Plans*. With an approved updated hazard mitigation

plan, Montgomery County will remain eligible for grants under the following federal hazard mitigation assistance programs:

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

### 1.3 Planning Process

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

Following the severe weather, tornado, and flood disaster that was declared in the spring of 2002 (DR-1412), Missouri's State Emergency Management Agency (SEMA) received flood buyout project proposals from 23 communities across the state. Fortunately, they were able to help some of the communities with federal mitigation grant funding provided through the Federal Emergency Management Agency (FEMA). After November 1, 2004, communities like these were eligible for federal disaster public assistance and individual assistance, but not for mitigation assistance unless they have an approved hazard mitigation plan.

Through SEMA's Scope of Work, Montgomery County contracted with Boonslick Regional Planning Commission and participated fully in the preparation of this update of the 2014 plan. Taking into consideration the updated Missouri State Hazard Mitigation Plan 2013 and the updated Montgomery County Emergency Operations Plan 2014, this report briefly discusses the man made incidents which can be just as devastating as natural disasters in Montgomery County. The following man made hazards are also addressed briefly in this update; nuclear power plants, hazardous materials, transportation, utility interruptions & power failure and terrorism. The natural hazards included in this plan update are dam failure, drought, earthquake, extreme heat, floods, thunderstorms and high winds, tornado, wildfire, levee failure and land subsidence (sink holes). Once this plan is approved, Montgomery County and cities within the county will still be eligible for future mitigation assistance from FEMA and will be able to more effectively carry out mitigation activities to lessen the adverse impact of future disasters within the county.

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## Acknowledgements and special thanks

Throughout the plan development process there were several county and city officials and state employees who provided valuable assistance in the form of data sources, contacts, and prioritization of action plans.

### 1.3.1 Multi-Jurisdictional Participation

**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.**

The Disaster Mitigation Act requires that each jurisdiction participate in the planning process and officially adopt the multi-jurisdictional hazard mitigation plan. A Hazard Mitigation Planning Committee (HMPC) was created that includes representatives from each participating jurisdiction, departments of the county, school districts and other agencies responsible for making decisions in the plan and agreeing upon the final contents. The HMPC contributed to this planning process by: providing facilities for meetings, attending and participating in meetings, collecting data, reviewing drafts, and coordinating and assisting with public involvement and plan adoptions. Minimum participation requirements are defined as follows:

- Provide information to support plan update through **at least one** of the following methods:
  - Attend the scheduled HMPC meetings;
  - Alternately schedule meetings as necessary with BRPC staff liaison for data collection, risk assessment and mitigation strategies (*2 plenary sessions were held with BRPC representatives and the Montgomery County EMD and 1 plenary session was held with BRPC, the EMD, and two members of the Montgomery County Commission*); or
  - Communicate with BRPC staff through email or telephone concerning data collection, risk assessment and mitigation strategies.
- Formally adopt the mitigation plan.

Representatives for each participating jurisdiction are listed in the table below. The second and third tables show the participation of Agency Representatives.

**Table 1.2; Representatives From Each Participating Jurisdiction**

Jurisdiction	Name of the HMPC Representative
Montgomery County	Bob Bishop, Emergency Management Director
Bellflower	Jeanie Martin, Mayor
High Hill	Floyd Weeks, Mayor
Jonesburg	Sherry Meyer, City Clerk
Mc Kittrick	Joey Los, Mayor
Middletown	Julia Fleming, Clerk
Montgomery City	Steven Deves, Montgomery City Administrator
New Florence	Adele Jonas, City Clerk
Rhineland	Steve Wehrle, Mayor
Wellsville	Carolyn See, Clerk
Montgomery Co. R-II School District	Michael Gray, Superintendent
Wellsville-Middletown R-I School District	Darin Sehlke, Principal
Gasconade Co. R-I School District	Darrel Boyer, District Representative

**Table 1.3; Participation Matrix of Agency Representatives**

Participating Jurisdiction	HMPC Meeting #1	HMPC Meeting #2	Email/ Phone	BRPC Staff Liaison Meeting	Formal Plan Adoption
Montgomery County	X	X	X	X	X
Bellflower	X	X	X	X	X
High Hill	X		X	<b>X</b>	X
Jonesburg			X	<b>X</b>	X
Mc Kittrick	X		X	<b>X</b>	X
Middletown		X	X	<b>X</b>	X
Montgomery			X	<b>X</b>	X
New Florence	X	X	X	<b>X</b>	X
Rhineland			X	<b>X</b>	X
Wellsville			X	<b>X</b>	X
Montgomery County R-II School District	X	X	X		X
Wellsville-Middletown R-I School District	X	X	X		X
Gasconade County R-I School District	X	X	X		X

**Table 1.4; Participation Matrix of Agency Representatives**

<b>Other Participants</b>	<b>Name of the HMPC Representative</b>
Montgomery City Police Department	Ahern, P.L.
Callaway Energy Center, Ameren Missouri	Bassford, John
Bellflower	Berry, John
Trinity Lutheran Church	Bolstad, Rev. Arthur
Immaculate Conception Church	Brainbridge, Richard
St. John's United Church of Christ	Brandenburg, Fred
City of New Florence	Burroughs, John
Montgomery County Court House	Cartee, Pamela A.
Bellflower Third Ward	Chandler, Marilyn
City of Middletown	Chandler, Wayne
Montgomery County Ambulance	Colbert, Dave
Montgomery County Developmental Disabilities	Cole, Dan
Warren County EMA	Daniels, Mike
Montgomery County Commission	Daniels, Rich
Wellsville Police Department	Daniels, Rich
Lincoln County EMA	Daugherty, Jerry
American Red Cross	Davis, Anita
Montgomery County	Davis, Robert
City of Montgomery	Deves, Steven
Community Edge LLC	Etcher, Steve
Middletown	Fleming, Julia
New Florence Fire District	Fortman, Cody
New Florence Fire District	Fortman, Ron
Consolidated Electric	Fuller, Michael S.
Montgomery County Health Department	Harman, Linda
Middletown Baptist Church	Hobbs, Clifford
City of New Florence	Ingle, David
Callaway County EMA	Kidwell, Michelle
Pike County EMA	Korte, Stephen
Montgomery County 911	LaBanca, Jody
University Extension Office	Larkin, Dean
City of Rhineland	Maddux, Cathy
American Red Cross	Mayne, Katharine M.
Herman Area District Hospital	McKinney, Dan
Reach Community Church	Meyer, Chris

Montgomery County PWSD #1	Moore, Rich
Montgomery County Commission	Noltensmeyer, John
City of Montgomery	Porter, Jeff
Montgomery County Commission	Poston, Ryan
Montgomery County Fire Protection District	Reynolds, Keith
Monroe County PWSD #2	Riechmann, Nancy
Middletown	Scarborough, Georgia
Gasconade County EMA	Schoeing, Mike
City of Wellsville	See, Carolyn
City of Jonesburg	Sellenriek, Robert
City of Bellflower	Sexton, Kalani
Audrain County EMA	Shaw, Steven
St. Patrick's Catholic Church	Sigler, Sr. Loretta
Ameren	Smith, Kelly
Montgomery County Economic Board	Speight, Brent
Montgomery County Ambulance	Staley, Chad
City of Wellsville	Steele, Howard
New Florence Methodist Church	Thomas, Russell
Montgomery Planning and Zoning	Veihmann, Donna
City of High Hill	Weeks, Joan
New Florence Fire District	Williams, Steve
City of Middletown	Willis, Sandra
Jonesburg Police Department	Wilson, Kevin
Wellsville Fire District	Wilson, Richard

### 1.3.2 The 12-step Planning Process

BRPC established the framework and process using FEMA's *Local Multi-Hazard Mitigation Planning Guidance* (2011). The plan structure follows the 2009 update as outlined below.

- a) Organize resources
- b) Assess risks
- c) Develop the mitigation plan
- d) Implement the plan and monitor progress

#### Phase 1 Organize Resources

##### ***Step 1: Organize the Planning Effort***

The process to develop a HMP for Montgomery County planning area was first initiated in 2004 and updated in 2009. The effort was revived in September 2014 as part of this update process. Boonslick met initially with the county Emergency Management Director to scope out the effort. It should be noted that prior to convening the full committee, Boonslick met with the EMD once again, and once with the county commissioners and the EMD to assess the methodology of conducting meetings, scope of work, and action plan updates. Two meetings were conducted during this update process. Display ads were placed for each meeting in the Montgomery County Standard newspaper, and public notices were posted on the BRPC website and office space, as well as in the Montgomery County Courthouse and all participating city halls announcing the meetings as being open to the public. There is no evidence to support this effort as having solicited any additional input. Agendas, sign-in sheets, and minutes along with the presentation from the first meeting are included in Appendix C; Planning Process Documentation.

### ***Step 2: Plan for Public Involvement***

**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.**

In accordance to Missouri's "sunshine law" (RSMo 610.010, 610.020, 610.023, and 610.024), the public was notified prior to each meeting. As stated earlier, a concerted effort was made to secure public participation in each of the two meetings. Following incorporation of the committee's revisions to the updated plan, copies of the plan were provided to all committee members for their review. Upon completion of the two-week review period the completed plan was made available via printed copies and DVDs to each participating city and school district, the Montgomery County Courthouse, and the adjoining counties' EMDs. Copies were also available at the BRPC offices and via the BRPC website. Concurrently notices were placed on the BRPC website, the Montgomery County Standard newspaper, the Montgomery County Courthouse, and all participating city halls announcing the public comment period and where to obtain copies for review. There were no comments or questions from the public during this period.

**Table 1.5 HMPC Meeting Details**

Meeting	Topic	Date
HMPC #1- Kickoff meeting	Hazard Mitigation Planning Purpose, Disasters in Montgomery County, List of Participating jurisdictions and agencies, Ranking the hazards, Mitigation goals, objectives, and action plans.	September 16, 2014
HMPC #2- Working Session	Review of progress to date, review and discussion of action plan and STAPLEE analysis.	November 18, 2014
Plan adoption meetings	Adoption resolution	Need to fill in the dates

**Step 3: Coordinate with Other Departments and Agencies**

**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 numerous organizations whose goals and interests interface with hazard mitigation in Montgomery County. BRPC shared the draft updated plan with the Emergency Management Directors (EMDs) of the neighboring counties on the draft of the Montgomery County Natural Hazard Mitigation Plan. The EMDs were given an opportunity to review and comment on the plan. The counties include: Audrain, Callaway, Gasconade, Lincoln, Pike, and Warren. As previously stated, the draft plan was posted on the BRPC website where any and all who have an interest in the plan have an opportunity to review and provide comments. No comments or questions were received from any adjacent agencies. The correspondence is attached under Appendix C- Planning Process.

**Phase 2 Assess Risk**

**Step 4: Identify the Hazards**

BRPC, with the help of the HMPC, validated the natural and manmade hazards that have impacted or could impact communities in Montgomery County. The Federal Declared Disaster data, USDA Declared Disaster data, NOAA’s National Climatic Development Center data, Missouri State Hazard Mitigation Plan 2013 as well as best judgment of the most knowledgeable local authorities were analyzed in developing the prioritization process.

**Table 1.6; Prioritization of County-Wide Natural Hazards**

<b>Natural Hazards</b>	<b>Probability</b>	<b>Severity</b>	<b>Vulnerability ranking</b>
Drought	Moderate	Moderate	Moderate
Earthquake	Moderate	Moderate	Moderate
Extreme Heat	High	Low	Moderate
Hail (>.75")	High	Moderate	Moderate
Thunderstorm and High Wind	High	Moderate	High
Tornado	High	High	High
Wild Fire	Moderate	Moderate	Moderate
Severe Winter Weather	High	Moderate	Moderate

**Table 1.7; Prioritization of Jurisdictional Specific Natural Hazards**

<b>Natural Hazards</b>	<b>Jurisdiction/School District impacted</b>	<b>Probability</b>	<b>Severity</b>	<b>Vulnerability ranking</b>
Dams	Unincorporated	Low	Low	Low
Dams	Middletown	Low	High	Low
Floods/Flash Floods	Montgomery City, Montgomery County R-II School District, Gasconade County R-I School District, New Florence, Rhineland, Wellsville-Middletown R-I School District	Moderate	Moderate	Moderate
Levee Failure	McKittrick, Rhineland, Gasconade County R-I School District	Moderate	Moderate	Moderate
Sinkholes	Unincorporated	Low	Low	Low

**Table 1.8; Prioritization of Man-Made Hazards**

<b>Man Made Hazards</b>	<b>Probability</b>	<b>Severity</b>	<b>Vulnerability ranking</b>
Terrorism	Low	High	Moderate
Hazardous Material Release	High	Moderate	Moderate
Nuclear Radiation Leak	Low	High	Moderate
Transportation Disruption	High	High	High
Utility Failure	High	Moderate	Moderate

**Step 5: Profile the Hazards**

Web resources, existing reports and plans, and existing geographic information systems (GIS) layers were used to compile information for profiling the hazards. Hazard profiles from the original plan and from the 2013 state plan were reviewed for applicability and revised accordingly. The revised hazard profiles detail the location, previous occurrences, probability of future occurrences, and magnitude/severity of each hazard. More information on the methodology and resources used to identify and profile the hazards can be found in Sections 3.1 and 3.2.

**Step 6: Identify Assets**

After profiling the hazards that could affect Montgomery County, BRPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions. This step included two parts: a vulnerability assessment and a capability assessment. The 2013 state plan was referenced and cited frequently where no data was available.

**Vulnerability Assessment**—The base for the vulnerability assessment for this update will include the Missouri State Hazard Mitigation Plan 2013. The State Plan vulnerability analysis is mostly based on Hazus-MH risk assessment. Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus is used for mitigation recovery as well as preparedness and response.

**Capability Assessment**—this assessment consisted of identifying the existing mitigation capabilities of participating jurisdictions. This involved collecting information about existing government programs, policies, regulations, ordinances, and plans that mitigate or could be used to mitigate risk from hazards. This information is included in Chapter 2 Planning Area Profile and Capabilities.

**Step 7: Estimate Losses**

Where sufficient information was available, a variety of methods were used to estimate losses for each profiled hazard. For the flood hazard, with the help of SEMA, HAZUS-MH was utilized to estimate losses in the planning area as a result of a 100-year flood event. The methodology is described in detail for each hazard analysis that included a loss estimate. This information can be found in Section 3.3.3.

**Phase 3 Develop the Mitigation Plan**

***Step 8: Set Goals***

The committee reviewed the plan's existing goals which were the same as the 2009 plan and achieved consensus that existing goals remain valid for the updated plan during the kickoff meeting. Consensus was achieved on the existing goals during both committee meetings and confirmed via email correspondence regarding draft review. BRPC staff liaison conducted meetings with each participating jurisdictions as necessary in order to complete the prioritization process. The specific information on the mitigation goals and action plans are detailed under Section 4 - Mitigation Strategy.

***Step 9: Review Possible Mitigation Activities***

The status on the existing mitigation activities were discussed prior to the HMPC meetings with the Montgomery County EMD and the County Commissioners and then brought before the committee as a whole. During the kickoff meeting, a list of the 2009 action plans were submitted to the committee in order to develop new ideas. The committee achieved consensus that the existing action plans remain valid for the updated plan with little tweaking required.

The STAPLEE analysis for this update remains the same as the 2009 plan as there were no new action plans to be included. A scoring methodology for likelihood of lives saved and the reduction of disaster damages as well as timeline for implementation were included to develop the prioritization of action plans. The process followed is discussed in detail under Section 4 - Mitigation Strategy.

***Step 10: Draft the Plan***

In order to update the plan, BRPC collected and reviewed existing technical data, reports, and plans. These included County Comprehensive Plan (1995), Montgomery County Emergency Operations Plan (2014), Disaster-Resistant Jobs Plan, Comprehensive Economic Development Strategy (CEDS, 2014), Region F Threat Hazard Identification and Risk Assessment (THIRA), and reports from the National Flood Insurance Program's Community Information System, Missouri State Hazard Mitigation Plan 2013, HAZUS data as well as other data from state and federal agencies. This information was used to improve the plan's risk assessment and to validate plan's goals, objectives, and mitigation actions.

Table 1.9 shows the list of existing plans, studies, reports, and technical information reviewed and further incorporated into the plan.

**Table 1.9; List of Existing Plans / Studies / Reports**

Existing Plan/ studies/ reports etc.	Does the jurisdiction have this plan technical document? (Yes/No)	Reviewed? (Yes/No)	Method of incorporation into the hazard mitigation plan
Comprehensive Plan 1995	Yes	Yes	Land uses, environmental issues.
Montgomery County Emergency Operations Plan 2014	Yes	Yes	Mitigation measures, Inventory of critical/key/essential facilities
Disaster resistant jobs plan	Yes	Yes	Information on economic effects of possible disasters in the county
CEDS 2014	Yes	Yes	Provides general demographic, economic, and environmental data
Transportation Plan	Yes	Yes	Existing road networks and transportation incidents
Flood plain management ordinance	Yes	Yes	Safety measures in times of floods
Subdivision regulations	Yes	Yes	Safe construction of water and sewer facilities
Flood insurance	Yes	Yes	Information on participating jurisdictions
Threat and Hazard Identification and Risk Assessment (THIRA)	Yes	Yes	Source data

### ***Step 11: Adopt the Plan***

To secure buy-in and officially implement the plan, the governing bodies of each participating jurisdiction adopted the plan. Copies of resolutions of adoption are included in Appendix C.

### ***Step 12: Implement, Evaluate, and Revise the Plan***

The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time. HMPC expressed interest in meeting annually to review and update potential changes to the plan that may be incorporated into the next update. This strategy is described in Chapter 5 Plan Maintenance Process. Table 1.10 shows the sections which are reviewed and revised. Also, includes the summary of changes and their respective location in the plan.

**Table 1.10; Reviewed and Revised Sections**

Plan Section	Section Reviewed	Section Revised	Basis for Revisions	Summary of Changes & Location in Plan
Planning Area Profiles	Yes	Yes	Demographic and Employment changes	Section 2- Updated maps; Updated population and housing estimates for each participating jurisdiction; updated information on existing plans & programs; updated future development trends
Risk Assessment	Yes	Yes	Updated hazard information	Section 3 - Updated federally declared and USDA declared disasters; updated probability and magnitude/severity; updated hazard maps; updated community assets and vulnerability assessment.
Mitigation Strategy	Yes	Yes	Status on action plans	Section 4- Reviewed the status on action plans; STAPLEE analysis & final prioritization
Plan Implementation & Maintenance	Yes	Yes	Annual review to be incorporated	Section 5- Revised plan maintenance process
Appendices	Yes	Yes	Updated the Bibliography and added the HMPC meeting details	HMPC meeting initiation letters, meeting agendas, and sign-in-sheets; Appendices.

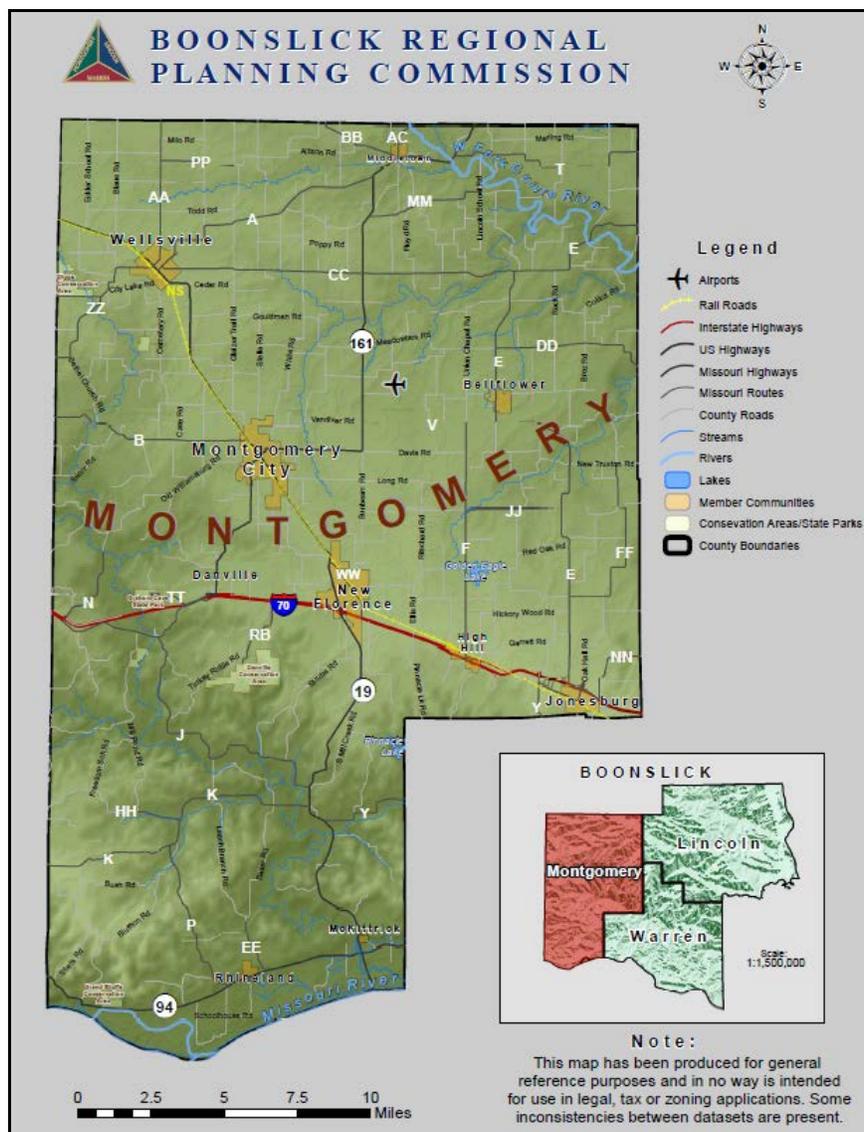
## SECTION 2 – Planning Area Profile and Capabilities

Section 2 provides a general profile of Montgomery County followed by descriptions of each of the jurisdictions participating in this plan and their existing mitigation capabilities.

### 2.1 Montgomery County Planning Area Profile

Figure 2.1 shows a map of the Montgomery County planning area.

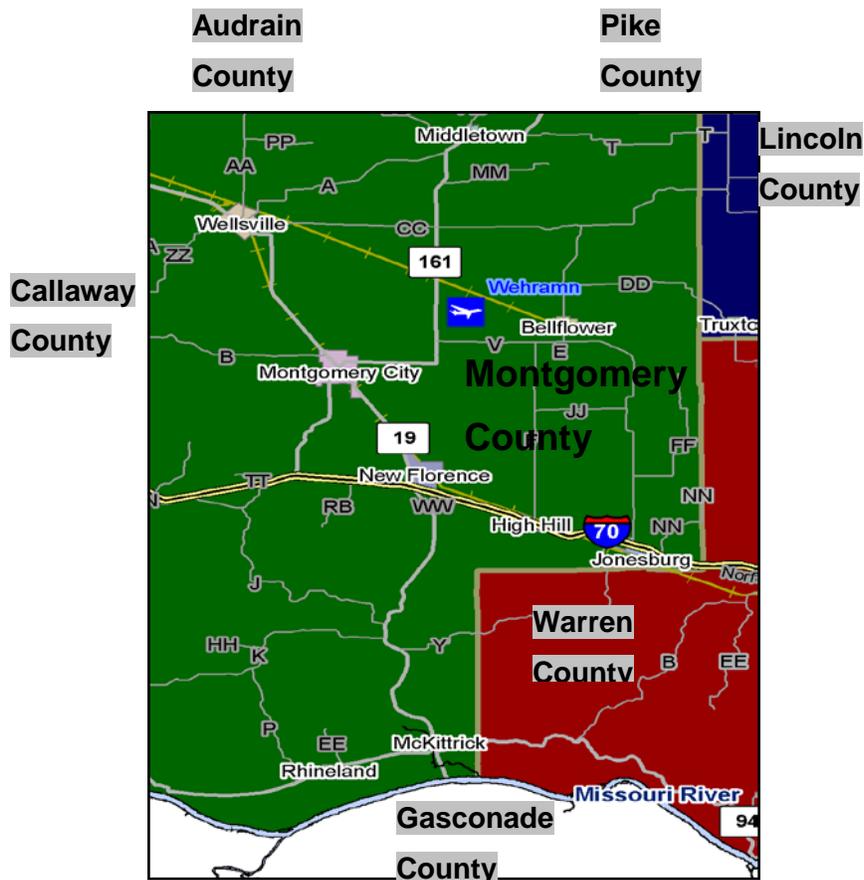
Figure 2.1; Planning Area



**2.1.1 Geography and Topography**

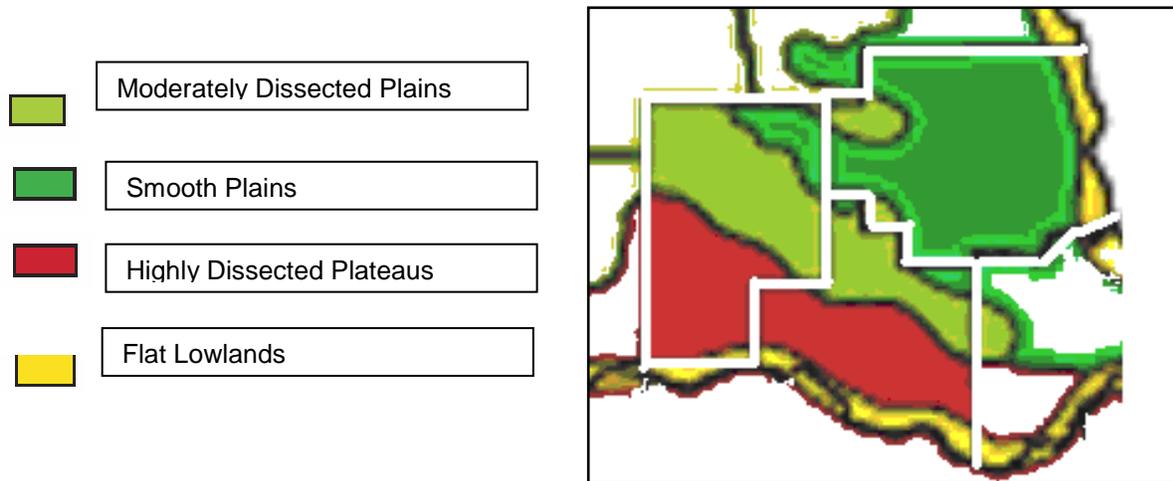
Montgomery County lies just west of the St. Louis Metropolitan Statistical Area boundary. The Loutre River flows across the southwest area of the county and the Cuivre River runs through the extreme northeast corner of the county. Callaway County lies to the west and Warren and Lincoln counties to the east. Audrain, Ralls and Pike counties connect with Montgomery's north boundary while Gasconade lies to the south.

**Figure 2.2; Montgomery County Roads and Surrounding Counties**



Montgomery County encompasses approximately 537 square miles, or 343,680 acres. The county's southern border is a wide strip of alluvium (silt, sand and gravel up to 150 feet thick). These flat lowlands give way to highly dissected plateaus covered in clay and cherty limestone gravel up to 50 feet thick. Roughly, the northern half of the county lies mostly in smooth plains covered with glacial deposits of clay, silt, sand, and gravel (up to 300 feet thick).

**Figure 2.3;**  
**Topographic Relief Map of Boonslick Region (Montgomery County at Far Left)**



*Source: Missouri Department of Natural Resources, 2002*

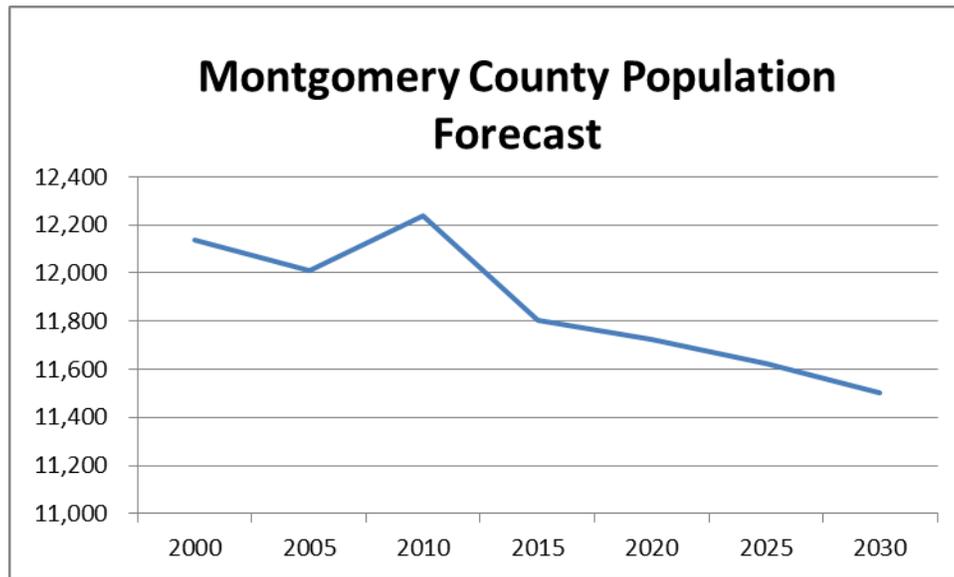
### **2.1.2 Climate**

The climate is generally moderate. Temperatures, according to the National Weather Service (NWS) station at Columbia, range from an average high of 89 degrees in July to an average low of 18 degrees in January. Rainfall averages 4 inches in March through July while the average is 3 inches September through December. December through February snowfalls can range from 4 to 7 inches. Average wind speeds range from 9 to 12 miles per hour throughout the year. Winter and spring winds are from the west-northwest while summer winds blow primarily from the south.

### **2.1.3 Population / Demographics**

Montgomery County's population was steady from 1900 through 1930. A 15 percent loss in population between 1920 and 1930 was the beginning of a steady decline through 1970. The county population has grown 9 percent since 1970; however, projections show a decrease in the population from 2010 to 2030 at a consistent rate of 6%. In Montgomery County, 6,429 live in small, incorporated places and 5,707 live in unincorporated areas (American FactFinder).

**Chart 2.1 Montgomery County Population Forecast (2000-2030)**



*Source: Missouri Office of Social and Economic Data Analysis (OSED)*  
*Note: Projections are based on the 2010 Census.*

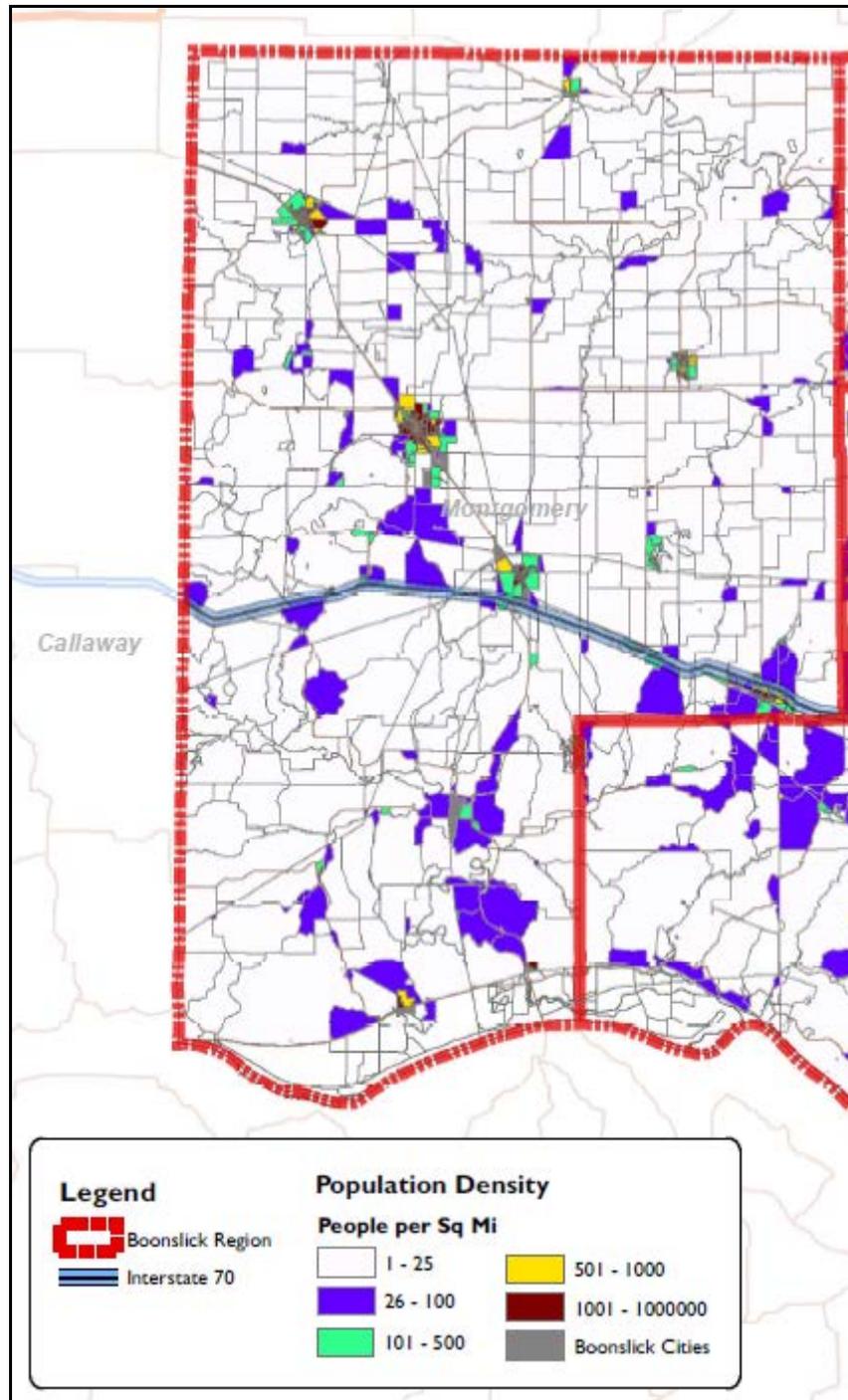
Population changes and housing units for each of the incorporated cities and the unincorporated County are provided in Table 2.1.

**Table 2.1; Population Changes and Housing Units 2000 - 2010**

Location	2000 Population	2010 Population	% Change 2000-2010	2010 Housing Units
Montgomery County	12,136	12,236	0.8%	6,130
Bellflower	427	393	-8.0%	187
High Hill	231	195	-15.6%	102
Jonesburg	695	768	10.5%	325
McKittrick	72	61	-15.3%	36
Middletown	199	167	-16.1%	104
Montgomery	2,442	2,834	16.1%	1,279
New Florence	764	769	0.7%	302
Rhineland	176	142	-19.3%	65
Wellsville	1,423	1,217	-14.5%	564
TOTAL CITY	6,429	6,546	1.8%	
Unincorporated	5,707	5,690	-0.3%	

The population density map shown below reflects the county's population density of 22.8 persons per square mile.

**Figure 2.4; Population Density**



Source: Boonslick Regional Planning Commission, 2014

### **2.1.4 History**

While the early pilgrims were settling in the eastern part of the United States during the 1700's, the land west of the Mississippi River was an unexplored wilderness. This region was discovered and claimed by France as early as 1682. France gave the region to Spain in 1762 but reclaimed it again in the early 1800's after the French and Indian War.

By 1810 the first white settlers in Montgomery County had established a settlement on Loutre Island- which was located in the southern part of the future county on the north side of the Missouri river just northwest of the present-day town of Hermann. On December 14, 1818, three years before Missouri achieved statehood; a part of western St. Charles County was officially established as Montgomery County by the Territorial Legislature of Missouri.

After the railroad was built to the east of Danville near New Florence, Montgomery City began to grow in prominence because of its location along the rail line. Later the county seat was permanently relocated from Danville to Montgomery City in 1921. While there were some settlements on the southern and northern parts of Montgomery County by the mid 1800's, the greatest concentration was in the central part. Communities such as Big Spring, McKittrick, Bluffton, and Rhineland were established on the southern part of the county to serve as commercial and social centers for the farmers who tilled the rich bottomlands of the Missouri River. Unfortunately, many of these towns have been constantly plagued by raging flood waters and are, today, just small rural residential communities.

The establishment of the greatest concentration of villages and towns was in the central part of the county along the Boone's Lick Trail. The communities of Jonesburg, High Hill, New Florence, Danville, and Mineola were founded to serve as stopovers along the trail and commercial centers for the local residents. In the northern and north-central parts of the county, towns such as Montgomery City, Wellsville, and Bellflower were established near the railroad lines, while Middletown was founded as settlers moved westward along the Cuivre River.

The present-day boundaries were created two years later when Callaway County was formed out of Montgomery County's western lands. Montgomery County was named for General Benjamin Montgomery of the Revolutionary War.

## 2.1.5 Economy/Industry

### 2.1.5.1 Labor Force, Average Wage Rate, Unemployment Rate

The 2010 U.S. Census reported the county had a civilian labor force (workers 16 and over) of 5,910 or 48% of the county's total population (Stats Indiana). The per capita income for the county in 2010 was \$31,958 which is a 5.3% increase from 2009, making it one of the 10 largest per capita income growth counties in Missouri (MERIC). Per the US Census Bureau's 2013 estimate, 17.2% of the population of Montgomery County; or 2,100 people, live below the federal poverty level. The 2013 unemployment rate for Montgomery County was 7% percent compared to Missouri's rate of 6.5 percent. Roughly 80% of Montgomery County's 25 year-old-plus population are high school graduates or higher.

### 2.1.5.2 Primary Industries

A few small manufacturers as well as a detention facility (operated by Missouri Division of Youth Services) exist in Montgomery City. The county's primary employers include schools, restaurants, nursing homes, convalescent homes, convenience stores, general contractors, banks, and metal buildings prefabricators.

Employment by category, as of Census 2010, consists of 9.7% manufacturing, 9.2% retail trade, and 7.7% health care and social assistance. Farm employment leads with 14.6% of total employment for the county, with the rest of the county's employment stemming from the remaining categories.

**Table 2.2; Montgomery County Employment by Category**

Sector	No. Employed	% of Total
Farm employment	799	14.6
Local government	539	9.9
Manufacturing	531	9.7
Retail Trade	502	9.2
Health care and social assistance	420	7.7
Construction	406	7.4
Other services, except public administration	351	6.4
Finance and insurance	323	5.9
Wholesale trade	236	4.3
Accommodation and food services	209	3.8
Real estate and rental and leasing	206	3.8

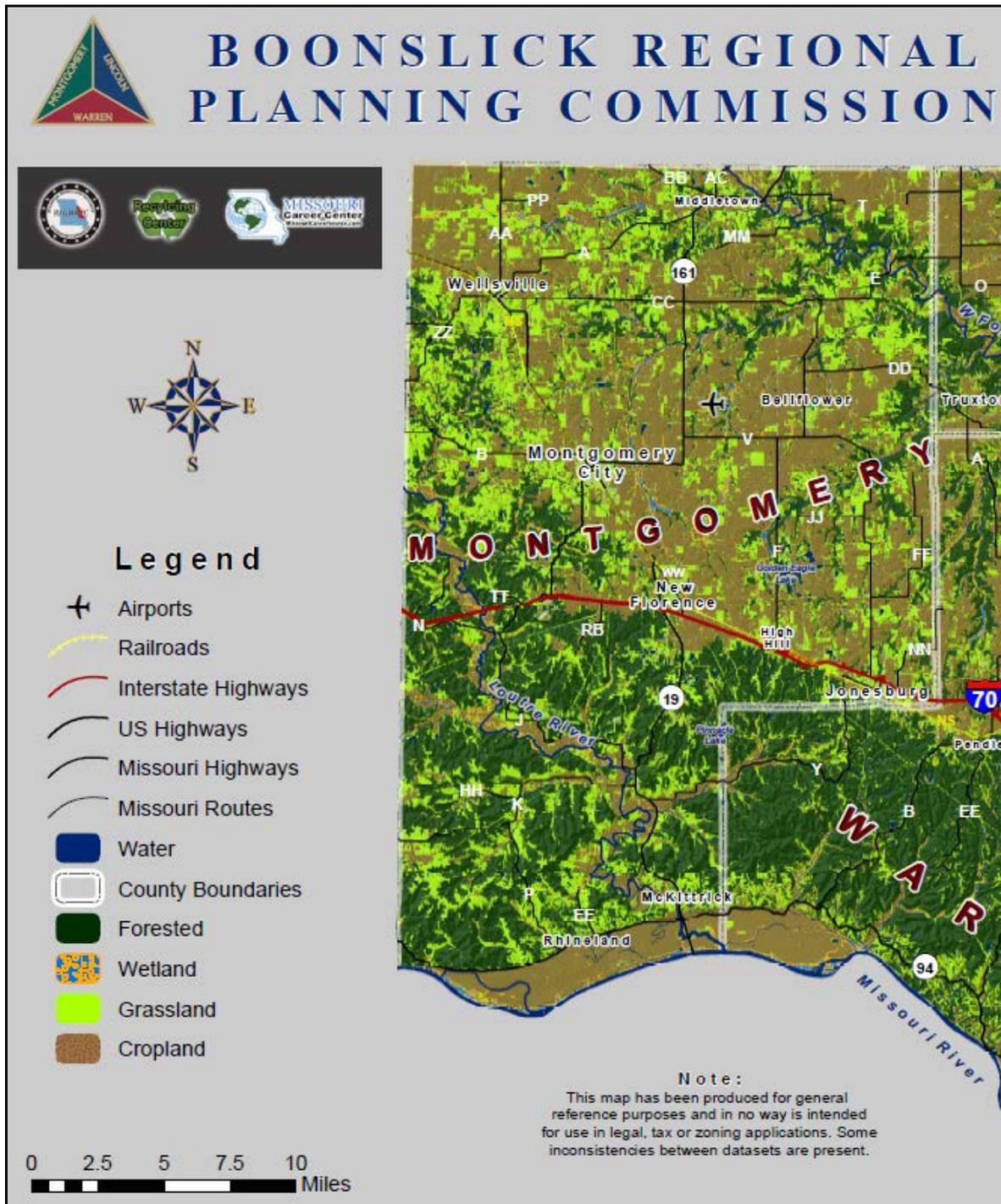
<b>Sector</b>	<b>No. Employed</b>	<b>% of Total</b>
Administrative and waste services	138	2.5
State government	137	2.5
Total Employment	5,467	

*Source: US Census Bureau, Summary File DP-3 & OSEDA, University of Missouri, 2014*

### **2.1.6 Land Use Information**

More than half the county is grassland and crops as shown on the land cover map. The remainder primarily is forested. However, rural land in the southern portion of the county has continually decreased in the face of increased urban development. BRPC's June 2014 Comprehensive Economic Development Strategy shows the number of farms in Montgomery County declined from 1036 in 2007 to 795 in 2010 for a 34% decrease. However, in 2002 there were 761 farms and by 2007 there were 1036 farms indicating sporadic periods of increase and decline

Figure 2.5; Land Cover



## **2.1.7 Existing Plans and Programs**

### **2.1.7.1 Montgomery County Emergency Operations Plan (EOP)**

The respective governments of Montgomery County and its incorporated subdivisions have developed this plan in order to maximize their emergency response capabilities. Its purpose is to assign responsibilities, develop procedures and identify resources that will give local officials the best comprehensive emergency management capability possible, considering available resources.

This Emergency Operations Plan and its supporting documents will assist the local government officials in meeting their responsibility for dealing with threats to the lives and property of their constituency. It will concentrate on actions that (1) insure prompt and proper responses, (2) minimize suffering, (3) eliminate conditions caused by shortages of materials or services, (4) speed the return to normal and (5) promote the well-being of the community.

This document basically explains how emergency operations will be controlled and the relationship of the various participating agencies. All hazards, man-made or natural, will be considered from the standpoint of the four aspects of Emergency Management: (1) Mitigation, (2) Preparedness, (3) Response and (4) Recovery

### **2.1.7.2 Threat and Hazard Identification and Risk Assessment (THIRA)**

The Boonslick region participates in the Missouri Office of Homeland Security Regionalization program which in 2013 included extensive work on development of a Threat and Hazard Identification Risk Assessment, THIRA. The Boonslick region has also taken steps to facilitate the long-term economic recovery of citizens, businesses, and communities from the devastating impacts of the 2008 flood events, and prepare them to meet future disasters of any type.

### **2.1.7.3 Relocation Best Practices**

As a result of flooding in 1993, 1995 and again in 2008, Boonslick Regional Planning Commission (BRPC) assisted in moving three Missouri communities out of harm's way; Rhineland, Silex, and Winfield.

**2.1.7.4 Comprehensive Economic Development Strategy 2014 update**

Boonslick Region's 2014 Comprehensive Economic Development Strategy update is designed to guide the region's economic growth by fostering a more stable and diverse economy, assisting in the creation of jobs, and improving the overall living conditions in Lincoln, Montgomery and Warren counties. It also provides a mechanism for coordinating the efforts of individuals, organizations, local government, and private industry concerned with the region's economic development. This plan further, integrates with the State's economic development priorities and workforce investment strategies.

**2.1.7.5 Business Continuity Planning**

To increase resiliency in the region's smallest businesses, Boonslick is promoting business continuity education for businesses vulnerable to disasters.

**2.1.7.6 RLF recap**

Access to capital will enable the region's businesses to build resiliency from economic hardship and natural disaster. To that end, EDA recapitalized the BRPC revolving loan fund. EDA provided \$300,000 and BRPC injected \$100,000 into the BRPC RLF loan pool.

**2.1.7.7 CDBG Land Use Planning Grant**

BRPC developed a detailed flood analysis and created a long range infrastructure deployment plan for the region. The project asserts that communities if armed with the knowledge of the vulnerabilities, informed of the options and assistance available will create and implement policies and procedures to protect the lives and property of the citizens. This plan can be utilized for future public and private investment decision-making in the region.

**2.1.7.8 Commodity Movement Study**

The purpose of the commodity movement study was to find a way to turn the adversity of continual river flooding into the opportunity of using those same rivers to anchor a multi-modal hub in the Boonslick Region which includes Lincoln, Montgomery, and Warren Counties.

### **2.1.7.9 National Flood Insurance Program (NFIP)**

Montgomery County participates in the National Flood Insurance Program (NFIP). The cities of Bellflower and New Florence do not participate.

### **2.1.8 Development Trends**

Per current trends, it is estimated that future development would occur along I-70 and Highway 19. Further, it was estimated that the cities along I-70 and Hwy 19, which are Montgomery City, New Florence, High Hill, Jonesburg, and Wellsville might tend to grow at an accelerated rate compared to other areas in the county.

The long range infrastructure deployment plan for Montgomery County was developed to ensure efficient and smarter use of existing infrastructure and deliver timely; well located additional infrastructure capacity. The existing infrastructure considered for the analysis includes- water system, wastewater system, fire hydrants, manhole covers, roads, and bridges. The other resources considered are population density, location of floodplain, transportation network, watersheds, soils, water bodies etc. The analysis is based on considering positive and negative impact of the above categories. For example, growth in the floodplain will be regulated and growth near existing infrastructure will be encouraged.

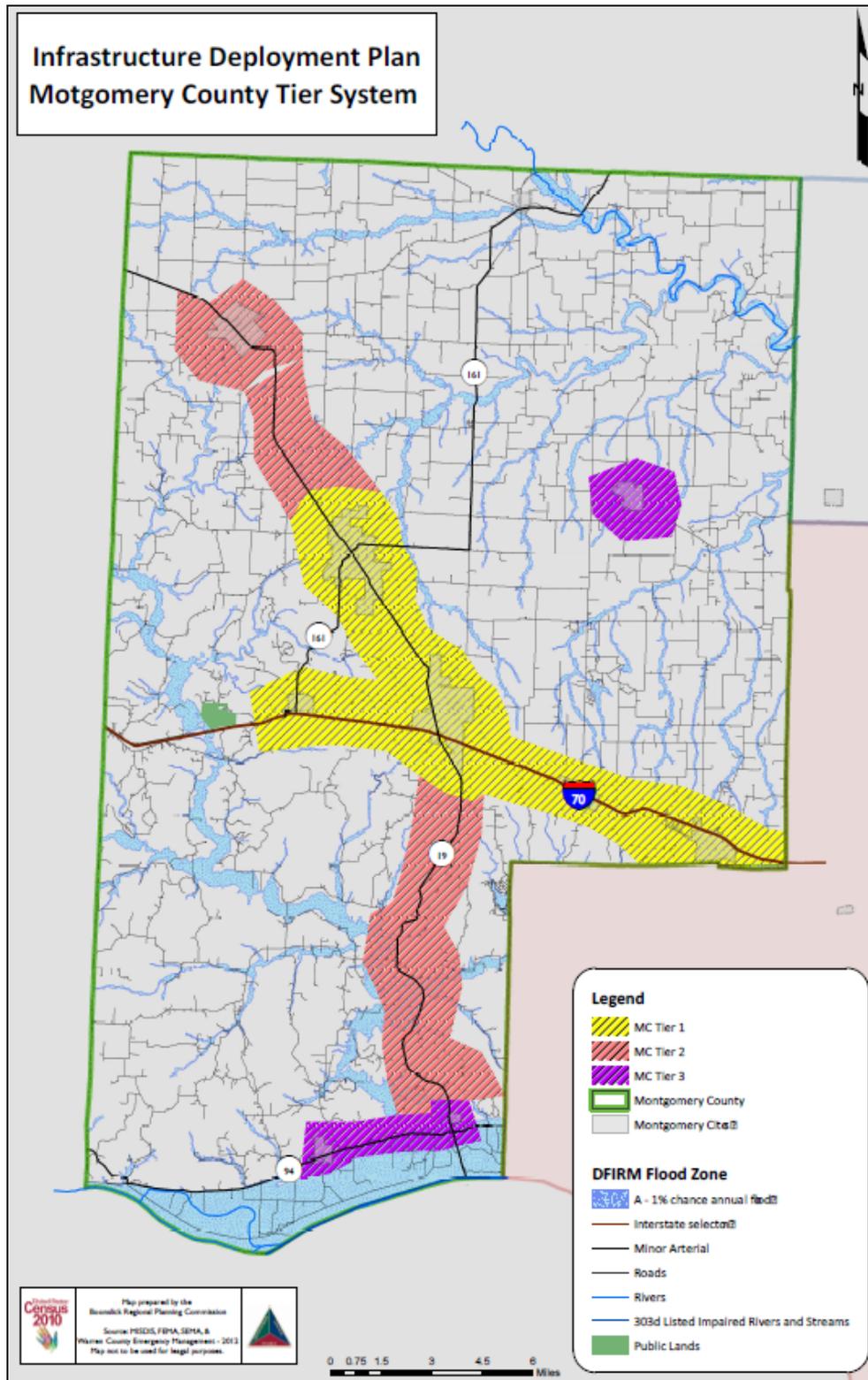
The three TIERS mapped for the region are:

**TIER I** includes areas in the region which can facilitate maximum growth. The primary focus of this development concentrates around those cities that are developed and can easily accommodate future growth.

**TIER II** includes areas in the region which can facilitate optimum growth. These are the areas where the basic infrastructure is available and can sustain future growth.

**TIER III** includes areas in the region which can facilitate minimum growth. Any future growth in these areas might entail the involvement of public water & sewer districts to respond to the demands for service.

Figure 2.6; Montgomery County Long Range Infrastructure Deployment Plan



## **2.2 Jurisdictional Descriptions and Capabilities**

### **Montgomery City**

#### **Overview**

Montgomery City is the county seat of Montgomery County and the largest community in the immediate area. It is centrally located to cities in the region, such as Chicago, Memphis and Kansas City, and is adjacent to the St. Louis Metropolitan Statistical Area. The city lies four miles north of Interstate 70, the major highway route between St. Louis and Kansas City and is served by State Highways 19, 161, and B. The city has a total area of 2.8 square miles.

There are two publicly owned industrial and commercial sites in Montgomery City. This site, known as the Montgomery City Industrial Park, is located on the southwestern edge of Montgomery City. It is bordered on the east by the Norfolk Southern Railroad and on the west by Industrial Park Drive. The Montgomery City Industrial Park is within the corporate limits of Montgomery City.

The government-owned structures include City Hall, Police Department, Fire Station, Library, Animal Shelter, Sewage Treatment Plant, Water Plant 2, County Courthouse, Jail, Communications Center, Road and Bridge Dept., MU Extension Center, Montgomery Ambulance District, and U.S. Post Office.

General aviation airports include Wehrman Aviation Service. Montgomery Ambulance District is located in Montgomery City and this serves Montgomery City, New Florence, High Hill, Jonesburg, Bellflower, Middletown, and Wellsville. There is a Montgomery County Fire protection District and one Montgomery volunteer fire protection district in Montgomery City.

The Montgomery County R-II School District encompasses over 320 square miles, located in the central portion of Montgomery County and portions extending into western Warren County. School facilities are located on four campuses: three elementary schools K-5 are located in Montgomery City, Bellflower, and students who live in High Hill attend the Elementary School in Jonesburg. The fourth campus is located south of Montgomery City and contains the Middle School and High School as well as a sports complex.

Several businesses operate in business parks along Hwy. 19 in Montgomery City. The city's 35-acre industrial park is home to Brandkamp Industries; Cargill, Inc.; Porta King Building Systems; Missouri Mounting; Division of Youth Services; Montgomery Treatment Center;

Martinsburg Elevator; and MFA Fertilizer. The city's business park includes Tyson Forward Warehouse, LaCrosse Lumber Co, Save-A-Lot Grocery, Dollar General, Mid-Missouri Concrete, Martinsburg Bank & Trust, and Lance's Auto Body Repair Shop. The unemployment rate in Montgomery City is 10.4% compared to the Missouri rate of 5.5%.

## **Bellflower**

### **Overview**

Bellflower is located on a prairie in the center of Bear Creek Township. Ernest Schowengerdt, Henry Kamp, and John Middlekamp came to this vicinity in 1880. New Bellflower was incorporated in March, 1914, south of the C.B& Q. tracks. The city has a total area of 0.6 square miles. The unemployment rate in Bellflower is 12.5%. The government-owned structures include City Hall, Police Department, Fire Station, Community Building, and U.S. Post Office.

## **High Hill**

### **Overview**

The High Hill was built and operated by the Miller family in 1869. Built in the late 1850s, the North Missouri Railroad was the first railroad to come through the County. High Hill was said to be the highest point between St. Louis and Kansas City. The population density was 502.2 people per square mile (193.9/km<sup>2</sup>). The government-owned structures include City Hall and police department. The unemployment rate in High Hill is 6.3% percent.

## **Jonesburg**

### **Overview**

The city has a total area of 1.3 square miles (3.3 km<sup>2</sup>). The unemployment rate in Jonesburg is 7.3%. The government-owned structures include City Hall, Police Department, Jonesburg-High Hill fire station, community hall and two city warehouses.

## **McKittrick**

### **Overview**

The town of McKittrick was founded in November 1892, when the M.K. & T. railroad was built throughout the area. Henry Bauman built the first swinging bridge across the Loutre River to enable settlers to go to McKittrick to trade.

**Middletown****Overview**

It is claimed that this village is now the oldest town in Montgomery County, coming into existence some time before Danville. It stands in a healthful location on the north bank of Coon creek, on the south-east quarter of section 1, township 50, and range 5. Middletown is the center of trade of a considerable section, and being located within one mile of Pike County and a few miles from Audrain and Lincoln, it enjoys patronage from people of four counties; and this although it is on no railroad or navigable water-course.

One source states that the name "Middletown" was derived from its location at the crossing of two roads. The north/south stage line from Fulton to Louisiana went through Middletown. Middletown is approximately halfway between the Missouri and Mississippi rivers. The unemployment rate in Middletown is 1.5%. The government-owned structures include County sheriff substation, Fire Station, Community Building, and U. S. Post Office.

**New Florence****Overview**

The town of New Florence stands on section 23, township 48, range 5, and is situated in the eastern part of Danville Township. The Wabash; St. Louis and Pacific Railroad runs through the place. The unemployment rate in New Florence is 12.4%. The government-owned structures include City Hall, police department, Fire station, water, sewer, gas department, and U.S. Post Office.

**Rhineland****Overview**

The town was incorporated in 1896. Located on the north bank of the Missouri River, Rhineland was devastated by water in the Great Flood of 1993. It became the first town to accept federal funds to move out of a flood plain. All the houses in the town were moved about 1½ miles uphill.

The unemployment rate in Rhineland is 12.7%. The government-owned structures include Village office, County sheriff substation, fire station, water department, and U.S. Post Office.

**Wellsville****Overview**

The city of Wellsville was laid out by Carty Wells in 1856 on land that he received from the federal government for services rendered in the Mexican War of 1848. Wellsville was

incorporated as a town by the county court on March 22, 1870. The unemployment rate in Wellsville is 3.1%. The government-owned structures include City Hall, police, fire, water, sewer, street departments, public library, filtering station, and U.S. Post Office.

### **Unincorporated Areas**

The Montgomery County's unincorporated area is a traditional agricultural land and it mostly consists of farmsteads. The total population living in the unincorporated area at the 2010 census is 5,690.

Table 2.3 below shows the brief jurisdictional description and capability matrix for the incorporated areas in Montgomery County.

**Table 2.3; Jurisdictional Description and Capability Matrix for Incorporated Areas Of Montgomery County**

	Montgomery County	Bellflower	High Hill	Jonesburg	Middletown	McKittrick	Montgomery City	New Florence	Rhineland	Wellsville
Total Pop.	12136	393	195	768	167	61	2834	769	142	1217
Classification	Third Class	Fourth class	Fourth class	Fourth Class	Fourth class		Fourth Class	Fourth Class	Fourth class	Fourth Class
Leadership	Presiding Commissioner / 2 associates	Mayor / Council	Mayor / Council	Mayor / Council	Mayor / Council	Mayor	Mayor / Council	Mayor / Council	Chairperson / trustees	Mayor / Council
Med. Income	\$40,565	\$25,938	\$37,656	\$34,688	\$28,750	\$28,214	\$40,060	\$34,175	\$35,625	\$25,958
Housing Units	6135	194	167	359	131	50	1356	347	89	608
Med. Gross Rent	\$577	\$746	\$700	\$445	\$607	--	\$560	\$687	\$296	\$447
Med. Housing Value	\$106,600	\$75,000	\$65,000	\$88,900	\$48,500	\$58,800	\$108,800	\$84,800	\$85,000	\$55,800
Master Plan	Yes	No	Yes	No	No	No	Yes	No	No	No
Zoning Regs	Yes	No	Yes	Yes	No	No	Yes	Yes	No	No
Building Regs	No	No	Yes	No	No	No	No	Yes	No	No
Subdivision Regs	Yes	No	No	No	No	No	No	Yes	No	No
Stormwater Regs	No	No	No	No	No	No	No	No	No	No
Floodplain Regs	Yes	No	No	No	No	No	No	No	Yes	No
NFIP Participation	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Water Service	Principally private wells	Bellflower	High Hill	Jonesburg	Middletown	Montgomery	Montgomery	New Florence	Rhineland	Wellsville
Sewer Service	Principally private septic tanks	Bellflower	High Hill	Jonesburg	Middletown	Septic tanks	Montgomery	New Florence	Rhineland	Wellsville
Electric Service	Ameren UE, Cuivre River	Ameren UE	Ameren UE	Ameren UE	Middletown (gas)	Ameren UE	Ameren UE	Ameren UE	Ameren UE	Ameren UE
Law Enforcement	County Sheriff	Bellflower	High Hill	Jonesburg	Montgomery	Montgomery	Montgomery	New Florence	Montgomery	Wellsville
Fire Service	8 districts, 8 stations within the county	Bellflower	Jonesburg - High Hill	Jonesburg - High Hill	Middletown	Montgomery County	Montgomery County	New Florence	Rhineland	Wellsville City/Rural
Ambulance Service	2 districts, 1 base within the county	Montgomery County	Montgomery County	Montgomery County	Montgomery County	Montgomery	Montgomery County	Montgomery County	Hermann Area	Montgomery County

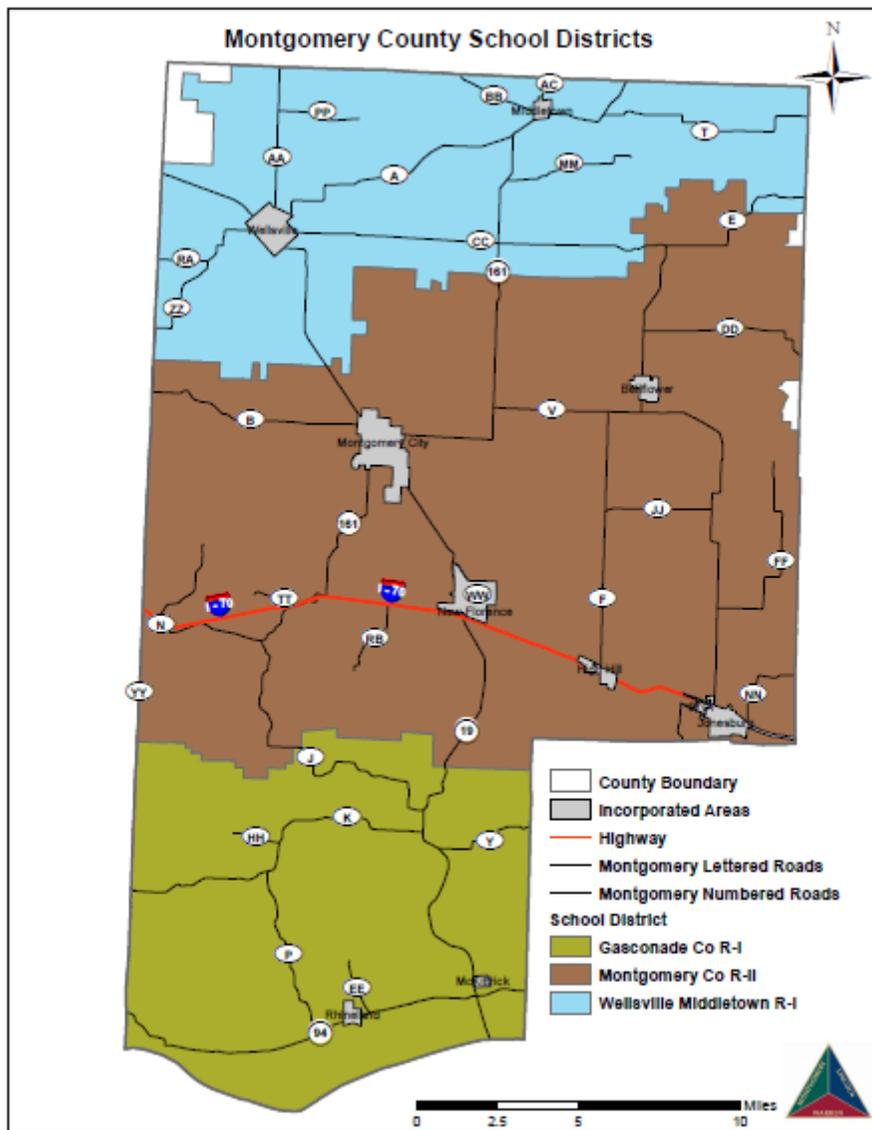
	Montgomery County	Bellflower	High Hill	Jonesburg	Middletown	McKittrick	Montgomery City	New Florence	Rhineland	Wellsville
Rivers, streams	Missouri River, Loutre River, West Fork Cuivre River, Bear Creek, Massie Creek, Millam Creek, Lichte Branch, Dry Fork, Pinch Creek, Fonso Branch, Cole Creek, Prairie Fork, Elkhorn Creek, Quick Creek, Brush Creek, Wolf Creek, Whetstone Creek, Little Loutre Creek, East Branch	East Branch	N/A	N/A	Coon creek	Missouri River, Loutre River	N/A	N/A	N/A	N/A
Major Arterials		Mo. Hwy. E	I-70, Mo. Hwy. F	I-70, Mo. Hwy. Y & Hwy E	Mo.Hwy.16, AC, & BB	Mo.Hwy.19, Hwy 94.	Mo.Hwy.19, 161 & B	I-70, Mo. Hwy. 19 & WW	Mo. Hwy. 94	Mo. Hwy. 19, A, ZZ, CC
Railroads	Norfolk & Western	Burlington Northern & Santa Fe	Norfolk & Western	Norfolk & Western	N/A	N/A	Norfolk & Western	Norfolk & Western	N/A	Norfolk & Western

### 2.2.2 School Districts

The 3 school districts in the County are Montgomery County R-II School District, Wellsville-Middletown R-I School District, and Gasconade County R-I School District (serves southern part of Montgomery County).

Figure 2.7 provides the boundaries of the school districts participating in this plan.

**Figure 2.7; School District Boundaries**



**Table 2.4; Schools in Participating Districts with Reported 2014 - 2015 Enrollment**

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<b>Name of the School District</b>	<b>No. of Schools</b>	<b>2014-2015 Enrollment</b>
<i>Montgomery County R-II School District</i>	4	1,257
Elementary Schools	2	601
Middle Schools	1	300
High Schools	1	356
<i>Wellsville-Middletown R-I School District</i>	2	377
Elementary Schools	1	214
High Schools	1	163
<i>Gasconade County R-I School District</i>	3	1,006
Elementary Schools	1	331
Middle Schools	1	330
High Schools	1	345

**Source: Missouri Department of Elementary & Secondary Education, 2014**



## ***SECTION 3 - Risk Assessment***

**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 effects of exposure to these hazards on the lives, property, and infrastructure of Montgomery County. The process allows Montgomery County and its communities to better understand the potential risk from natural and manmade hazards and it provides a framework for developing and prioritizing mitigation actions to further reduce risk from future hazard events should they occur.

The risk assessment for Montgomery County and its jurisdictions followed the methodology described in the Local Mitigation Planning Handbook (March 2013).

This section is further divided into three parts: Hazard Identification, Hazard Profiles, and Vulnerability Assessment (which includes an inventory assets and estimate of losses):

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the entire county and describes why some hazards have been omitted from further consideration.
- **Section 3.2 Hazard Profiles** discusses the threat to the planning area and describes previous occurrences of hazard events and the probability of future occurrence.
- **Section 3.3 Vulnerability Assessment** examines the County's total exposure to natural hazards; considering critical facilities and other community assets at risk; and an assessment of growth and development trends.

### **Multi-Jurisdictional Risk Assessment**

For this multi-jurisdictional plan, the risk assessment assesses each jurisdiction's risks where they deviate from the risks facing the entire Montgomery County. Montgomery County is not a large county (537 square miles) and is fairly uniform in terms of climate and topography as well as construction characteristics and development trends. Accordingly; with a few exceptions to be discussed later, overall hazards and vulnerability do not vary greatly across the planning area.

### 3.1 Hazard Identification / Elimination Process

<b>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.</b>
--

#### 3.1.1 Methodology

The largest disaster to impact Montgomery County in the past three decades was the Great Flood of 1993. Loss of agricultural lands, homes, businesses, and infrastructure - as well as the relocation of the entire community of Rhineland - contributed to significant economic losses throughout the county and the state of Missouri.

Most recent disasters include the tornadoes in 2006, 2007, and 2013; floods in 2008 and 2013, thunderstorms in 2007, 2008, and 2013; ice storms in 2005 and a severe winter storm in 2011, plus severe storms and straight-line winds in 2013. History indicates Montgomery County is at risk of tornadoes and severe thunderstorms; flooding (including flash floods); severe winter weather (snow, ice, extreme cold); drought; extreme heat. Although earthquakes, wildfires and dam failures have not occurred within Montgomery County in the past 50 years, historical data and regional event models indicate the possibility of an occurrence in the future.

Review of the June 2013 Missouri State Hazard Mitigation plan and the updated Montgomery County Emergency Operations Plan of August 2014, shows a gradual increase in man-made incidents which can be just as devastating as natural disasters. Therefore, the man-made hazards included as part of 2009 plan update process: nuclear power plants, hazardous materials, transportation, utility interruptions and power failures, and terrorism are included in this update as well.

The following natural hazards are not included in this analysis because they do not threaten Missouri: avalanches, coastal erosion, coastal storms, hurricanes, tsunamis, and volcanoes. While expansive soils, landslides, and rock falls are recognized as hazards in Missouri, they occur infrequently and their impacts are minimal; so they will not be profiled further in this document.

**Table 3.1; Summary of Hazard Identification Lists (2004 and 2014 Plans)**

2004 Plan Hazard List	2014 Plan Hazard List
<ul style="list-style-type: none"> <li>• Dam failure</li> <li>• Drought</li> <li>• Earthquakes</li> <li>• Floods</li> <li>• Heat wave</li> <li>• Severe Winter Weather (Snow, Ice and Extreme Cold)</li> <li>• Tornadoes/Severe Thunderstorms</li> <li>• Wildfires</li> </ul>	<ul style="list-style-type: none"> <li>• Dam</li> <li>• Drought</li> <li>• Earthquake</li> <li>• Extreme Heat</li> <li>• Flood/Levee Failure</li> <li>• Hailstorm</li> <li>• Land Subsidence</li> <li>• Severe winter weather</li> <li>• Thunderstorm and high winds</li> <li>• Tornado</li> <li>• Wildfire</li> <li>• Hazardous materials</li> <li>• Nuclear Power Plant</li> <li>• Terrorism</li> <li>• Transportation</li> <li>• Utility Interruption &amp; Power failure</li> </ul>

Data on the past impact and future probability of these hazards in the Montgomery County planning area was collected from following sources:

- Missouri Hazard Mitigation Plan (June 2013)
- Montgomery County Emergency Operations Plan (August 2014)
- Information on early past hazard events from the Spatial Hazard Event and Loss Database (SHELDUS), a component of the University of South Carolina Hazards Research Lab that compiles county-level hazard data for 18 different natural hazard event types.
- Information on past extreme weather and climate events from the National Oceanic and Atmospheric Administration’s (NOAA) National Climatic Data Center.
- Federal Disaster Declarations from the Federal Emergency Management Agency (FEMA)
- The U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) were major sources for earthquake information.
- The Dam Safety Division of Missouri (DNR) provided major information concerning dams.
- 2014 Threat Identification and Risk Assessment (THIRA) from Region F
- Other sources included Missouri Department of Natural Resources (MDNR), Missouri Department of Conservation (MDC), county officials; existing county, regional and state plans; reports on the floods of 1993 and 1995; position papers on transportation issues; and information from local residents (sources are indicated where data is cited).

**3.1.2 Disaster Declaration History**

Federal and state declarations may be granted when the severity and magnitude of an event surpass the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government’s capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments’ capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and the Small Business Administration. FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected.

A USDA disaster declaration certifies that the affected county has suffered at least a 30 percent loss in one or more crop or livestock areas and provides affected producers with access to low-interest loans and other programs to help mitigate disaster impacts. In accordance with the Consolidated Farm and Rural Development Act, counties neighboring those receiving disaster declarations are named as contiguous disaster counties and are eligible for the same assistance.

Table 3.2 lists federal disaster declarations received by Montgomery County. Each of the disaster events affected multiple counties; estimated damages reflect total losses to all counties.

**Table 3.2; Federal Declared Disasters**

Declaration Number	Declaration Date	Disaster Description	Counties Included	Estimated Damage
FEMA-1809-DR	November 13, 2008	Severe Storms, Flooding, and tornadoes	Boone, Callaway, Chariton, Howell, Jefferson, Lewis, Lincoln, Linn, Marion, <b>Montgomery</b> , Osage, Schuyler, St. Charles, St. Louis, Stone, Taney, Texas, and Webster Counties and the Independent City of St. Louis.	\$21,572,603
FEMA-1749-DR	March 19, 2008	Severe Storms and Flooding	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,	NA

Declaration Number	Declaration Date	Disaster Description	Counties Included	Estimated Damage
			Jefferson, Laclede, Lawrence, Lincoln, Madison, Maries, McDonald, Miller, Mississippi, <b>Montgomery</b> , Moniteau, Morgan, New Madrid, Newton, Oregon, Osage, Ozark, Pemiscot, Perry, Phelps, 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.	
FEMA-1736-DR	December 27, 2007	Severe Winter Storms	Adair, Andrew, Atchison, Audrain, Barton, Benton, Boone, Buchanan, Caldwell, Callaway, Camden, Cedar, Clinton, Cole, Dade, Daviess, DeKalb, Gentry, Grundy, Harrison, Hickory, Holt, Jasper, Lincoln, Linn, McDonald, Mercer, Miller, Moniteau, <b>Montgomery</b> , Morgan, Newton, Nodaway, Osage, Pike, Putnam, St. Clair, Schuyler, Scotland, Sullivan, Warren, and Worth Counties.	\$28,931,081
FEMA-1676-DR	January 14, 2007	Severe Winter Storms and Flooding	Barry, Barton, Callaway, Camden, Christian, Cole, Crawford, Dade, Dallas, Dent, Franklin, Gasconade, Greene, Hickory, Jasper, Laclede, Lawrence, Lincoln, Maries, McDonald, Miller, <b>Montgomery</b> , Newton, Osage, Phelps, Polk, Pulaski, St. Charles, St. Clair, St. Louis, Stone, Warren, Webster, Wright, and the independent City of St. Louis	\$68,000,000
FEMA-1631-DR	March 16, 2006	Severe Storms, Tornadoes, and Flooding	Benton, Boone, Carroll, Cass, Cedar, Christian, Cooper, Greene, Henry, Hickory, Iron, Johnson, Lawrence, Lincoln, Mississippi, Monroe, <b>Montgomery</b> , Morgan, New Madrid, Newton, Perry, Pettis, Phelps, Putnam, Randolph, Scott, St. Clair, Ste. Genevieve, Saline, Taney, Vernon, Webster, and Wright Bates, Christian, Howard, Jefferson, Monroe, Montgomery.	\$33,400,000

Source: FEMA

Table 3.3 below lists U.S. Department of Agriculture disaster declarations for Montgomery County (2005-2014). Please note that Hail events were tracked in aggregate.

**Table 3.3; U.S. Department of Agriculture Disaster Declarations**

USDA Disaster No.	Start Date	Drought	Flooding	Tornado	Severe Storms	Below Normal Temps	Winter Storms	Excessive Moisture	Excessive Heat	Hail
M4144	8/2/2013				x					
S3592	7/15/2013		x							
M4130	5/29/2013		x	x	x					
S3460FT	11/1/2012	x								
S3266	4/1/2012	x							x	
S3186	7/1/2011	x							x	
S3164	5/1/2011		x							
S3120	4/1/2011		x							
N1043	2/1/2011						x			
M1961	1/31/2011						x			
M1934	6/12/2010		x	x	x					
S3020	2/1/2010		x							
S2920	2/1/2009		x							
M1736	12/6/2007						x			
N873	10/12/2007						x			
M1708	5/5/2007				x			x		
S2536	5/5/2007							x		
S2532	3/30/2007					x	x			
M1676	1/12/2007					x	x	x		
M1673	11/30/2006						x			
M1631	3/11/2006			x	x			x		
S2407	1/1/2006	x								
S2119	1/1/2005	x								
Incidents										65

Source: USDA Farm Service Agency

### 3.2 Hazard Profiles

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

#### 3.2.1 Methodology

Each hazard identified in Section 3.1, Hazard Identification / Elimination Process, is profiled individually in this section in alphabetical order for easy reference. The level of information

presented in the profiles varies by hazard based on the granularity of the information available. With each subsequent update of this plan, new information will be incorporated to provide for better evaluation and prioritization of the hazards that affect Montgomery County.

The sources used to collect information for these profiles include those mentioned in Section 3.1.1 as well as any sources cited individually in each hazard section. Detailed profiles for each of the identified hazards include information on the following characteristics of the hazard.

### **Hazard Description**

This section consists of a general description of the hazard and the types of impacts it may have on a community. The section also includes a ranking that indicates typical warning times and an anticipated duration of hazard events. Definitions for these rankings are included in Table 3.4, Ratings for Each Hazard.

### **Historical Statistics**

This section describes the location or geographic extent of the hazard in the planning area and includes the information on historic incidents and their impacts based upon the sources described in Section 3.1 Hazard Identification / Elimination and through information provided by individual jurisdictions. Where available, maps are utilized to indicate the areas of the planning area that are vulnerable to the subject hazard.

### **Location**

This details the areas that have been previously been impacted and illustrates the areas probable to receive hazard impacts. Tables 3.5 and 3.6 list the identified hazards for each participating jurisdiction for Montgomery County.

### **Probability of Future Occurrence**

The frequency of past events is used to gauge the likelihood of future occurrences. Where possible, the probability and severity of occurrence was calculated based on historical data. The probability was assigned a rank as defined in Table 3.4, Probability Ratings for Each Hazard.

### **Magnitude / Severity**

The magnitude of the impact of a hazard event (both actual and forecast) is related directly to the vulnerability of the people, property, and the environment it affects. This is a function of when the event occurs, the location affected, the resilience of the community, and the effectiveness of the emergency response and disaster recovery efforts. The ratings are defined in Table 3.4.

**Hazard Summary**

To maintain a consistent reporting format, prioritization was based on two elements of risk: probability and magnitude / severity. Table 3.4 defines the ratings for each element of risk wherein Probability equates to the likelihood that the event will occur and Magnitude / Severity equals the level of deaths, injuries, and property damage that could ensue.

**Table 3.4; Probability Ratings for Each Hazard**

<b>Probability</b>	<b>Definition</b>
Low	The hazard has little or no chance of happening (Less than 1 percent chance of occurrence in any given year).
Moderate	The hazard has a reasonable probability of occurring (Between 1 and 10 percent chance of occurrence in any given year)
High	The probability is considered sufficiently high to assume that the event will occur (Between 10 and 100 percent chance of occurrence in any given
<b>Magnitude / Severity</b>	<b>Definition</b>
Low	Few or minor damage or injuries are likely
Moderate	Injuries to personnel and damage to property and the environment
High	Deaths and major injuries and damage will likely occur.

**Table 3.5; County-Wide Natural Hazards Rankings**

<b>Natural Hazards</b>	<b>Probability</b>	<b>Severity</b>	<b>Vulnerability ranking</b>
Drought	Moderate	Moderate	Moderate
Earthquake	Moderate	Moderate	Moderate
Extreme Heat	High	Low	Moderate
Hail (>.75")	High	Moderate	Moderate
Thunderstorm and High Wind	High	Moderate	High
Tornado	High	High	High
Wild Fire	Moderate	Moderate	Moderate
Severe Winter Weather	High	Moderate	Moderate

<b>Table 3.6; Jurisdiction Specific Natural Hazards Ranking</b>				
<b>Natural Hazards</b>	<b>Jurisdiction/School District impacted</b>	<b>Probability</b>	<b>Severity</b>	<b>Vulnerability ranking</b>
Dams	Unincorporated	Low	Low	Low
Dams	Middletown	Low	High	Low
Floods/Flash Floods	Montgomery City, Montgomery County R-II School District, Gasconade County R-I School District, New Florence, Rhineland, Wellsville-Middletown R-I School District	Moderate	Moderate	Moderate
Levee Failure	McKittrick, Rhineland, Gasconade County R-I School District	Moderate	Moderate	Moderate
Sinkholes	Unincorporated	Low	Low	Low

<b>Table 3.7; Man Made Hazards</b>			
<b>Man Made Hazards</b>	<b>Probability</b>	<b>Severity</b>	<b>Vulnerability ranking</b>
Terrorism	Low	High	Moderate
Hazardous Material Release	High	Moderate	Moderate
Nuclear Radiation Leak	Low	High	Moderate
Transportation Disruption	High	High	High
Utility Failure	High	Moderate	Moderate

Note: The following considerations were taken into account by the HMPC for prioritizing the hazards

- All Hazards are important.
- All Rankings are Subjective and depend on the best judgment of the most knowledgeable local authorities.
- If all criteria are equal, subjective judgment was used to determine the rank

### 3.2.2 Dam

#### Hazard Description

A dam is defined by the National Dam Safety Act as an artificial barrier that impounds or diverts water and is at least 6 feet high and stores at least 50 acre-feet of water; or, is at least 25 feet high and stores at least 15 acre-feet. Missouri’s DNR regulates the design, construction and maintenance of 4,100 non-federal, non-agricultural dams that are at least 35 feet high.

Regardless of the size of the dam, dam owners have primary responsibility for the safe design, operation, and maintenance of their dams. They are responsible 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. DNR's Dam Safety Division maintains a database of all dams regardless of federal, state, local or private ownership. Primary Levees are built and maintained by the Army Corps of Engineers while Secondary Levees; i.e., those constructed on secondary rivers and streams, are regulated by the Corps who sets design and construction standards. DNR does not become involved unless the levees adversely impact secondary streams. Levees will be discussed in Section 3.2.6, Flood / Levee Failure.

The failure of dams can result in injuries, loss of life, and damage to property and the environment. While levees are built solely for flood protection, dams often serve multiple purposes, one of which may be flood control. Severe flooding and other storms can increase the potential that dams and levees will be damaged and fail as a result of the physical force of the flood waters or overtopping.

Dams are usually engineered to withstand a flood with a computed risk of occurrence. If a larger flood occurs, then that structure will likely be overtopped. If during the overtopping, the dam fails or is washed out, the water behind is released as a flash flood. Failed dams can create floods that are catastrophic to life and property, in part because of the tremendous energy of the released water.

The problem of unsafe dams in Missouri was underscored by dam failures at Lawrenceton in 1968, Washington County in 1975, Fredericktown in 1977, and a near failure in Franklin County in 1978. On December 14, 2005, the Taum Sauk reservoir dam owned by Ameren Missouri failed. A 600-foot breach in the northwest side of the retention facility released 1.5 billion gallons of stored water into the Johnson Shut-Ins State Park in just 10 minutes. The waters destroyed the park and the park superintendent's house and swept the superintendent's family out of their house. All five family members survived. The lower reservoir was overtopped by the flow of the east fork of the Black River. As a precautionary measure, the City of Lesterville evacuated 100-150 people to higher ground. If the dam had failed during the summer months, during the park's peak use, it is likely that many lives would have been lost.

The 2011 floods in Missouri led to the Corps of Engineers having to release record levels of water through the Gavin Point Dam. This release caused downstream flooding; however, the reservoirs upstream were at 100% capacity. The difficult choice to release so much water was

supported by local officials. In Wyatt, Missouri the Corps had to breach the Bird's Point Levee late at night, in order to reduce pressure on a floodwall protecting the town.

Oversight is extremely valuable to the owners as well as those people living downstream of the dam who could be flooded in the event the dam should fail. Dams can fail for many reasons.

The most common are:

- **Piping:** Internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
- **Erosion:** Inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
- **Structure Failure:** Caused by an earthquake, slope instability or faulty construction.

These types of failures are often interrelated. For example, erosion; either on the surface or internal to the structure, may weaken the dam or lead to structural failure. Additionally, a structural failure may shorten the seepage path and lead to a piping failure.

Missouri DNR has defined three levels of hazard potential; high, significant, and low, as accepted by the Interagency Committee on Dam Safety. The definitions are:

- **High;** Failure or incorrect operation will probably cause loss of human life.
- **Significant;** Failure or incorrect operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. 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.
- **Low;** Failure results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

### **Historical Statistics**

According to DNR's Dam Safety Division, Montgomery County has 86 dams. All Montgomery County dams are earthen construction. The mean dam height is 27.58 feet with a maximum storage capacity of 287.48 acre-feet. (An acre-foot is one acre of water that is one foot deep. For example, a 10-acre lake that is 10 feet deep would have a maximum storage capacity of 100 acre-feet.) Most of the dams are less than 35 feet high and therefore not regulated by Missouri DNR. Therefore, people living downstream of these smaller unregulated dams are at the mercy of the dam owner's construction and maintenance practices.

There are three downstream hazard classifications. Class I applies to high hazard dams, Class 2 relates to intermediate hazard dams; and Class 3 to low hazard dams. Out of 86 dams; 10 pose a high hazard, 19 pose a significant hazard (really 18 because one dam is breached), and the remaining 57 are classified as low hazard. Nine of the 10 high hazard dams in Montgomery County are regulated by the state and just one, Loutre Valley Lake dam, has an emergency action plan on record. The largest lakes are Pinnacle Lake and Golden Eagle Lake, each with over 100 acres of lake area. Below is a summary table of these high-hazard dams.

**Table 3.8; Montgomery County High-Hazard Dams**

Name	Nearest City	Distance from City	Purpose	Ht.	Maximum Storage	Reg. / Plan
Pinnacle Lake	McKittrick	12	Recreation	49	2607	Yes/Yes
Carl Dreyer Lake Dam	New Florence	2	Recreation	34	200	No/No
Cates Dam	Mineola	9	--	22	106	No/No
Zander Lake Dam	Montgomery City	3	Recreation	18	96	No/No
Golden Eagle Lake Dam	Truxton	14	Recreation	33	1871	No/No
Cool Valley Lake Dam	Jonesburg	2	Co	20	407	No/No
Easterday Dam	Mineola	10	Recreation	34	437	No/No
Ehrlick Lake Dam	Middletown	0	Recreation	20	193	No/No
Loutre Valley Lake Dam	McKittrick	16	Recreation	35	290	No/Yes
Allgeyer Lake Dam	Americus	1	Recreation	29	96	No/No

*Source: DNR Dam Safety Program*

## Location

The hazard analysis for this hazard was conducted based on:

- a) DNR's Hazard ranking Class 1, "High Hazard" dams.
- a) The Digital Elevation Models (DEM) and jurisdictional boundaries for Village of Middletown along with overlays of flood boundary and the lakes, helped identify the expected flow direction for the Ehrlick Lake dam at Middletown. The Hazard Mitigation Planning Committee (HMPC) further identified the Ehrlick Lake dam as "High Risk" because of its potential affect on Middletown.
- b) Once the anticipated flow directions for dam failure events were projected based on the topography, a basis analysis concerning the impacts of dam failure was conducted.

A map highlighting adverse impact to the City of Middletown should the Ehrlick Lake dam give way is included, but maps depicting anticipated impacts in other areas of the county were not included. The Ehrlick Lake dam is the only dam considered high risk by the HMPC.

The “Significant” and “Low” DNR ranking dams which are not analyzed in the below map are expected to have minimal impact on the jurisdictions represented in the plan. Additionally, it is anticipated that failures of these dams would only affect the unincorporated portions of the county where few structures and people would be affected.

Inundation maps are not currently available for Missouri’s high-hazard dams; however, a project is underway throughout Missouri to map high-hazard dams. Further information on this study of dam failure and resulting inundation areas is available from DNR’s Division of Dam Safety. When these maps are completed, a more accurate analysis of Dam Failure and its effects on the jurisdictions represented in the plan will be included in subsequent plan updates.

### **Probability of Future Occurrence**

No records were found to indicate any dams have failed previously in Montgomery County. The probability of occurrence of dam failure is rated as “Low”.

**Low** – The hazard has little or no chance of happening (less than 1% chance of occurrence in any given year).

### **Magnitude / Severity**

City of Middletown - “High”

All other participating jurisdictions - “Low”

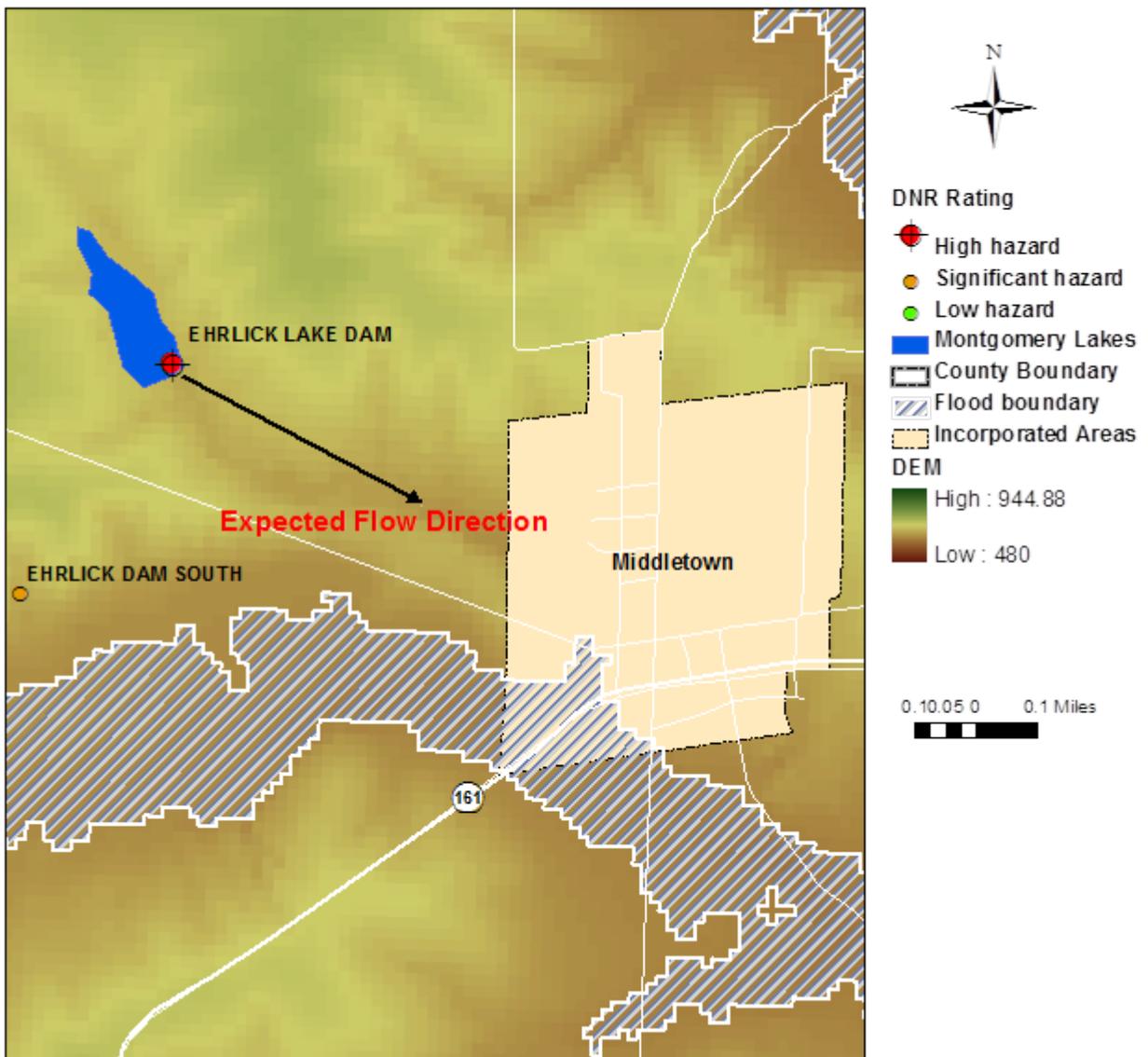
**High** – Deaths, major injuries, and damage to property and the environment.

**Low** – Few or minor damage or injuries are likely.

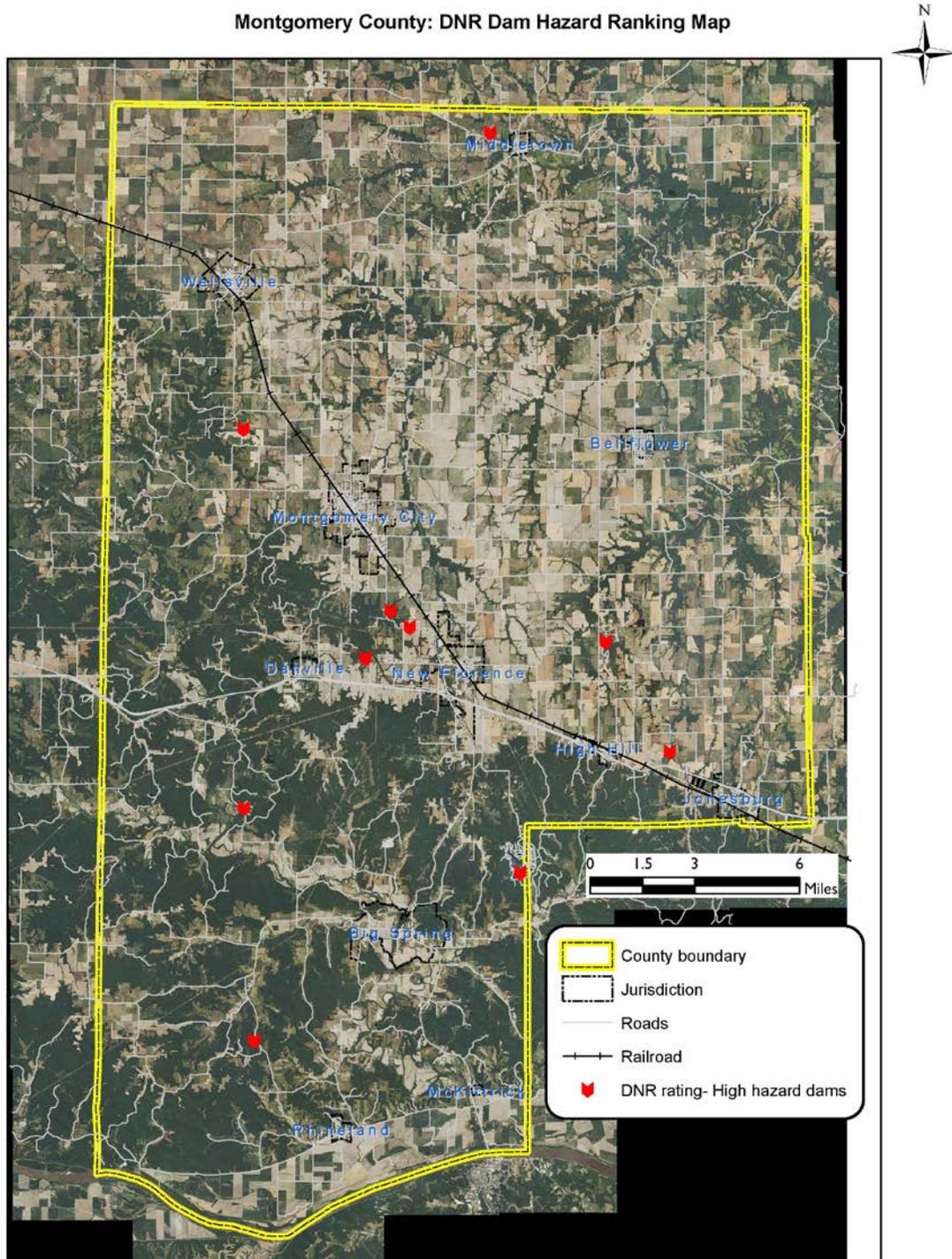
**Map 3.2; City of Middletown – Dam Hazard Analysis** illustrates why Middletown is categorized as High in Magnitude and Severity. The legend helps to define the topography and the arrow shows the direction of flow. The anticipated path of the flow runs through low-lying areas and carries the runoff directly through the town.

Map 3.1; City of Middletown – Dam Hazard Analysis

City of Middletown - Dam Hazard Analysis



**Map 3.2; DNR Hazard Ranking for Montgomery County Dams**



### 3.2.3 Drought

#### Hazard Description

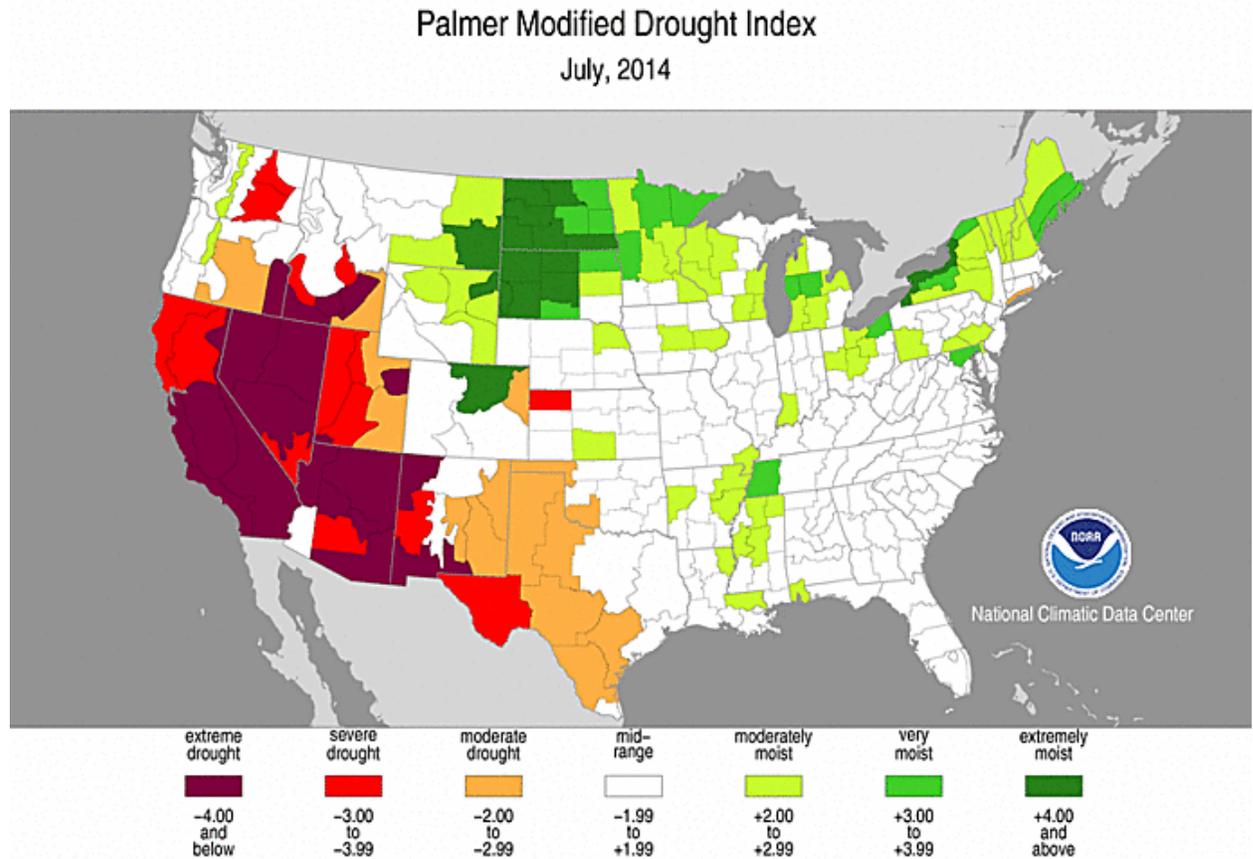
The National Weather Service (NWS) defines drought as “a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and people. The Missouri Drought Response Plan distinguishes between five categories of drought;

- Agricultural drought defined by deficiencies in soil moisture
- Hydrological drought defined by declining supplies of surface and groundwater
- Meteorological drought defined by deficiencies in precipitation
- Hydrological drought and land use defined as a meteorological drought in one location that has hydrological impacts in another location; that is, a drought in the Rocky Mountains may be significant in Missouri because the Missouri River is in part dependent upon upstream precipitation and snow pack
- Socioeconomic drought defined as drought impacting supply and demand of some economic commodity.

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI) published jointly by NOAA and the United States Department of Agriculture (USDA). The PDSI measures the departure of water supply (in terms of precipitation and stored soil moisture) from demand (the amount of water required to recharge soil and keep rivers, lakes and reservoirs at normal levels). The result is a scale from +4 to -4, ranging from an extremely moist spell to extreme drought. By relating the PDSI number to a regional index, one can compile data that reflects long-term wet or dry tendencies.

**Figure 3.1; Palmer Modified Drought Index**, shows data as of July 2014. With the exception of the extreme Bootheel region, the entire state of Missouri, including Montgomery County, is in the Mid-Range Index with “Mid-Range” being defined as -1.99 to +1.99. It should be noted that the Palmer Modified Drought Index is updated frequently and reflects a wide range of extremes.

**Figure 3.1; Palmer Modified Drought Index, July 2014**



*Source: National Climatic Data Center*

Regional indicators such as the PDSI are limited in that they respond slowly to deteriorating conditions. On the other hand, observing surface conditions and groundwater measurements may provide only a snapshot of a very small area. Therefore, the use of a variety of drought indicators is essential for effective assessment of drought conditions, with the PSDI being the primary drought severity indicator. Montgomery County water districts monitor their consumption and water levels constantly and adjust usage as required to avert a water shortage.

### **Historical Statistics**

Drought in Montgomery County is primarily a problem of rural water supply, especially those supplied by small water structures. When good water becomes a scarce commodity and people

must compete for the available supply, the importance of drought severity and duration increases dramatically.

According to the Climate Prediction Center, average annual precipitation for the St. Louis regional area of which Montgomery County is part; is 39 inches, and the state rates the county for high to moderate drought susceptibility. Precipitation-related impacts on time scales ranging from a few days to a few months can include effects on wildfire danger, non-irrigated agriculture, topsoil moisture, range and pasture conditions, and unregulated stream flows. Lack of precipitation over a period of several months or years adversely affects reservoir stores, irrigated agriculture, groundwater levels, and well water depth.

Montgomery County Public Water and Sewer District (PWSD) 1 and Monroe County PWSD 2; which serves the northern part of Montgomery County, are the two systems supply Montgomery County. Groundwater resources in the county may be adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. Montgomery County lies in an area of lime stone and sandstones that generally yields 1-15 gallons per minute up to 400 feet deep. Below that depth, the water is mineralized.

The DNR's drought response system has four phases. Phase 1 begins when water monitoring analysis indicates anticipated drought consequences. The situation moves into Phase 2 when the PDSI reads -10 to -20. At the same time, stream flow, reservoir levels and groundwater levels are below normal over a period of several months. Phase 3 is based on a PDSI between -2 to -4 and various other factors. Phase 4, or activation of drought emergency procedures, generally begins when the PSDI exceeds -4. Table 3.8 shows the existing water systems in Montgomery County. In the table under "Type", a "C" indicates a community of at least 15 service connections used by year-round residents or otherwise serves 25 or more year-round residents regardless of connection. A type of "NC" indicates a Transient Community that regularly serves at least 25 non-residential individuals during 60 or more days per year. "NTNC" indicates Non-Transient Non-Community which serves at least the same 25 non-residential individuals during 6 months of the year.

**Table 3.9; Montgomery County Public Water Sources**

<b>Water System Name</b>	<b>Type</b>	<b>Status</b>	<b>Source Water Type</b>
Bellflower	C	Active	Ground Water
Danville Sinclair	NC	Active	Ground Water
Graham Cave State Park Campground	NC	Active	Ground Water
Graham Cave State Park Office	NC	Active	Ground Water
High Hill	C	Active	Ground Water

<b>Water System Name</b>	<b>Type</b>	<b>Status</b>	<b>Source Water Type</b>
JD Streett #170	NC	Active	Ground Water
Jonesburg	C	Active	Ground Water
Kan Do Kamp ground & RV Park	NC	Active	Ground Water
Lazy Day Camp ground	NC	Active	Ground Water
Loutre Market	NC	Active	Ground Water
Loutre Shore Country Club	NC	Active	Ground Water
Middletown	C	Active	Ground Water
Montgomery City	C	Active	Ground Water
Montgomery CO PWSD #1 Jonesburg	C	Active	Purchased Ground Water
Montgomery CO PWSD #1 Montgomery City	C	Active	Purchased Ground Water
New Florence	C	Active	Ground Water
New Florence Wood Products	NTNC	Active	Ground Water
Rhineland	C	Active	Ground Water
Roy L Utilities	C	Active	Ground Water
Wellsville	C	Active	Surface Water

*Source: DNR, Drinking Water Watch*

### **Location**

USDA data show drought disasters declared for Montgomery County in the years 2005, 2006, 2011 and 2012. No records were found to indicate loss of lives or property including livestock and crops in Montgomery County due to drought. Given the geography of Montgomery County no particular area would be more or less at risk for drought, hence the hazard is determined to be one of county-wide nature.

### **Probability of Future Occurrence**

It is possible for Montgomery County to experience drought in any given year. The probability of future occurrence of a drought is "Moderate".

**Moderate** – The hazard has a reasonable probability of occurring (Between 1% and 10% chance of occurrence in any given year).

### **Magnitude / Severity**

Drought impacts are wide-reaching and may be economic, environmental, societal, or a combination thereof. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. An ongoing drought may also leave an area more prone to wildfires. Reserve drinking water supply can also be of concern during periods of prolonged drought. The magnitude / severity of drought is "Moderate".

**Moderate** – Injuries to personnel and damage to property and the environment.

### **3.2.4 Earthquake**

#### **Hazard Description**

According to SEMA, 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 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 6.5 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 one plate joins another, they form boundaries. Pressures on the North Atlantic ridge affecting the eastern side of the North American plate and movements along the San Andreas Fault by the Pacific plate have reactivated the subterranean faults in the Mississippi embayment.

#### **Historical Statistics**

Three earthquake zones -- the New Madrid Fault, the Wabash Valley Fault, and the Illinois Basin -- could affect Montgomery County because of their close proximity. Of these three, the New Madrid poses the greatest threat. During the winter of 1811-1812 three earthquakes estimated to have been magnitude 7.5 or greater were centered in the New Madrid fault in the Bootheel region of southeast Missouri. Thousands of aftershocks continued for years. Eight earthquake seismic zones are located in the central United States, two of which are located in Missouri. The most active zone is the New Madrid Seismic Zone, which is also the most active seismic area in the United States east of the Rocky Mountains according to the U.S. Geological Survey. The New Madrid Zone is by some measures as high a risk for tremors as seismic zones in California. It runs from northern Arkansas through southeast Missouri and western Tennessee and Kentucky to the Illinois side of the Ohio River Valley.

Significant earthquakes, each about magnitude 6, occurred in 1843 near Marked Tree, Arkansas, and on October 31, 1895 near Charleston, Missouri. In November 1968 a magnitude 5.5 earthquake centered in southeastern Illinois caused moderate damage to chimneys and walls at Hermann, St. Charles, St. Louis, and Sikeston, Missouri. The quake was felt in areas that include all or portions of 23 states. Other earthquakes have occurred throughout southeastern parts of Missouri. Smaller, but still destructive earthquakes are even more likely, according to the Missouri Seismic Safety Commission.

According to the USDA Risk Management Agency, insured crop losses throughout the State of Missouri as a result of earthquakes for the eleven year period of 1998 – 2008 totaled \$4,082 in only Lafayette County.

### **Location**

While no records were found to indicate any earthquake events in Montgomery County, no parts of the county are exempt from this hazard. The hazard would likely affect the entire county.

### **Probability of Future Occurrence**

The Center for Earthquake Research and Information (CERI) at the University of Memphis has computed conditional probabilities of a magnitude 6.0 earthquake in the New Madrid seismic zone. According to a fact sheet prepared by SEMA in 2003, the probability for a magnitude 6.0 to 7.5 or greater earthquake along the New Madrid Fault is 25 to 40 percent over the next 50 years.

Because Montgomery County lies a good distance from the New Madrid Fault, small earthquakes usually are not noticeable. The more severe threat stems from an earthquake producing Modified Mercalli impact levels of VII-XIII. According to SEMA, a major earthquake affecting Montgomery County definitely is expected. The probability of future occurrence of an earthquake is “Moderate”.

**Moderate** – The hazard has a reasonable probability of occurring (between 1% and 10% chance of occurrence in any given year).

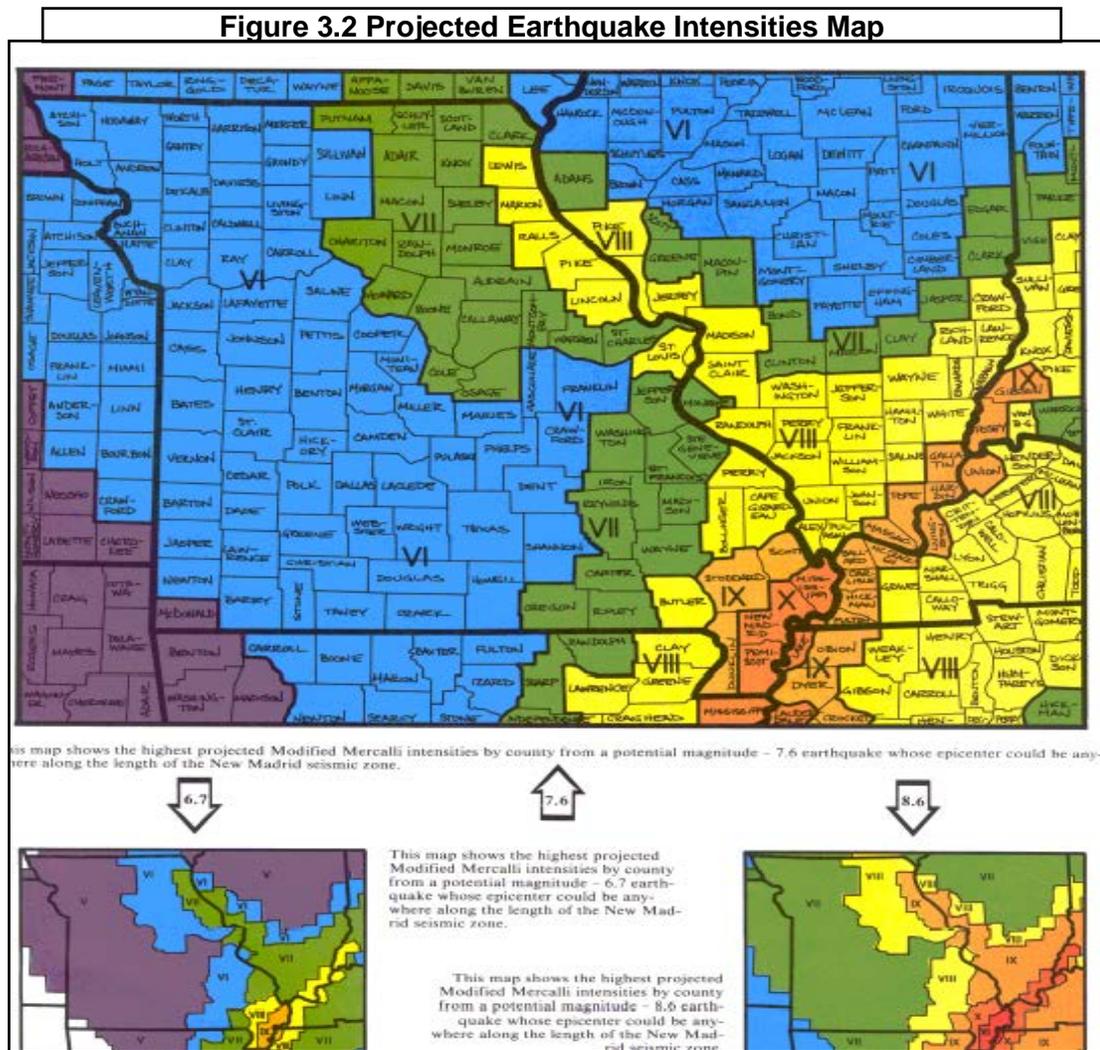
### **Magnitude / Severity**

The amount of energy released during an earthquake is most commonly expressed on the moment magnitude scale and is measured directly from energy released from the fault or epicenter as recorded on seismographs. Another measure of earthquake magnitude is intensity. Intensity is an expression of the amount of shaking at any given location on the surface as felt by humans and defined by the Modified Mercalli Intensity Scale. It is typically the greatest cause of losses to structures during earthquakes and is determined by many factors including soil types and distance from epicenter.

The magnitudes of the 24 recent earthquakes in the New Madrid fault ranged from 1.1 to 2.4. None of these quakes impacted Montgomery County in any way. However, the scientists from

the U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information at the University of Memphis (CERI) recently updated their forecast.

Figure 3.2 shows the projected earthquake intensities map for the State of Missouri. According to Missouri State Emergency Management Agency, Montgomery County is at risk for a Level VI impact on the Modified Mercalli Intensity Scale from a 6.7 earthquake, Level VII from a 7.6 earthquake and Level VIII from a 8.6 earthquake.



The following is an abbreviated description of the 12 levels of Modified Mercalli 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 vehicles 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 vehicles rocked noticeably.
- V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
- VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
- VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
- VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
- IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
- X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
- XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
- XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

*Source: Abridged from The Severity of an Earthquake, a U. S. Geological Survey General Interest Publication.*

The Magnitude / Severity of an earthquake in Montgomery County is “Moderate”

**Moderate** — Injuries to personnel and damage to property and environment.

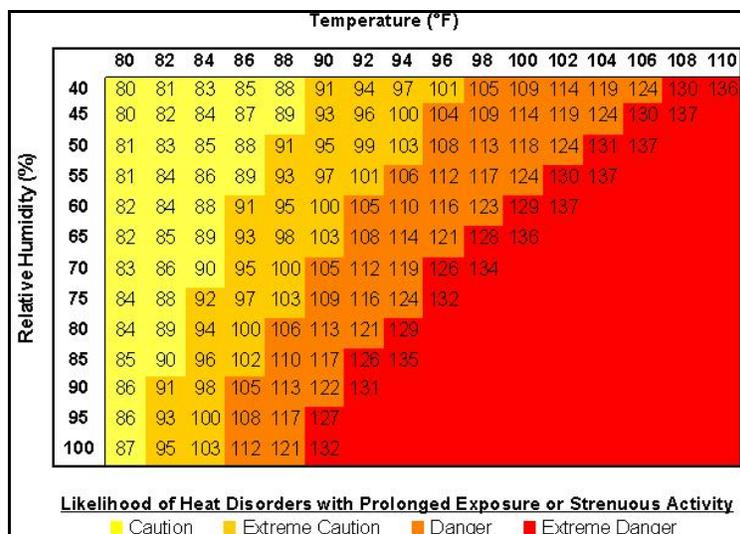
### 3.2.5 Extreme Heat

#### Hazard Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature.

In addition, the National Weather Service (NWS) recently has devised a method to warn of advancing heat waves up to seven days in advance. The new Mean Heat Index is a measure of how hot the temperatures actually feel to a person over the course of a full 24 hours. It differs from the traditional Heat Index in that it is an average of the Heat Index from the hottest and coldest times of each day. Figure 3.3 shows the NWS Heat index scale. To find the Heat Index from the table, see the relative humidity along the left side of the table and the air temperature along the top. Where the two intersect is the Heat Index for any given time of day.

**Figure 3.3; Mean Heat Index**



Source: NOAA's National Weather Service Heat Index, August 2014.

From 1980 to 2013, there were 1062 fatalities in Missouri attributed to summer heat. According to the National Weather Service, among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—takes a greater toll.

The levels of severity, by Heat Index apparent temperature are shown in the Table 3.10.

**Table 3.10; Levels of Severity by Heat Index Apparent Temperature**

Category	Heat Index	Health Hazards
Extreme Danger	130°F - Higher	Heat Stroke/ Sunstroke is likely with continued exposure.
Danger	105°F - 129°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and /or physical activity.
Extreme Caution	90°F - 105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and /or physical activity.
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service Heat Index Program, August 2014

The National Weather Service has a system in place to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F) and the night time minimum Heat Index is 80°F or above for two or more consecutive days.

Along with humans, animals also can be affected by high temperatures and humidity. For instance, cattle and other farm animals respond to heat by reducing feed intake, increasing their respiration rate, and increasing their body temperature. These responses assist the animal in cooling itself, but this is usually not sufficient. The hotter the animal is, the more it will begin to shut down body processes not vital to its survival, such as milk production, reproduction, or muscle (meat) building.

### Historical Statistics

DHSS initiated statewide hyperthermia death surveillance in 1980 in response to a summer heat wave that resulted in the death of 295 individuals. The program defines hyperthermia as physician-diagnosed heat exhaustion, heat stroke, or hot weather/natural environment as a contributing factor in a death. In 2005 and 2006, 25 Missourians died each year from heat-related illnesses. Missouri's heat-related deaths are primarily in the urban, more densely populated areas of St. Louis City, St. Louis County, and Jackson County (Kansas City) (Missouri DHSS, 2013).

In August 2007, Missouri experienced a heat wave that lasted approximately 21 days and resulted in 34 hyperthermia deaths. The heat wave started August 2 with a heat index of 101 in Cape Girardeau and spread across the State. By August 7, the five cities that DHSS receives daily heat data on from the National Weather Service were experiencing heat indices of 103 or

higher. The heat index remained in the upper 90s or higher in at least one of the five areas until August 25. Public and private emergency response plans were implemented across the State. These responses included opening cooling centers, distributing ice, water, and people checking door-to-door for persons in danger from the heat. Without this quick and intensive response, public health officials believe mortality from the August 2007 heat wave would have been much greater. Fortunately, hot weather during the summer of 2008 was much more sporadic and less prolonged, resulting in 10 deaths statewide.

In 2012, an intense heat wave plagued the Midwest, setting record maximum temperatures in both St. Louis and Columbia in Missouri. The heat wave began at the end of June and extended past the July 4<sup>th</sup> holiday, occurring during a drought that ranged in severity from moderate to severe. In the St. Louis metropolitan area, 18 heat-related deaths occurred in total (NWS, 2012).

According to the USDA Risk Management Agency, insured crop losses throughout the State of Missouri as a result of excessive heat for the eleven year period of 1998 – 2008 totaled \$13,751,457. Excessive heat ranked 6<sup>th</sup> in the State for insured crop losses. From 2000 to 2010, drought and heat were the source of about 31% of the crop losses in Missouri by indemnity payments (Milhollin, 2012). Also, hot winds in Missouri totaled \$885,893 in insured crop losses from the same timeframe.

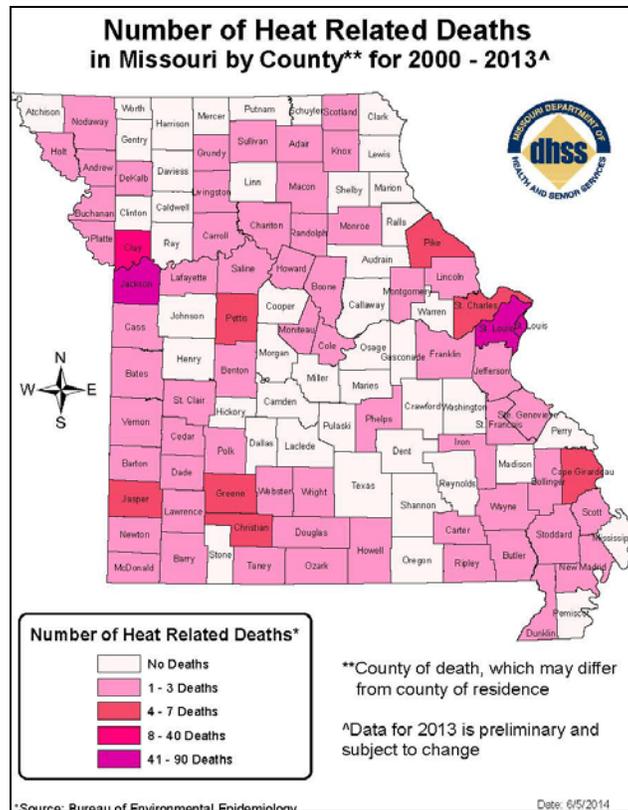
**Table 3.11; Recent Heat Waves In Montgomery County**

Date	Heat Index	Deaths	Injuries	Property Damage
08/05/2007	100-105	0	0	0
06/21/2009	100-107	0	0	0
06/18/2010	100-105	0	0	0
07/07/2014	105-110	0	0	0
07/17/2010	105	0	0	0
07/22/2010	105-110	0	0	0
08/02/2010	110	0	0	0
08/08/2010	100-115	0	0	0
06/27/2012	108	0	0	0
07/01/2012	107	0	0	0
07/16/2012	100-106	0	0	0
07/22/2012	108	0	0	0
07/31/2012	105-110	0	0	0
08/01/2012	105-110	0	0	0

Source: National Climatic Data Center

**Figure 3.4** from DHSS shows Missouri heat related deaths by county between the years of 2000 and 2013.

**Figure 3.4; Missouri Heat Related Deaths by County**



**Location**

Based on the statistics, extreme heat frequently strikes Montgomery County during its seasonal pattern. No parts of the county are exempt from this hazard.

**Probability of Future Occurrence**

Although periods of extreme heat generally occur on an annual basis, events that cause significant health impacts occur less frequently. Based on patterns of previous occurrences, the probability of future occurrence is considered “High”.

**High** – The probability is considered sufficiently high to assume the event will occur (between 10% and 100% chance of occurring in any given year).

**Magnitude / Severity**

The magnitude / severity of extreme heat for Montgomery County is considered as being “Low”.

**Low** – Few or minor damages or injuries are likely.

### **3.2.6 Flood / Levee Failure**

A flood is a 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.

Flash flooding is characterized by rapid accumulation or runoff of surface waters from any source. This type of flooding can occur within six hours of a rain event, after a dam or levee failure, or following a sudden release of water held by an ice or a debris jam. Flash floods can catch people unprepared. Because flash floods can develop in just a matter of hours, most flood-related deaths result from this type of flooding event.

Several factors contribute to flooding. Two key elements are rainfall intensity and duration. Intensity is the rate of rainfall and duration is how long the rain lasts. Topography, soil conditions, and ground cover also play important roles. Most flash flooding is caused by slow-moving thunderstorms or heavy rains. Floods, on the other hand, can be fast-rising, but generally develop over a period of hours or days.

Urbanization further aggravates the flooding potential by increasing runoff two to six times over what would occur on natural terrain. As land is converted from fields or woodlands to buildings and pavement, it loses its ability to efficiently absorb rainfall. During periods of urban flooding, streets can become swift moving rivers, while basements and viaducts can become death traps as they fill with water.

The areas adjacent to rivers and stream banks that serve to carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowlands including the 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.

### **Historical Statistics**

The largest disaster to impact Montgomery County in recent years was the flood of 1993 where flooding occurred along a 15-mile section of the Missouri River at the county’s southern border. Loss of agricultural lands, homes, businesses, and infrastructure -- as well as the temporary closing of obstructed transportation routes -- contributed to economic losses. Rhineland was

especially hard hit. By July 7, 1993, 80% of the town was under roughly six feet of water. Four additional record crests from the Missouri River inundated the town.

The residents of Rhineland made international news by moving the entire town to the hills above the floodplain. The SEMA buyout program included more than 40 homes in Rhineland, located in the Missouri River floodplain. Commercial businesses received buyout assistance and built new buildings on high ground in the new Rhineland. The Rhineland mitigation was funded by a \$1 million grant and by \$360,000 in relocation funds from FEMA.

The flood levels of 1995 were similar of those in 1993. However, this time, flood impacts were minimal for Rhineland. Only one home remained in the floodplain and the roadbeds of previously inundated highways had been raised.

The U.S. Army Corps of Engineers produced a set of maps showing damage estimates for the 1993 flood. Losses also included 2,141 acres of lost crops and unemployment in the county's agri-business. According to the maps, Montgomery County damages included:

- \$5M - \$10M in agricultural damage
- 5K – 9.9K acres of agricultural land damaged
- More than \$500,000 in commercial damage
- \$1M - \$5M in public facilities damage
- More than \$5M in transportation system damage
- \$10,000 - \$25,000 in emergency expenses
- \$1M - \$5M in residential damage.

Within the past 14 years, flood events have not resulted in any deaths and caused only one injury. One year after the months-long flooding of 1993, the Missouri River crested 10 feet above flood stage. With the 1993 flood buyouts incomplete, damage was repeated in many locations. Since 1994, damages have been limited to agricultural lands and temporary roadway closings. Route J was closed three times while Routes CC and K were closed twice. Routes 161 and Y were each closed once due to flash flooding while Highway 19 was closed three times.

According to the National Mapping System, major rivers in Montgomery County include West Fork Cuivre River, Loutre River, and Missouri River. Other water bodies include: Big Lead Creek, Sandy Creek, Coon Creek, West Fork Cuivre River, Elkhorn Creek, White Oak Creek, Brush Creek, Wolf Creek, Little Loutre Creek, Whitestone Creek, Prairie Branch, Bear Creek, Dry Creek and Loutre Slough.

The tables below show flood events in Montgomery County since 1994.

**Table 3.12; Montgomery County Flood Events 1994 to 2014**

Date	Type	Death	Injury	Property	Crops
4/11/1994	River Flood	0	0	\$5,000,000	\$5,000,000
4/11/1994	Flash Flood	0	0	\$5,000	0
5/17/1995	Flash Flood	0	0	\$5,000	0
5/1/1996	Flood	0	0	0	0
7/1/1996	Flash Flood	0	0	0	0
6/22/1997	Flash Flood	0	0	0	0
10/5/1998	Flood	0	0	0	0
10/6/1998	Flood	0	0	0	0
5/4/1999	Urban/Small Stream Flood	0	0	0	0
6/24/2000	Flash Flood	0	0	0	0
6/4/2001	Flood	0	0	0	0
5/6/2002	Flood	0	0	0	0
5/8/2002	Flood	0	0	0	0
5/9/2002	Flash Flood	0	0	0	0
5/12/2002	Flash Flood	0	0	0	0
6/11/2002	Flash Flood	0	1	0	0
5/19/2004	Flash Flood	0	0	0	0
5/1/2005	Heavy Rain	0	0	0	0
6/1/2006	Flash Flood	0	0	0	0
5/8/2007	Flood	0	0	0	0
5/25/2008	Flash Flood	0	0	\$15,000	0
6/15/2009	Flash Flood	0	0	0	0
7/28/2009	Flash Flood	0	0	0	0
10/0/2009	Flash Flood	0	0	0	0
10/29/2009	Flash Flood	0	0	0	0
9/2/2010	Flash Flood	0	0	0	0
6/5/2012	Flood	0	0	0	0
06/01/2013	Flood	0	0	\$1,000	\$2,000

Source: National Climatic Data Center

**Table 3.13; Flash Flood Events From 2004 to 2014**

Date	Time	Description
19 May 2004	1:20 AM	The County sheriff reported water 6 inches deep flowing over the Elkhorn Creek bridge on Highway 161. Six to 8 inches of water was reported on Hwy 19 in Montgomery City.
01 June 2006	1:30 PM	Two to four inches of rain fell over Montgomery County in less than 2 hours, causing numerous roads to become flooded. Some flooding was reported at the junction of County Highways J & N and portions of Hwy J. Also, State Hwy 19 south of Montgomery City was flooded, as well as State Hwy 161 between Montgomery City and Danville.
25 May 2008	8:15 PM	Heavy rain flooded several county roads. Two people had to

<b>Date</b>	<b>Time</b>	<b>Description</b>
		be rescued from a car trapped in flood water on Hwy Y, 2 miles east of Hwy 19.
15 June 2009	6:45 AM	In excess of 3 inches of rain fell in a short amount of time, mainly along the Interstate 70 corridor. Parts of Interstate 70 and Hwy 19 had to be shut down due to flooding.
28 July 2009	10:00 PM	Between 2 and 5 inches of rain has fallen in a short amount of time causing flash flooding. Hwy 19 both north and south of Interstate 70 has water covering it. Also, Boonslick Road and Coal Chute Road near High Hill and Sunbeam Road north of New Florence were flooded for a time.
08 Oct 2009	05:45 AM	4-5 inches of rain during short period flooded numerous roads including Highways 161 and 19 near Montgomery City
29 Oct 2009	03:53 PM	More than 3 inches of rain fell on saturated soil flooding Highway Y
02 Sept 2010	05:45 PM	Three inches of rain fell during a short period of time flooding several roads including Highway 94 east of Rhineland

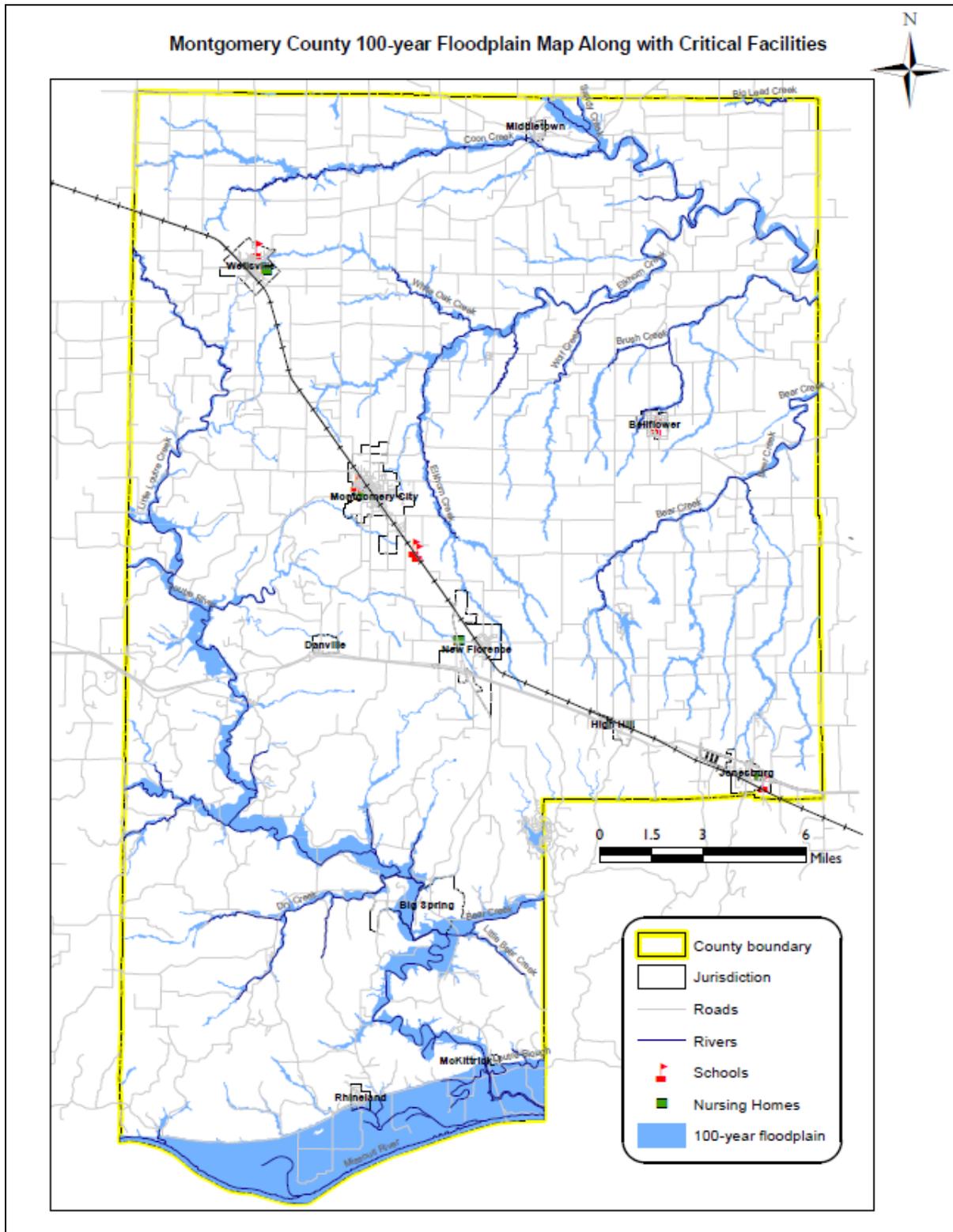
*Source: National Climatic Data Center*

The flash flooding for Montgomery County is mostly confined to the 100-year floodplain and no data suggests that it occurs outside the 100-year floodplain. An action plan has been proposed to improve drainage of roadways in flash flood areas.

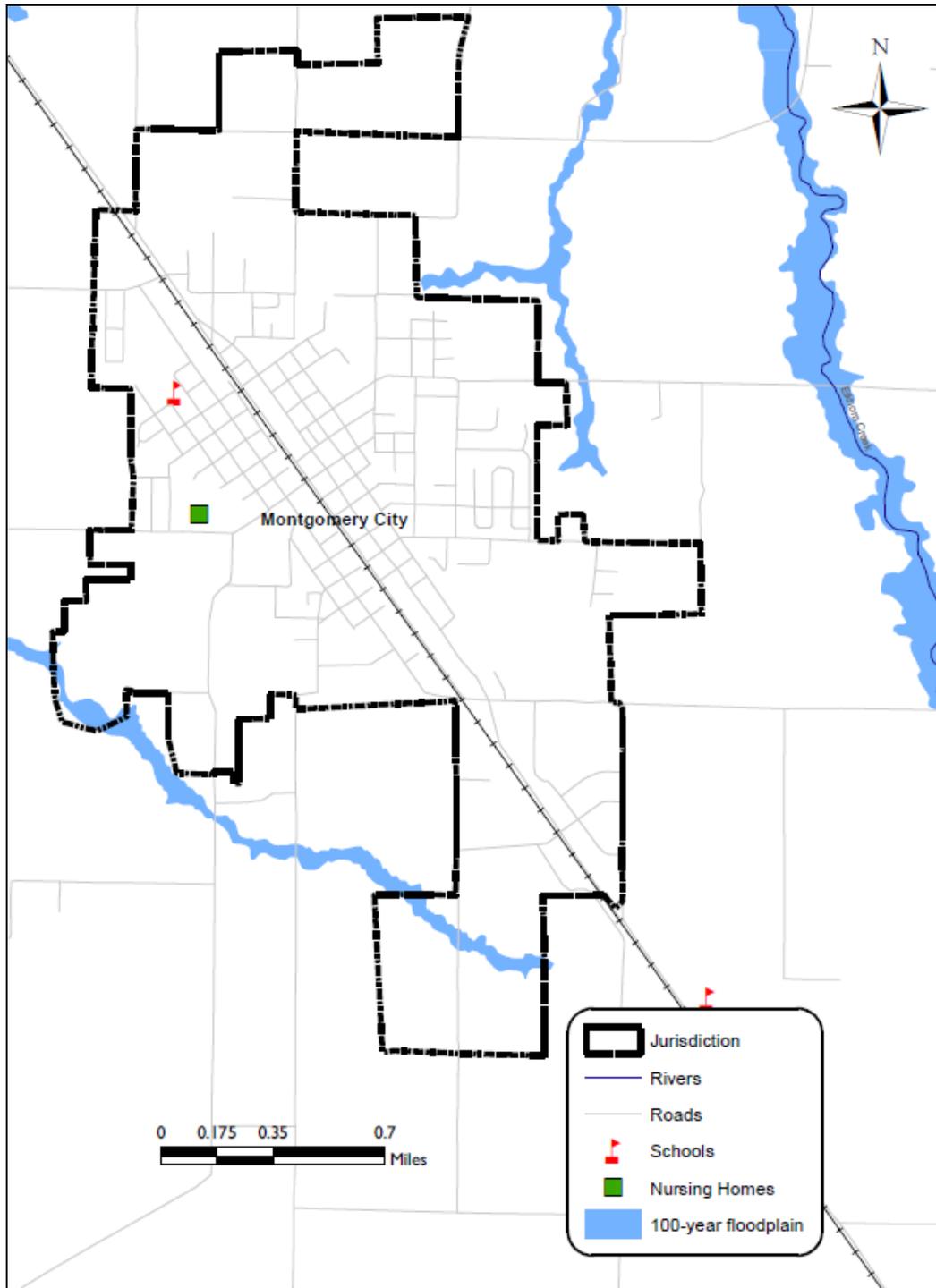
### **Location**

The major flood hazards have occurred along the Missouri river floodplain and Loutre River basin. Some areas in the county are less likely to be impacted by riverine flooding, though localized flooding is possible if storm drainage systems are not developed in densely populated areas. Jurisdictions most likely to be affected by floods are Montgomery City, the Montgomery County R-III School District, the Gasconade R-I School District, the cities of New Florence and Rhineland, and the Wellsville-Middletown School District.

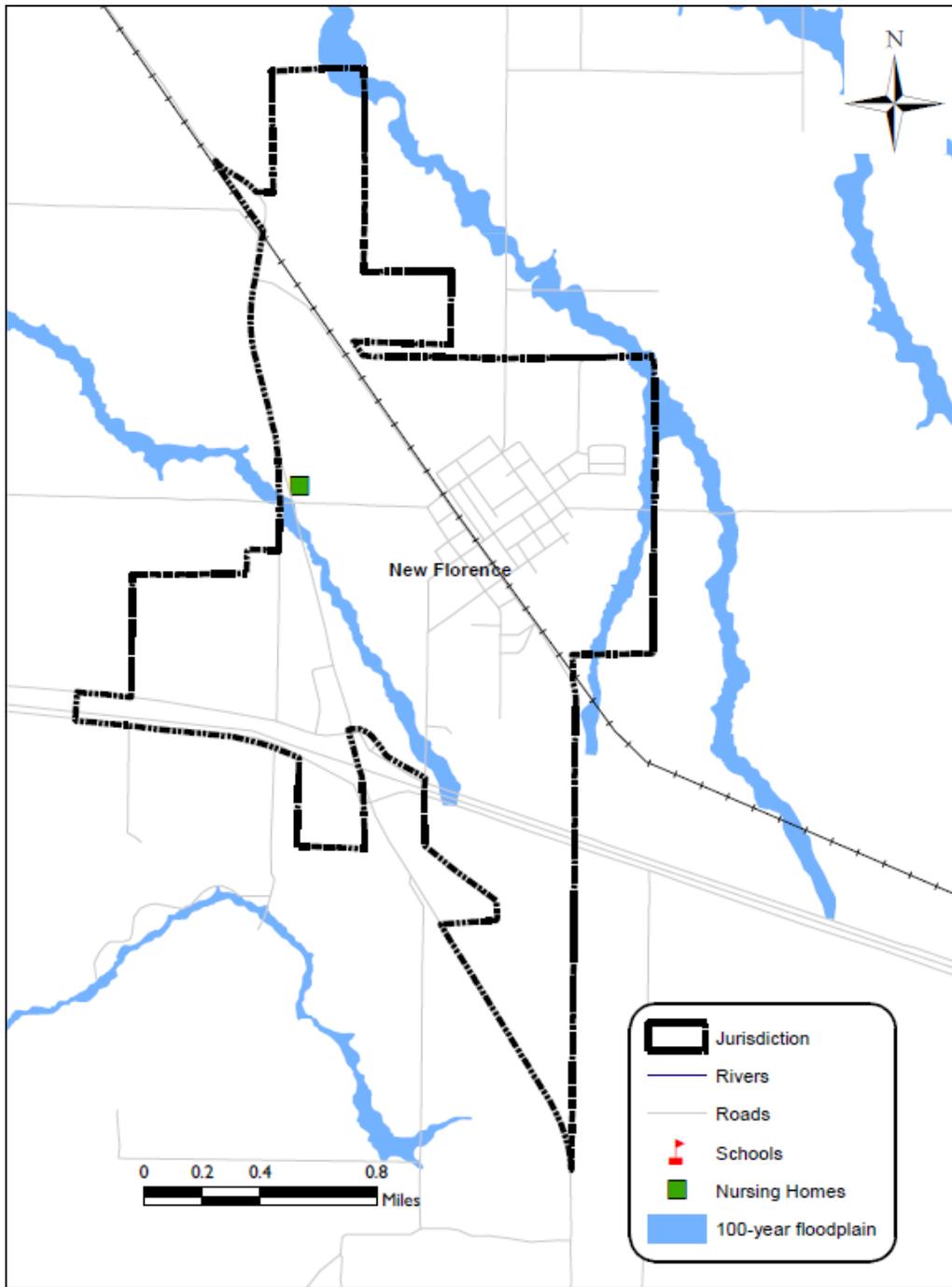
Map 3.3; Montgomery County 100-Year Floodplain Map



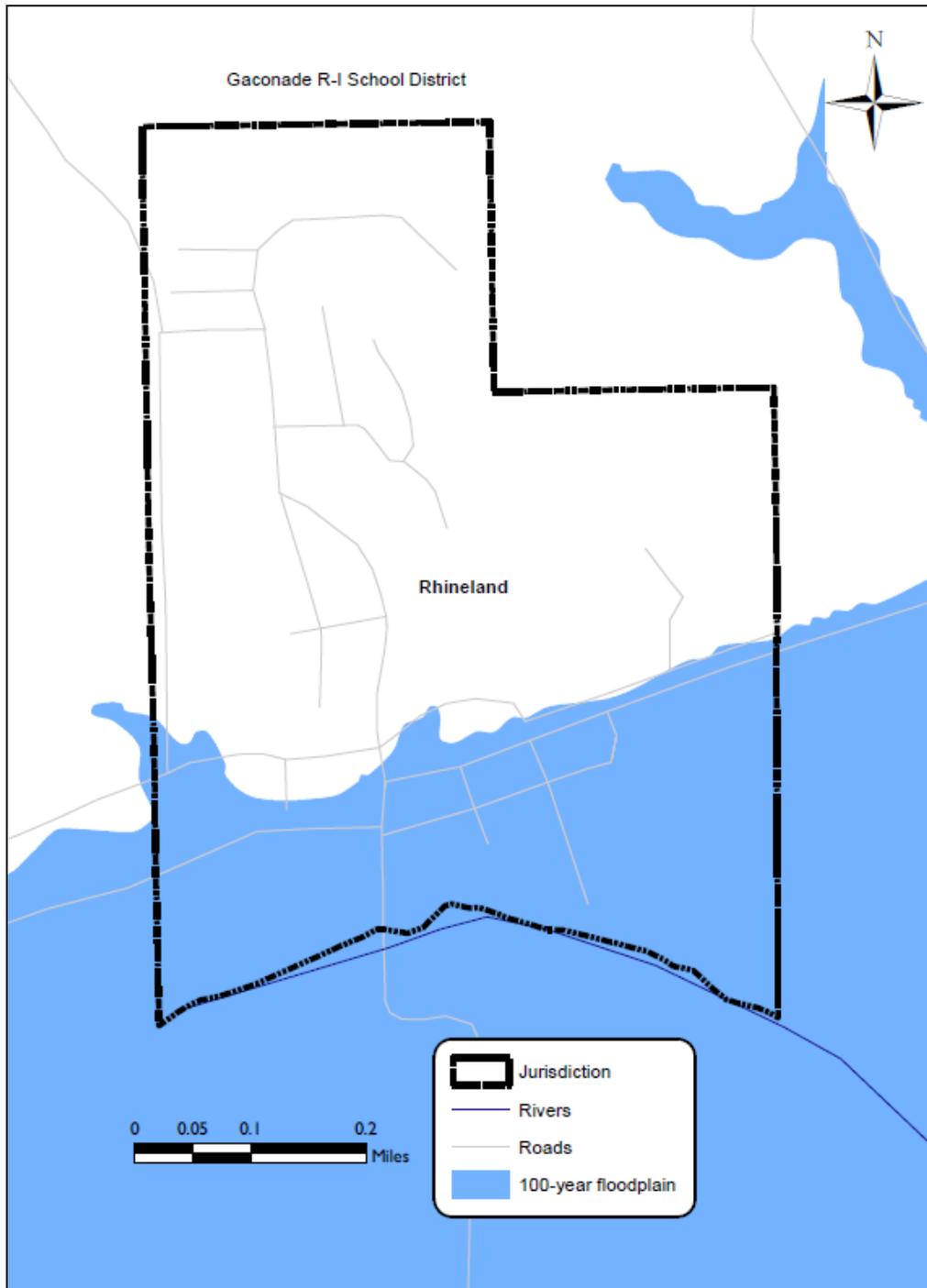
**Map 3.4; Montgomery City 100-year Floodplain Map along with Critical Facilities**



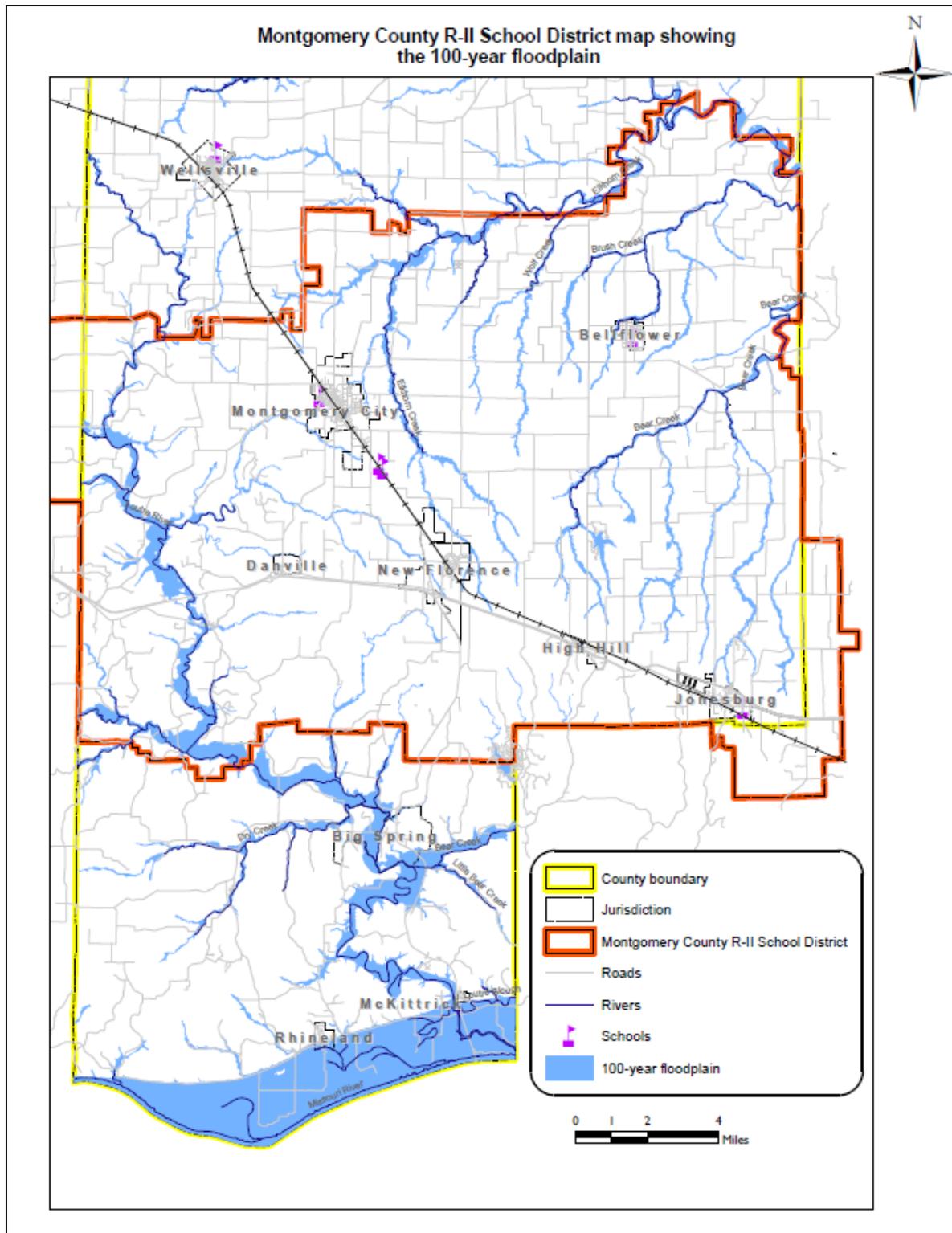
**Map 3.5; City of New Florence 100-year Floodplain Map along with Critical Facilities**



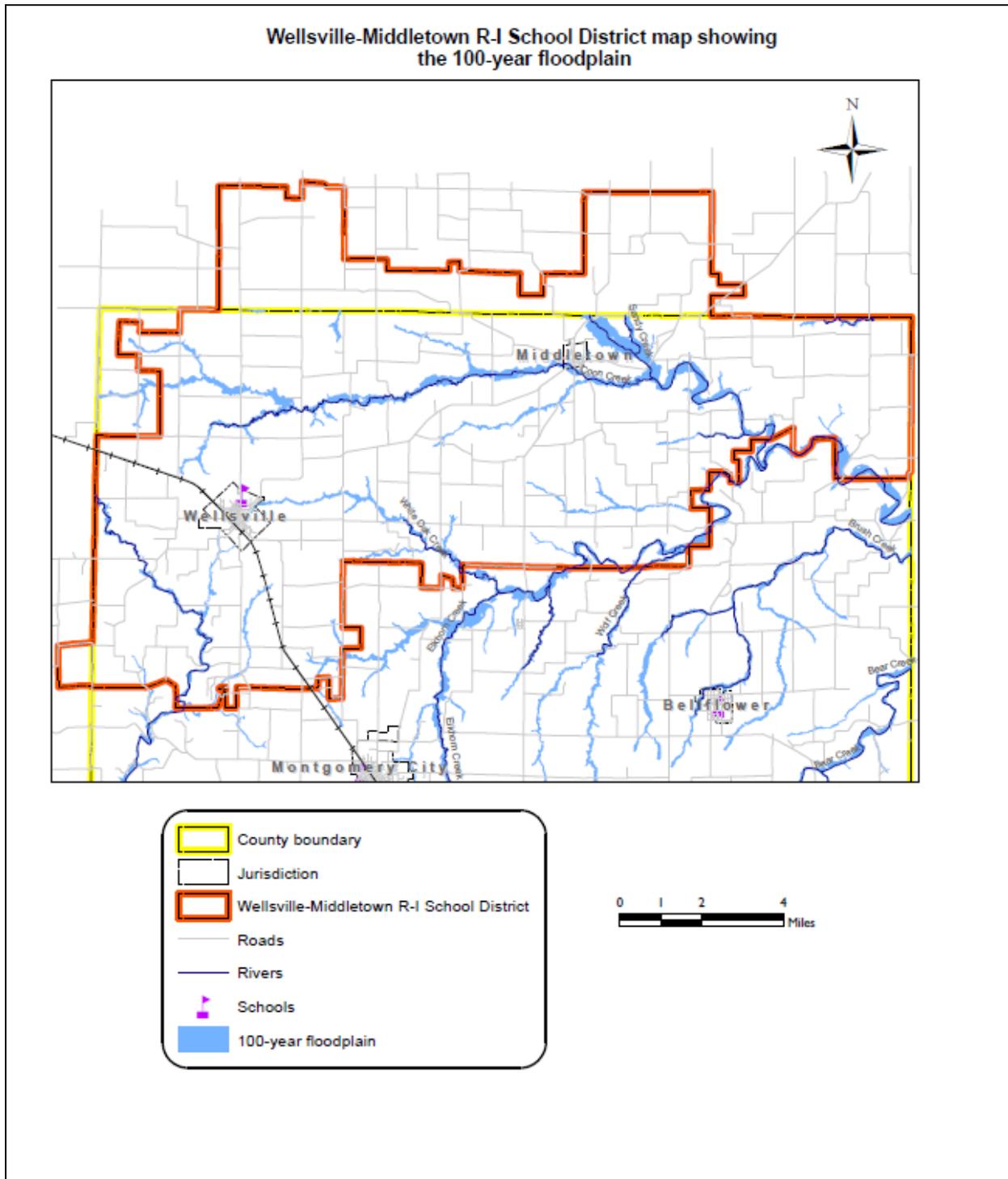
**Map 3.6; Village of Rhineland 100-year Floodplain Map along with Critical Facilities**



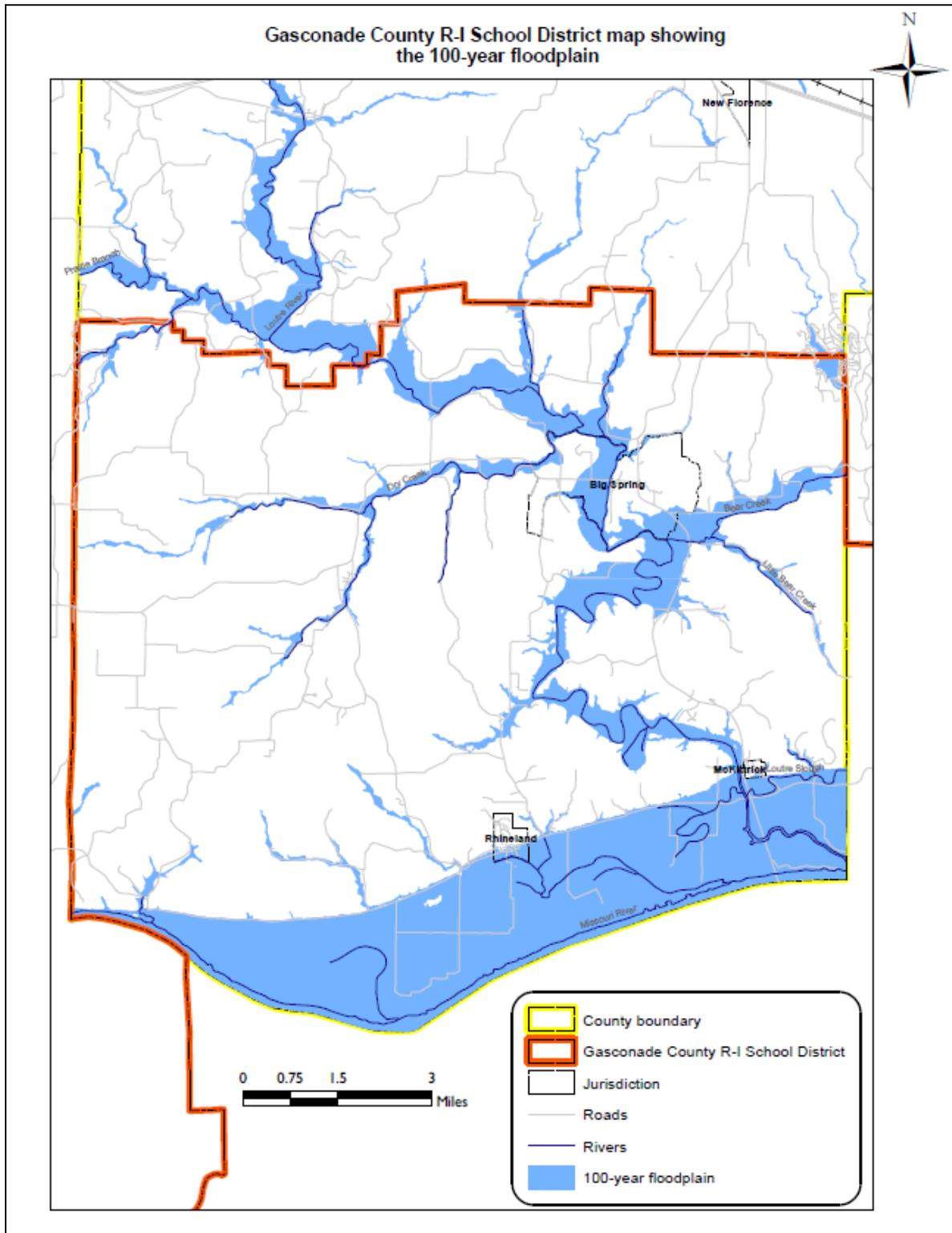
**Map 3.7; Montgomery County R-II School District 100-Year Floodplain Map**



**Map 3.8; Wellsville – Middletown R-I School District 100-Year Floodplain Map**



**Map 3.9; Gasconade County R-I School District 100-Year Floodplain Map**



### Probability of Future Occurrence

The main origin of Montgomery County flooding is the Missouri River. As part of the Missouri River watershed, the Loutre River drains the southwestern half of the county. The upper reaches of the Cuivre River watershed drain the northeastern half of the county. Along the length of the county's southern border, the river's floodplain is 2 - 3 miles wide. The communities of Rhineland and McKittrick lie on the edge of the floodplain along State Highway 94. Montgomery County participates in the National Flood Insurance Program (NFIP). The cities of Bellflower and New Florence do not participate.

Several individual communities are situated on or near small creeks. Although no reports were found of these creeks causing flooding, an inventory may be useful in the future as urban areas expand. Coon Creek runs through a corner of Middletown, East Branch Brush Creek runs through the northeast section of Bellflower, Smith Branch generally parallels State Highway 19 through New Florence, and the Modoc Creek makes up the southern boundary of the Rhineland city limits.

In the lower half of the county, drainage is a major factor in the steep hills above the floodplain. The loess-based soils covering the relatively flat northern half tend to drain well. The seasonal pattern is shown below. May and June would be the most likely time of year for flooding.

**Table 3.14; Flood Events By Month 1993 to 2014**

Month	No. of Events
April	2
May	11
June	7
July	1
September	1
October	4
TOTAL	28

Out of 28 total floods, sixteen are flash floods, eleven are river and stream floods, and one is a heavy rain. The probability of future occurrence of a flood in Montgomery City, the Montgomery County R-III School District, the Gasconade R-I School District, the cities of New Florence and Rhineland, and the Wellsville-Middletown School District is "Moderate".

**Moderate** – The hazard has a reasonable probability of occurring (between 1% and 10% chance of occurrence in any given year).

**Magnitude / Severity**

Past flood events in Montgomery County have caused significant damage to property and agriculture, endangered lives, and shut down critical facilities and agriculture. The magnitude / severity of a flood is "Moderate".

**Moderate:** Injuries to personnel and damage to property and the environment.

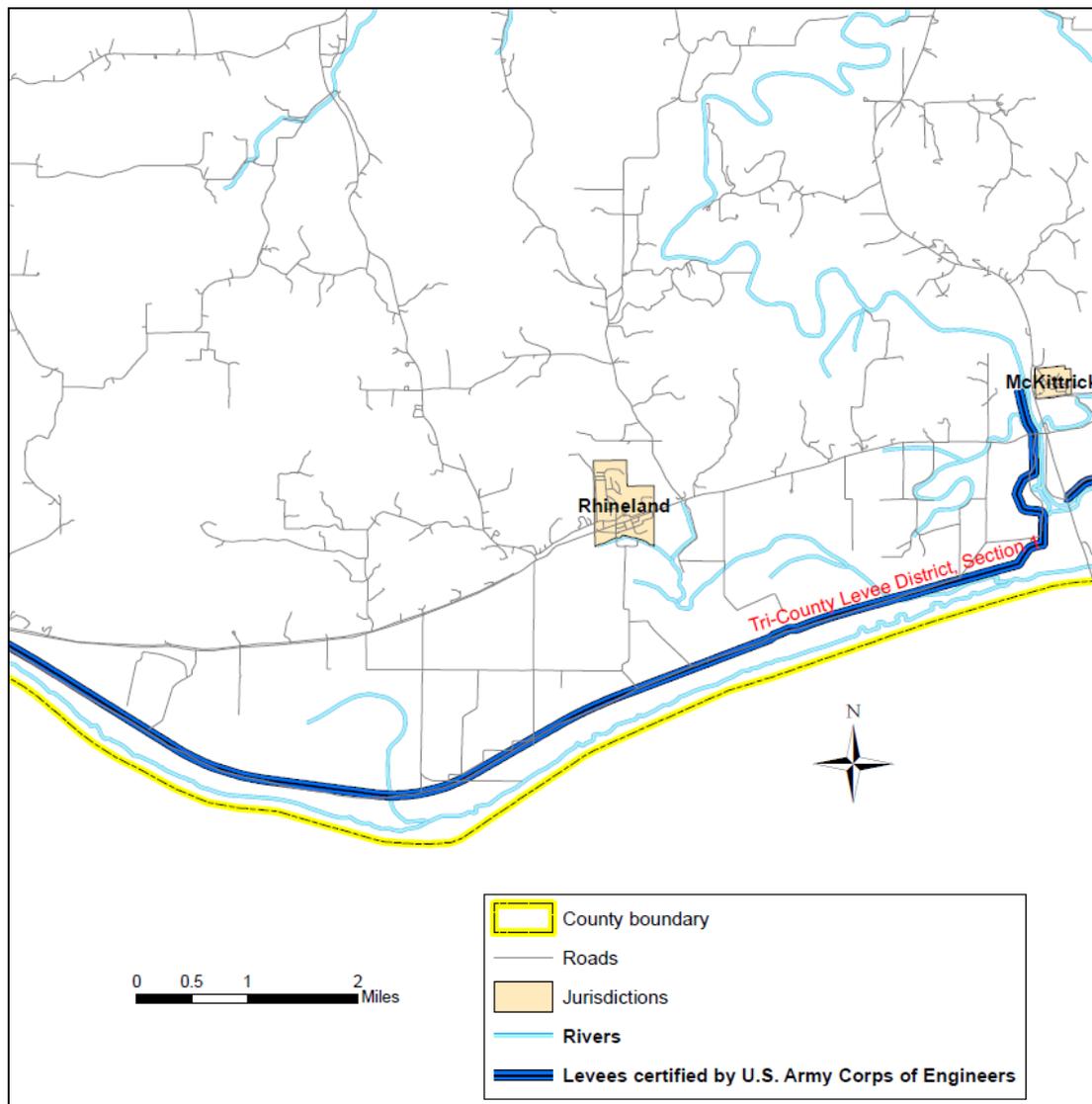
**Levee Failure:** Levee failure is included with floods as it falls within the scope of potential flooding events. FEMA defined a levee as "man-made structure, usually an earthen embankment, designed and constructed on accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding". Associated with the riverine flooding hazard are floods caused by breaching or failure of levees. Levees usually protect seasonal flooding, and may be subject to water loading for periods of only a few days or weeks each year.

Levees in Missouri are either regulated or non-regulated. Regulated levees are designed, built and maintained by the US Army Corps of Engineers (USACE) and are located on the two major rivers, the Mississippi and the Missouri. Non-regulated levees are constructed along lesser waterways to control flooding for private enterprise such as farming. Montgomery County has no regulated levee and just two non-regulated levees, one at McKittrick and one at Rhineland, each on the Missouri river. Both non-regulated levees are owned by the Tri-County Levee District which owns levees in Gasconade and Warren Counties as well.

HAZUS-MH floodplain boundaries used for flood impact analysis did not take the levees for Montgomery County into account. Therefore, impacts associated with levee failure would likely correspond to the impacts of a 100 year flood event.

When conducting analysis for levee failure, it was determined that most of the levees protect agricultural areas, and that most impacts of levee failure would concern agricultural production. Analysis also determined that the protective level (i.e. 5, 10, 25, 50, 100 year flood) of the levees in Montgomery County are not known. Per the USACE National Levee Database, there are 2 levee districts that are currently active in the USACE Rehabilitation and Inspection Program. They are the Tri County Levee District located south of Montgomery County and Missouri Valley Levee District located south of Warren County. The total levee-ed area for Tri County Levee District is 5,261.83 acres and the total leveed area for Missouri Valley Levee District is 8,785.50 acres

**Map 3.10; U.S. Army Corps of Engineers Certified Levees in Montgomery County**



**Probability of Future Occurrence**

There were more than 1,000 Federal and non-Federal levee breaches during the Great Flood of 1993. From June to August 1993, rainfall totals surpassed greater than 24 inches of rain fell on northern and central Missouri. These amounts were approximately 200-350 percent greater than normal. The Missouri River crested at 48.87 feet at Kansas City on July 27. This crest moved down the Missouri River setting new records at Boonville, Jefferson City, Hermann, St. Charles, and numerous other locations. The first levee was overtopped on June 7, but levee failures soon became common. Levee failures resulted in large amounts of sediments deposited in some inundated areas, and large quantities of sediments were scoured from other inundated

areas. No location specific information is available for Montgomery County. However, in St. Louis, out of 42 Federal levees, 12 of them failed or overtopped and out of 47 non-Federal levees, 39 failed (U. S. Geological Survey).

The probability of future occurrence of a levee failure in Montgomery County is “Moderate”.

**Moderate** – The hazard has a reasonable probability of occurring (between 1% and 10% chance of occurrence in any given year).

**Magnitude / Severity**

McKittrick, Rhineland and the Gasconade County R-I School District - “Moderate”.

**Moderate** – Injuries to personnel and damage to equipment and the environment.

**3.2.7 Hail**

**Hazard Description**

Hail develops in strong thunderstorms when rapidly rising currents of air, called updrafts, carry raindrops to a height where they freeze. Other droplets of super cooled water will continue to freeze onto the hailstones. Stronger updrafts will produce larger hailstones and they will eventually fall out of the sky when the updraft can no longer support their weight.

Hailstorms cause damage to property, crops, and the environment, and harm livestock.

Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury and occasionally death to humans, often associated with traffic accidents.

Based on information provided by the Tornado and Storm Research Organization, Table 3.15 below describes typical damage impacts of the various sizes of hail.

**Table 3.15; Hailstorm Intensity Scale**

<b>Intensity Category</b>	<b>Diameter (mm)</b>	<b>Diameter (inches)</b>	<b>Size Description</b>	<b>Typical Damage Impacts</b>
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, Grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage
Severe	31-40	1.2-1.6	Pigeon’s egg > squash ball	Widespread glass damage, vehicle bodywork damage

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball> cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>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 (TORRO), 2014

### Historical Statistics

The NCDRC reported 79 hail events in Montgomery County from January 1994 through December of 2013. Table 3.16 shows the number of hail events by the size of the hail stone. These events caused a reported \$5,000 in crop damages and \$6,000 in property damages.

**Table 3.16; Montgomery County Hail Events 1994 to March 2009**

Hail Size (inches)	Number of Events
0.75	22
0.88	9
1.00	31
1.25	3
1.50	5
1.75	8
2.00	1
<b>Total</b>	<b>79</b>

Source: NCDRC, 2014

### Location

Hailstorms frequently strike throughout Montgomery County during its seasonal pattern. No parts of the county are exempt from this hazard.

### Probability of Future Occurrence

Based on NCDRC data, there were 79 hail events in Montgomery County from 1994 through 2013, an average of 4.16 each year. Hail events producing hail 1.00 inches and larger occurred 48 times over the same 19 year period. The probability of future occurrence is "High".

**High** - The probability is considered sufficiently high to assume the event will occur (between 10% and 100% chance of occurrence in any given year).

### **Magnitude / Severity**

On an average, Missourians experience hail 2 - 3 times a year; most of the time it is smaller than a pea (1/4") and will cause little or no damage. The magnitude / severity of a hail storm in Montgomery County is "Moderate".

**Moderate** - Injuries to personnel and damage to equipment and the environment.

## **3.2.8 Severe Winter Weather (Snow, Ice, and Extreme Cold)**

### **Hazard Description**

Winter storms in Missouri typically involve snow, extreme cold, and freezing rain (ice storms). According to SEMA, severe winter weather events can cause various injuries, deaths and property damage. Causes of death range from traffic accidents during adverse driving conditions to heart attacks caused by overexertion while shoveling snow. Hypothermia or frostbite may be considered the most direct cause of death and injury attributed to winter weather.

Economic costs are difficult to measure. Heavy ice can bring down trees, power lines, telephone lines, and communications towers. Power outages create an increased risk of fire as residents seek alternative fuel sources (wood or kerosene 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, homeowners, business owners, and power companies can be faced with spending millions of dollars to restore services and remove debris.

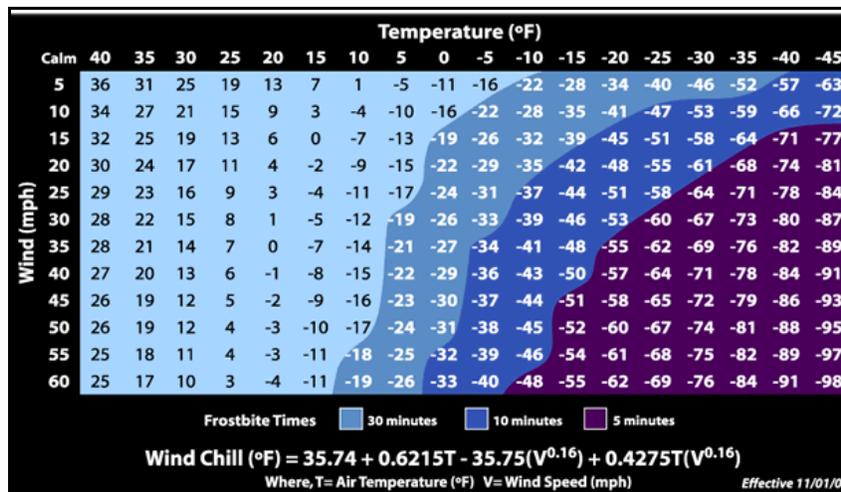
According to the National Center for Health Statistics, 3,468 people died directly from hypothermia, or with hypothermia listed as a contributing cause of death, in the U.S. between the years of 2006 and 2010. That is approximately 867 deaths per year. The isolated elderly are among the most at risk followed by those without shelter or those who live in a home that is poorly insulated or without heat. Other potential health and safety threats include toxic fumes from emergency heaters, household fires caused by fireplaces or emergency heaters, and driving in treacherous conditions.

The National Weather Service describes different types of winter storm conditions as follows:

- **Blizzard:** Winds of 35mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow:** Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls:** Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers:** Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain:** Measurable rain that falls onto a surface whose temperature is below freezing. This causes the rain to freeze on surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet:** Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Figure 3.5, provided by the National Weather Service, shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

**Figure 3.5; Wind Chill Chart**



Source: NOAA, National Weather Service

### Historical Statistics

Montgomery County received 2 presidential major disaster declarations, and 5 USDA declarations for winter storms as shown in Table 3.17.

**Table 3.17; Winter Storm Disaster Declarations in Montgomery County**

<b>Declaration Date</b>	<b>Description</b>	<b>Declaration Type</b>	<b>Disaster Number</b>
30-Nov-06	Winter Storms	USDA	M1673
12-Jan-07	Winter Storms	USDA	M1676
14-Jan-07	Severe Winter Storms	Presidential- Major Disaster Declaration	1676-DR
30-Mar-07	Winter Storms	USDA	S2532
12-Oct-07	Winter Storms	USDA	N873
6-Dec-07	Winter Storms	USDA	M1736
27-Dec-07	Severe Winter Storms	Presidential- Major Disaster Declaration	1736-DR
31-Jan-11	Winter Storms	USDA	M1961
1-Feb-11	Winter Storms	USDA	N1043

The NCDRC reports in October of 2014 there were 33 events from 1994 through August 2014.

No deaths, property or crop damage was listed.

**January 31, 2011, USDA M1961 / N1043;** winter storm and snowstorm during the period of January 31 to February 5, 2011.

**December 8, 2007, FEMA 1736 DR:** A major ice storm hit parts of central, northeast, and east central Missouri. Up to a half inch of ice accumulated along with up to one inch of sleet. Trees and power lines were down throughout the area. Many businesses had to close due to loss of electricity. Schools across the area were closed for several days. There were two fatalities reported in automobile accidents across mid-Missouri. Montgomery County received \$175,111.34 in FEMA Public Assistance funds as a result of this disaster.

**November 30, 2006, USDA- S2407:** A major winter storm hit Central, Northeast, East Central and parts of Southeast Missouri from November 30 through December 1. Ice accumulations of 1 inch or more downed trees and power lines resulting in at least 300,000 electric customers losing service for up to a week. Downed limbs and trees damaged homes and automobiles across the area as well. Many rural schools were closed for several days due to slick roads and power outages.

**January 12, 2007, USDA- M1676:** An arctic boundary settled south of the area on the 12th and 13th of January bringing subfreezing temperatures to the northwestern half of the county warning area. Three rounds of precipitation occurred during this period, with the first being the most destructive of all. Significant tree and limb damage was reported as a result of this storm, together with widespread power outages. More than 100,000 homes and businesses lost power during this storm. About 1.5 inches of sleet fell and a 1/2 inch of ice accumulation hit parts of

Central and Northeast Missouri. From 1/4 to 1/2 inch of ice accumulated from freezing rain across Eastern Missouri and parts of Southwest Illinois.

### **Location**

Severe winter weather events frequently strike all of Montgomery County during its seasonal pattern. No parts of the county are exempt from this hazard. Low levels of traffic allow snow or ice to accumulate on unpaved roads making it difficult to plow. This hazard may have a lesser effect on city residents where most roads are paved and city road crews can clear roads more frequently. On the other hand, the cities and towns can be strongly affected during severe winter weather because greater numbers of people travel within and within its boundaries for work, shopping, and education.

### **Probability of Future Occurrence**

During the 19-year period from 1994 through December 2013, there were 33 recorded winter storm events in Montgomery county. The probability of future occurrence of a winter storm in Montgomery County is “High”

**High** – The probability is considered sufficiently high to assume that the event will occur (between 10% and 100% chance of occurrence in any given year).

### **Magnitude / Severity**

The Magnitude / Severity of a severe winter storm is “Moderate”

**Moderate;** Injuries to personnel and damage to equipment and the environment.

## **3.2.9 Thunderstorms and High winds**

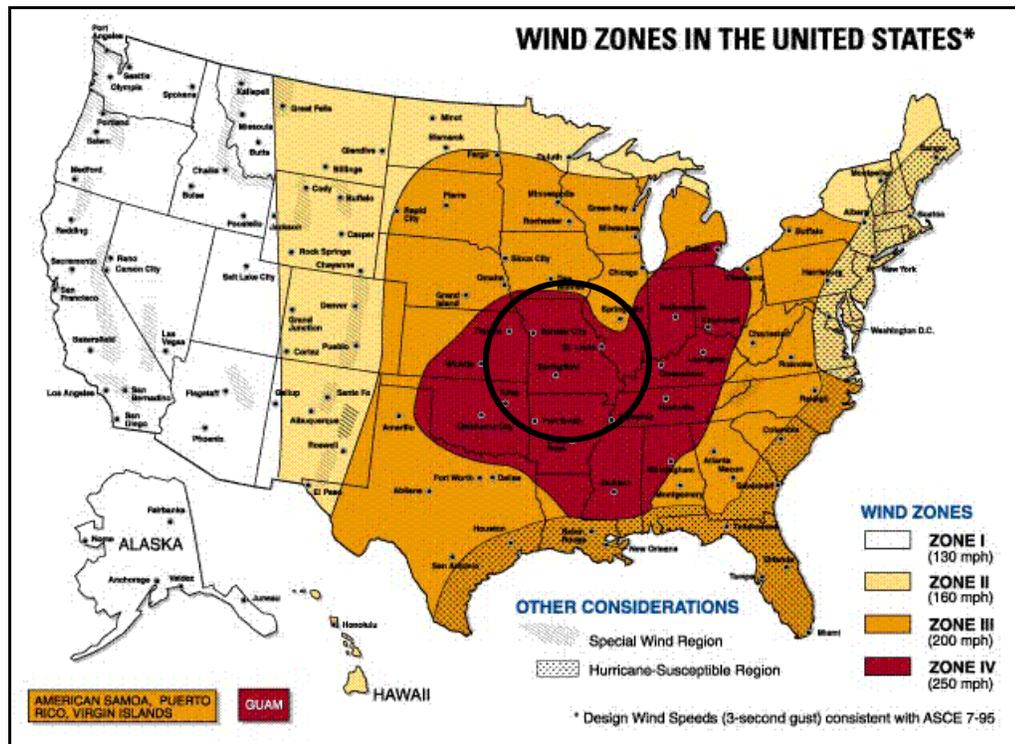
### **Hazard Description**

Thunderstorms can produce a strong rush of wind known as a downburst, or straight-line winds which may exceed 120 miles per hour. These storms can overturn mobile homes, tear roofs off houses and topple trees. The National Weather Service defines a thunderstorm as severe if it produces a tornado, winds of at least 58 mph, and / or hail at least one inch in diameter. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. High winds often accompany thunderstorms. High winds can result in property damage and injury. Strong gusts can rip roofs from buildings, snap power lines, shatter windows, down trees, and sandblast paint from cars. Other associated hazards

include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire from this natural hazard.

Figure 3.5 shows wind zones in the United States. Montgomery County, along with the entire state, is under Zone IV with a wind rate of 250 mph.

**Figure 3.6; U.S. Wind Zones**



Source: FEMA

**Historical Statistics**

During the 19-year period from 1994 through December 2013, there were 68 thunderstorms and wind events recorded by NCD. Sixty-three were reported as thunderstorms, 2 as strong wind events, and 3 as high wind events. According to NCD, these events contributed to 1 injury, \$57.2K personal property damage, and \$2K in crop damage.

Table 3.18 shows the magnitude and number of thunderstorm and high wind events in Montgomery County from 1994 – December 2013.

**Table 3.18; Thunderstorm and High Wind Events**

Magnitude	No. of Thunderstorms & high winds
0 – 39 Knots	8
40-50 Knots	8
51 - 60 Knots	46

<b>Magnitude</b>	<b>No. of Thunderstorms &amp; high winds</b>
61 - 70 Knots	5
>70 Knots	1

*Source: NCDA, 2014*

### **Location**

Thunderstorms and high wind events frequently strike all of Montgomery County during its seasonal pattern. No parts of the county are exempt from this hazard.

### **Probability of Future Occurrence**

The probability of future occurrence of thunderstorms and high winds in Montgomery County is “High”.

**High** – The probability is considered sufficiently high to assume that the event will occur (between 10% and 100% chance of occurrence in any given year).

### **Magnitude / Severity**

The magnitude / severity of thunderstorms and high winds in Montgomery County is “Moderate”

**Moderate** - Injuries to personnel and damage to property and the environment.

## **3.2.10 Tornadoes**

### **Hazard Description**

Tornadoes are cyclical windstorms or a violently rotating column of air. The average forward speed of a tornado is about 30 mph., but it may vary from nearly stationary to 70 mph. The average pathway may vary in any direction, but the average tornado moves from southwest to northeast. Tornadoes are most likely to occur between 3 pm and 9 pm, but may ensue at any hour of the day. Any person or structure at any location could be damaged by a tornado. The amount of damage depends on 1) the strength of the tornado, 2) the tornado’s proximity to the person/structure, 3) the strength of the structure, 4) how well a person is sheltered. Damage can range from very slight to total.

The Fujita Scale (F-Scale) is the standard measurement for rating the strength of a tornado. The National Weather Service (NWS) bases this scale on an analysis of damage after a tornado to infer wind speeds. On February 1, 2007, the NWS transitioned from the F-Scale to the Enhanced Fujita scale (EF-Scale). The EF-Scale is considerably more complex and enables surveyors to assess tornado severity with greater precision. Table 3.17 details both the scales.

**Table 3.19; F-Scale Compared to EF-Scale**

F-Scale	3-sec. gust speed (mph)	EF-Scale	3-sec. gust speed (mph)	TYPICAL DAMAGE
F0	45–78	EF0	65–85	Light damage. Some damage to chimneys. Branches broken off trees. Shallow-rooted trees pushed over; signboards damaged.
F1	79–117	EF1	86–109	Moderate damage. Peels surface off roofs. Mobile homes pushed off foundations or overturned. Moving autos blown off roads.
F2	118–161	EF2	110–137	Considerable damage. Roofs torn off frame houses. Mobile homes demolished. Boxcars overturned. Large trees snapped or uprooted. Light-object missiles generated. Cars lifted off ground.
F3	162–209	EF3	138–167	Severe damage. Roofs and some walls torn off well-constructed houses. Trains overturned. Most trees in forest uprooted. Heavy cars lifted off the ground and thrown.
F4	210–261	EF4	168–199	Devastating damage. Well-constructed houses leveled. Structures with weak foundations blown away some distance. Cars thrown and large missiles generated.
F5	262–317	EF5	200–234	Incredible damage. Strong frame houses leveled off foundations and swept away. Automobile-sized missiles fly through the air in excess of 100 meters (109 yards). Trees debarked. Incredible phenomena will occur.

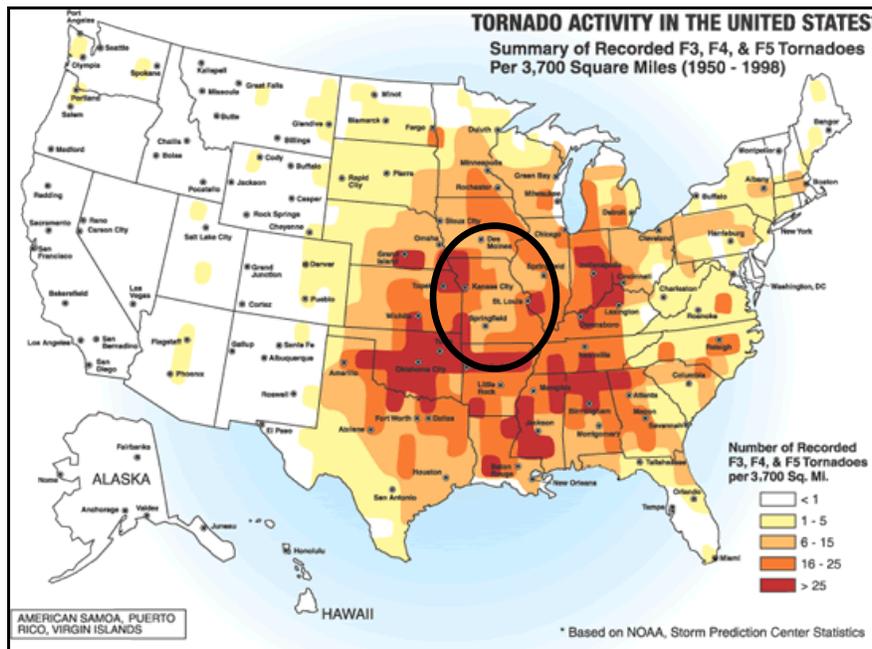
Source: National Weather Service

**IMPORTANT NOTE ABOUT ENHANCED F-SCALE WINDS:** The Enhanced F-scale still is a set of wind estimates (not measurements) based on damage. It 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 3 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.

### Historical Statistics

The 12 tornadoes reported by NCDC between January 1994 and December 2013 most impacted areas near Bellflower, Jonesburg and New Florence. Figure 3.7 illustrates the number of F3, F4, F5 tornadoes recorded in the United States per 3,700 square miles between 1950 and 1998. This data remains unchanged since through October 2014. Montgomery County falls under the range of 6-15 as shown in the map below.

**Figure 3.7 Tornado Activity in the United States**



Source: FEMA, 2014

The historical data from 1994 through 2013 is shown in the table below. It shows 12 tornado events contributing to 1 injury and \$1.125K in property damage. No deaths were reported.

**Table 3.20; Montgomery County Tornado Events; 1994 to 2013**

Location	Date	Mag	Deaths	Injuries	Property Damage	Crop Damage
BELFLOWER	4/13/1998	F0	0	0	0.00K	0.00K
BELFLOWER	7/18/2000	F1	0	0	75.00K	0.00K
JONESBURG	5/27/2004	F0	0	0	0.00K	0.00K
BLUFFTON	3/12/2006	F0	0	0	0.00K	0.00K
JONESBURG	3/13/2006	F3	0	1	800.00K	0.00K
BELFLOWER	3/13/2006	F2	0	0	200.00K	0.00K
NEW FLORENCE	6/10/2006	F0	0	0	0.00K	0.00K
BUELL	10/2/2007	EF0	0	0	50.00K	0.00K
NEW FLORENCE	5/25/2011	EF1	0	0	0.00K	0.00K
DANVILLE	5/31/2013	EF0	0	0	0.00K	0.00K
MONTGOMERY CITY	5/31/2013	EF0	0	0	0.00K	0.00K
NEW FLORENCE	5/31/2013	EF0	0	0	0.00K	0.00K
<b>Totals:</b>			0	1	1.125M	0.00K

Source: National Climatic Data Center, 2014

The NCDL provided descriptions of damages from the following tornado events:

**May 31, 2013:** A weak tornado(s) briefly touched down at three locations, the first along Highway 161 from 2.5 miles south southwest to 2 miles south southwest of Montgomery City. One large tree snapped about a third of the way from the base and fell onto a parked school bus. No one was inside the bus. Three power poles were bent about 40 degrees to the northeast. Overall, the tornado path length was half a mile and max path width was 30 yards. The damage was rated as EF0 with max winds of 75 MPH. Before lifting and dissipating near the intersection of Blue Bird Road and Bob White Road, the roof of an old machine shed was peeled off to the south. Subsequently, a tornado touched down 2 miles north northwest of New Florence. The tornado traveled east for about a mile causing minor siding and soffit damage to a home and uprooted a large tree in the backyard. The tornado path length was 1.06 miles with a max path width of 40 yards. The damage was rated EF0 with max wind speeds of 80 MPH.

**May 25, 2011:** A tornado touched down just east of Highway 19 on County Road 219. The tornado moved northeast to County Road 221, just south of County Road 226, where it struck a small farm causing extensive tree damage and minor damage to some of the outbuildings. The tornado continued northeast to County Road 226, just east of intersection with County Road 221 where it tore roofing from a metal machine shed with some of the tin blown approximately one half mile to the north-northeast. Also, a grain bin was partially caved in and there was more significant tree damage. On the next road north, County Road 227, a metal machine shed had the eastern portion of the roof partially caved in. On Highway V, approximately 2 miles east of Highway 161, another farm sustained damage. Three outbuildings were destroyed and a full grown oak tree was snapped at the base. Metal roofing was tossed northeast at least one half mile with a couple pieces wrapped around high tension power lines to the north of Highway V. This was the most intense damage along the tornado path and was rated high end EF-1. The tornado continued moving northeast causing minor tree damage along County Road 153 and finally dissipated in an open field west of County Road 141 about two miles northwest of Bellflower, MO. The maximum width of the tornado was 100 yards and the path length was 7 miles.

**October 31, 2007:** A tornado touched down near the intersection of CR 165 and CR 168. It travelled to the northeast destroying one outbuilding and damaging or destroying numerous trees. Also, the southeast corner of a hog confinement building was damaged, leading to a partial roof collapse. Some of the debris was thrown a third of a mile to the northeast. An unoccupied car was also damaged. The tornado lifted and dissipated on CR 160 about a quarter of a mile south of CR 164.

**March 13, 2006:** A super-cell thunderstorm produced a tornado that tracked from northeast Montgomery County, across northern Lincoln County, crossed into southeast Pike County, and then crossed the Mississippi River into Calhoun County, IL during the early morning hours of Monday, March 13, 2006. The total damage track was almost 45 miles with the tornado reaching a maximum damage width of 300 yards and a F3 rating. The tornado first formed and caused damage in northeast Montgomery County about 1:20 am CST along Union Chapel Road northwest of Bellflower. A home suffered roof damage with several trusses on the northwest side destroyed. The tornado was about 100 yards wide at this point and was rated F1. The tornado moved northeast and crossed Highway E several times. In the small community of Gamma, two homes suffered major roof damage, a barn and several outbuildings destroyed. The tornado was rated F2 at this location and was about 200 yards wide. The tornado weakened and caused tree damage near the West Fork of the Cuivre River as it crossed into Lincoln County southwest of Olney. Total damage was reported at \$200K.

**March 16, 2006 - FEMA 1631 DR and March 11, 2006- USDA M 1631:**

- In Montgomery County, the F0 tornado destroyed a small shed along County Road 289 and then dissipated about 2 miles north of Bluffton on March 12, 2006.
- The F2 tornado on March 13, 2006 first formed and caused damage in northeast Montgomery County along Union Chapel Road northwest of Bellflower. A home suffered roof damage with several trusses on the northwest side destroyed. There was a reported property damage of \$200,000.
- The F3 tornado on March 13, 2006 formed in Jonesburg caused a property damage of \$800,000. The Montgomery County Emergency Management Agency reported 8 structures destroyed, 10 with extensive damage and 14 with moderate damage. This covers homes and businesses and does not include barns and outbuildings.

**May 27, 2004** - A F0 tornado hit Jonesburg causing some tree and roof damage. About a dozen buildings suffered roof damage from the tornado. There were also numerous trees and power lines down.

**July 18, 2000:** A F1 tornado struck eastern Montgomery County causing damage at a farm and downing trees and power lines. The tornado first caused damage at a farm on Leonard Road which was also where the most extensive damage occurred. A large garage lost both doors and half of its roof. A grain trailer was overturned and 2 grain bins blown away, one to the northwest

and the other about 1/2 mile to the east. The remainder of the damage path consisted of downed trees and crop damage.

### **Location**

Statistics show that Bellflower, Jonesburg, and New Florence have been affected by tornadoes. Tornado events are likely to occur countywide. No parts of the county are exempt from this hazard.

### **Probability of Future Occurrence**

The location of Montgomery County in Wind Zone IV makes the probability of a tornado in any given year “High”.

**High** – The probability is considered sufficiently high to assume that the event will occur (between 10% and 100% chance of occurrence in any given year).

### **Magnitude / Severity**

The magnitude / severity of thunderstorms and high winds in Montgomery County is “High”

**High** - Deaths, major injuries and property damage will likely occur.

## **3.2.11 Wildfires**

### **Hazard Description**

Wildfires occur throughout wooded and open vegetation areas of Missouri. They can occur any time of the year, but mostly occur during long, dry hot spells. Any small fire, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness or negligence. However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion.

Open fields, grass, dense brush and forest-covered areas are typical sites for wildfire events. Forest and grassland fires can occur any day throughout the year. Each year, an average of about 3,100 wildfires burn more than 53,000 acres of forest and grassland in Missouri (MDC, 2013). Most of the fires occur during the spring season, normally between February 15 and May 10. The length and severity of burning periods largely depend 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 extremely high fire danger. In addition, due to the continued lack of moisture throughout many areas of the State, conditions are likely to increase the risk of wildfires. Under dry conditions or droughts, wildfires have the potential to

burn forests as well as croplands. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not provide for adequate firefighting suppression. Spring is when many rural residents burn their garden spots, brush piles, and other areas. This is also a time when bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris. Some landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush. Therefore, with the possibility of extremely high fire dangers and the increased opportunities for fires, the spring months are the most dangerous for wildfires. The second most critical period of the year is fall, when dried leaves are also fuel for fires.

### **Historical Statistics**

According to SEMA's 2000 Hazard Analysis wildfires are most common in the southern districts of the state. However, it is possible for wildfires to occur in Montgomery County due to drought, debris burning, and incendiary fires. Debris burning is consistently the number one cause of wildfires. Incendiary fires, willfully set on another person's property, continue to rank second in the number of wildfires each year. Fires caused by natural ignition, like lightning, are rare despite 50 to 70 thunderstorm days per year.

NCDA reports no wildfires for Montgomery County. However, according to the Missouri Department of Conservation Forest Fire Reporting mechanism, 887 acres were burned in Montgomery County from January 1, 1994 through December 31, 2013. During that period, 12 residences and 13 outbuildings were threatened resulting in 2 residences being destroyed along with 1 outbuilding. Causes vary significantly and range from Arson to Miscellaneous to Unknown, to Debris. Debris burning is the most common "known" cause cited. The table 3.21 below shows the causes listed in the MDC report.

**Table 3.21;  
Causes of Montgomery County Wildfires  
1994 through 2013**

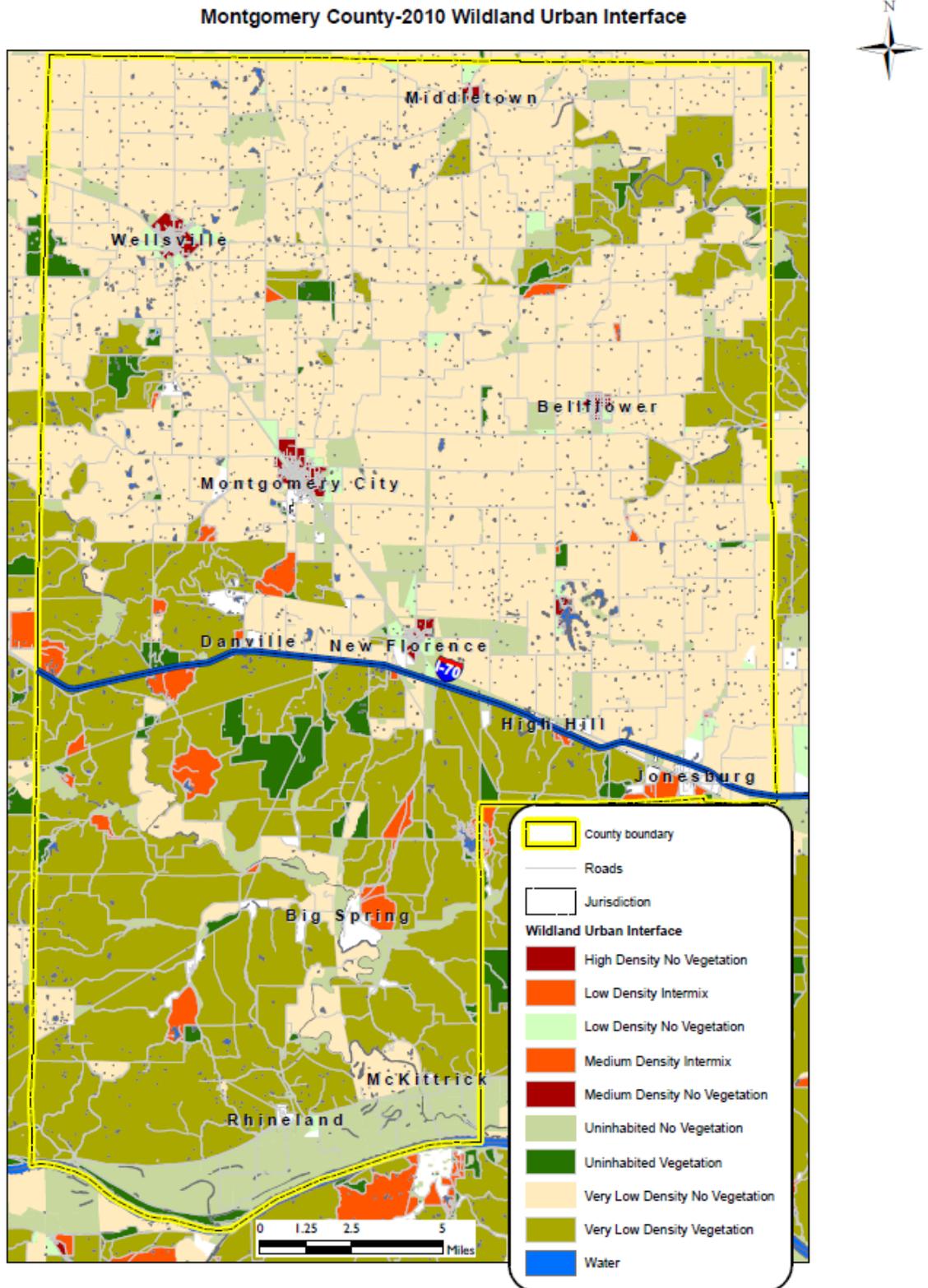
<b>Cause</b>	<b>No. of Incidents</b>
Arson	3
Campfire	2
Debris	69
Equipment	8
Lightning	1
Miscellaneous	47
Not Reported	2
Railroad	1
Smoking	8
Unknown	38
Blank	0
<b>TOTAL</b>	<b>179</b>

Source: Missouri Department of Conservation, 2014

## Location

Wildland Urban Interface GIS data were designed to provide a spatially detailed national assessment of the Wildland Urban Interface (WUI) across the coterminous U.S. to support inquiries into the effects of housing growth on the environment, and to inform both national policy and local land management concerning the WUI and associated issues. These data are useful within a GIS for mapping and analysis at national, state, and local levels.

**Map 3.11; Montgomery County Wildland / Urban Interface**



**Table 3.22; Description of Wildland / Urban Interface Densities**

Description
Low density interface: Areas with housing density $\geq 6.177635$ (housing units/km <sup>2</sup> ) and $< 49.42108$ (housing units/km <sup>2</sup> ), Vegetation $\leq 50\%$ , within 2.414 km of an area with $\geq 75\%$ Vegetation.
Medium density interface: Areas with housing density $\geq 49.42108$ and $< 741.3162$ , Vegetation $\leq 50\%$ , within 2.414 km of an area with $\geq 75\%$ Vegetation.
High density interface: Areas with housing density $\geq 741.3162$ , Vegetation $\leq 50\%$ , within 2.414 km of an area with $\geq 75\%$ Vegetation.
Low density intermix: Areas with housing density $\geq 6.177635$ and $< 49.42108$ , Vegetation $> 50\%$ .
Medium density intermix: Areas with housing density $\geq 49.42108$ and $< 741.3162$ , Vegetation $> 50\%$ .
High density intermix: Areas with housing density $\geq 741.3162$ , Vegetation $> 50\%$ .
Very low density with vegetation: Areas with Housing density $> 0$ and $< 6.177635$ , Vegetation $> 50\%$ .
Uninhabited with vegetation: Areas with housing density = 0, Vegetation $\geq 50\%$ .
Uninhabited and no vegetation: Areas with housing density = 0, Vegetation $\leq 50\%$ .
Very low density with no vegetation: Areas with housing density $> 0$ and $< 6.177635$ , Vegetation $\leq 50\%$ .
Low density with no vegetation: Areas with housing density $\geq 6.177635$ and $< 49.42108$ , Vegetation $\leq 50\%$ .
Medium density with no vegetation: Areas with housing density $\geq 49.42108$ and $< 741.3162$ , Vegetation $\leq 50\%$ .
High density with no vegetation: Areas with housing density $\geq 741.3162$ , Vegetation $\leq 50\%$ .

Source: <http://silvis.forest.wisc.edu/old/Library/WUIDefinitions.php>

### Probability of Future Occurrence

Judging from the amount and location of the county's forests, a disastrous wildfire is not likely. Therefore, the probability of future occurrence of a wildfire is "Moderate".

**Moderate** – The hazard has a reasonable probability of occurring (between 1% and 10% chance of occurrence in any given year).

### Magnitude / Severity

Severity for all participating jurisdictions in Montgomery County is considered "Moderate".

**Moderate** – Injuries to personnel and damage to property and the environment.

## 3.2.12 Land Subsidence / Sinkholes

### Hazard Description

Land subsidence is sinking of the earth's surface due to the movement of earth materials below the surface. This sinking can be sudden or gradual and is generally attributed to the removal of subsurface water or the draining of organic soils. In Missouri, subsidence is primarily associated with sinkholes. In the case of sinkholes, the rock below the surface is limestone, carbonate rock,

salt beds or some other rock that can be naturally dissolved by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings into bedrock caves eroding and collapsing into the cave opening. These collapses are called “cover collapses” and geologic information can be applied to predict the general regions where collapse will occur.

Sinkholes range in size from several square yards to hundreds of acres and may be quite shallow or hundreds of feet deep. Sinkhole formation is most intense where the bedrock is most soluble and has been exposed to extended periods of weathering and where surficial materials are between 40 and 80 feet in thickness and are composed of relict bedrock structure residuum containing clays with low dry densities. Bedrock faulting also contributes to deep weathering, cave formation, and sinkhole formation.

#### **Types of Sinkholes:**

- Dissolution sinkholes- caused by dissolution of subsurface rock, generally limestone. Dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface.
- Cover-subsidence sinkholes- tend to develop gradually where the covering sediments are permeable and contain sand.

#### **Sinkholes can be Human-induced**

New sinkholes have been correlated to land-use practices, especially from ground-water pumping and from construction and development practices. The other sources are changes in natural water-drainage patterns, and changes in land surface.

#### **Historical Statistics**

Sinkhole damage has not occurred in Montgomery County until recently. Taking into consideration the geological aspects, two areas have been identified.

#### **Location**

Taking into consideration the underlying geology of Montgomery County and the locations of known sinkhole occurrence, four areas likely to be impacted by this hazard have been identified. All the four sinkholes are located in unincorporated areas of the county.

The closest intersections of the locations are:

- Prairie Fork and Speno Drive

- Highway 19 and Highway J
- Hannal and Strube Road
- Hwy 161 and Featherston

**Probability of Future Occurrence**

The probability of future occurrence of a sinkhole in Missouri is “Low”.

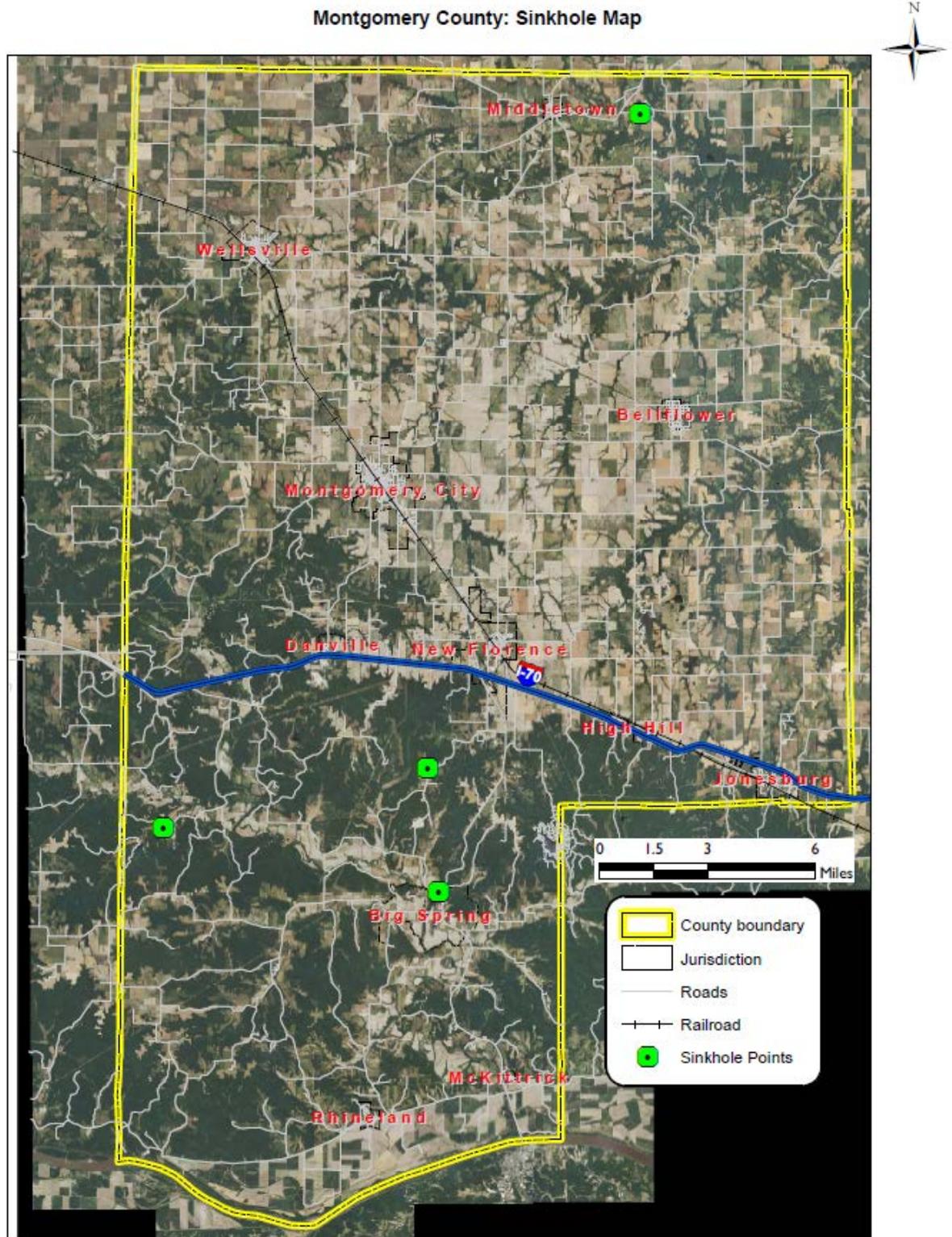
**Low** – The hazard has little or no chance of happening (less than 1% chance of occurrence in any given year).

**Magnitude / Severity**

Sinkholes vary in size and location. The possible impacts are loss of a personal vehicle, a building collapse, damage to infrastructure such as roads, water, or sewer lines, and ground water contamination. Because the location of the sinkholes is identified in the unincorporated areas, the Magnitude / Severity for all the participating jurisdictions is considered as “Low”.

**Low** – Few or minor damage or injuries are likely.

Map 3.12; Identified Sinkholes In Montgomery County



## **Manmade and Other Hazards**

### **3.2.13 Hazardous Materials Release**

#### **Hazard Description**

A hazardous material is any substance or material in a quantity or form that may pose a reasonable risk to health, the environment, or property. Per the State Hazard Mitigation Plan published in June 2013, the hazardous materials included are substances such as toxic chemicals, fuels, nuclear wastes and /or products, and other radiological and biological or chemical agents. In this section, hazardous materials incidents from fixed facilities and transportation accidents are addressed.

#### **Historical Statistics**

Montgomery County is at continual risk for a hazardous materials incident. Although the number of fixed sites using hazardous materials locally is relatively small, the county remains vulnerable to accidents involving these materials. Release of hazardous materials can come from fixed sites but is more likely to occur from transportation incidents on major transportation routes in the county.

The major highways crossing the county are Interstate 70 and Highway 19. There is one railway running through the county and four pipelines. The pipelines carry Crude Oil, Anhydrous Ammonia, Natural Gas, Petroleum, and other product lines. There is one navigable river in the county.

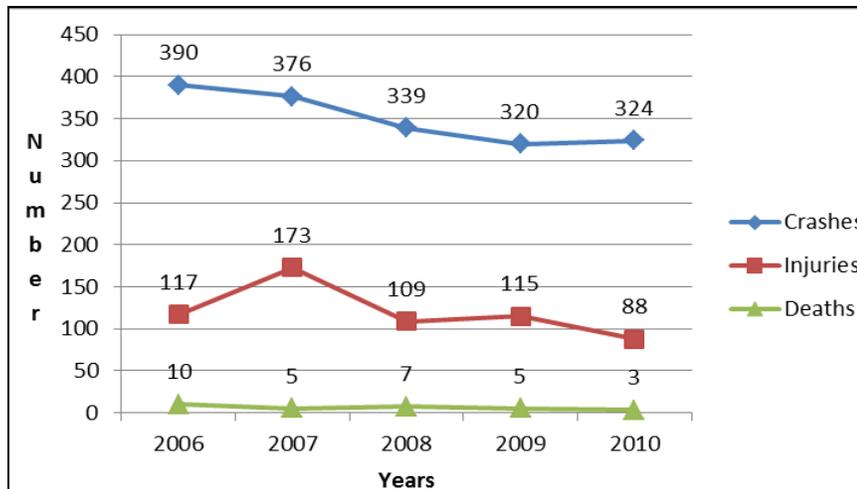
#### **Fixed Facility Accidents**

There are several fixed facilities in Montgomery County that use or store hazardous substances. There was a major pipeline spillover on September 6, 2007. This failure resulted in the release of approximately 3,843 barrels of crude oil near the town of Bellflower, Missouri. The crude oil shot high into the air as it leaked from the pipeline. Three homes within one-half mile of the site were evacuated as a precautionary measure. The release occurred on one of five segments of the Platte Pipeline consisting of Kaiser SSAW pipe manufactured in 1952. The property damage was \$2,829,625 (PHMSA Pipeline Safety Program).

**Transportation Accidents**

According to the Highway Safety Report conducted by Boonslick Regional Planning Commission, Montgomery County experienced 324 accidents (fatal, personal injury, property damage) in 2010, 320 in 2009, 339 in 2008, 376 in 2007 and 390 in 2006.

**Figure 3.8; Vehicle Accidents, Injuries, and Deaths in Montgomery County**



Source: Boonslick Regional Planning Commission, 2014

Figure 3.9 shows the major roads where the accidents occurred. Most of them have been occurring on I -70 and on the intersection of HWY 19 and HWY 161.

**Location**

Montgomery County is at continuous risk for a hazardous materials incident. No parts of the county are exempt from this hazard.

**Probability of Future Occurrence**

The probability of future occurrence of fixed facility accidents and hazardous materials transportation accident is “High”.

**High** – The probability is considered sufficiently high to assume that the event will occur (between 10% and 100% chance of occurrence in any given year).

**Magnitude / Severity**

The magnitude / severity is “Moderate”.

**Moderate** – Injuries to personnel and damage to property and the environment.

### **3.2.14 Nuclear Power Plant**

#### **Hazard Description**

There are two categories of nuclear reactors; research reactors and commercial nuclear power reactors. Research reactors cause hazard only to the personnel or others on-site at the facility. Therefore, these are not included in state radiological plans involving off-site emergency preparedness. Commercial nuclear power reactors, a worst-case scenario involving a significant release of radioactive material could force the evacuation of the general population within a 10-mile radius of the facility. This would further contaminate food and water sources within a 50-mile radius.

#### **Historical Statistics**

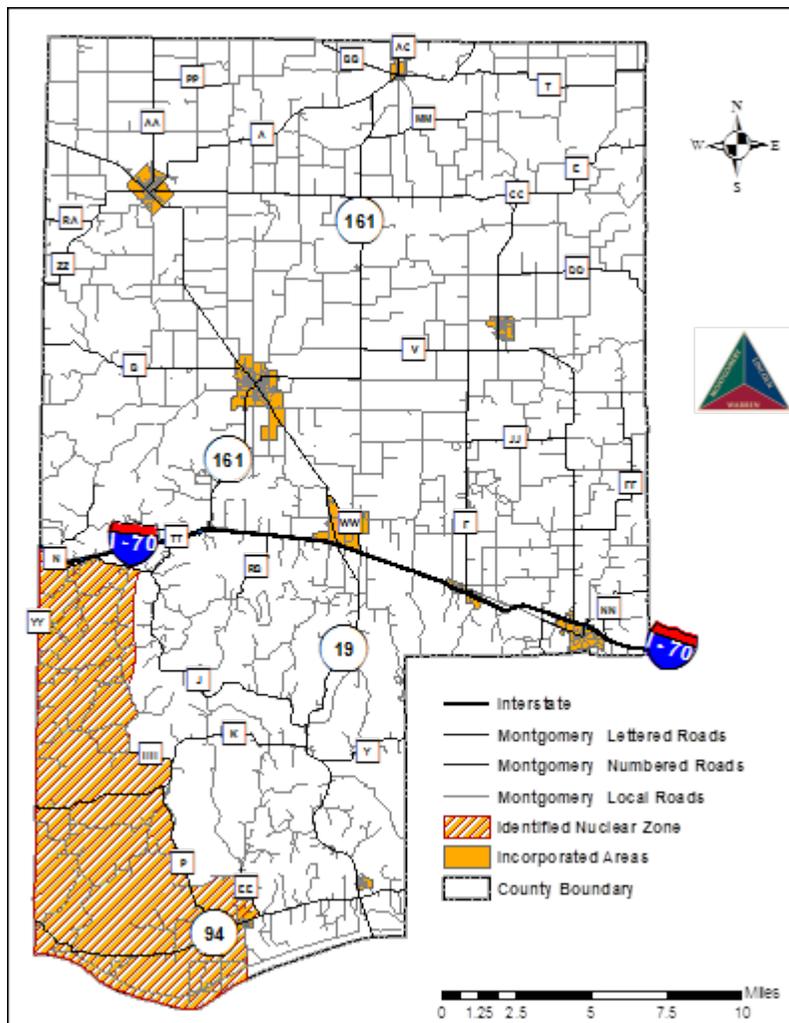
The Callaway Plant consists of one unit with a pressurized water reactor capable of providing 1150 megawatts of electricity. The plant is located in Callaway County, Missouri, and is owned and operated by Ameren Electric of St. Louis. The plant is located 10 miles southwest of Fulton, 25 miles northeast of Jefferson City, 20 miles southwest of Montgomery County, 5 miles north of the Missouri River, and 80 miles west of St. Louis.

The population within the 2.5 mile radius of the plant is low (approximately 30 residents). Approximately 4,500 people reside within a 10-mile radius of the plant. The plume exposure pathway has been expanded beyond the 10-mile radius to include the City of Fulton (population 12,128). Thus, the population within the plume exposure pathway is approximately 16,000. Land within a five-mile radius of the plant site is rural, consisting of 60 percent forest, 20 percent farm / crop land, and 20 percent pasture.

#### **Location**

Rhineland and McKittrick are at risk for nuclear power plant failure. However, depending on the event, the entire county may be susceptible to this hazard.

**Map 3.13; Montgomery County Nuclear Zone**



Source: Boonslick Regional Planning Commission

**Probability of Future Occurrence**

The probability of future occurrence is “Low”.

**Low** – The hazard has little or no change of happening (less than 1% chance of occurrence in any given year).

**Magnitude / Severity**

The magnitude / severity is “High”.

**High** – Deaths and major injuries and damage will likely occur.

### **3.2.15 Terrorism**

#### **Hazard Description**

Federal Bureau of Investigation (FBI) defines Terrorism as “the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.” Terrorism causes loss of life, injuries to people and properties, and disruptions in services. According to the State Hazard Mitigation Plan, potential terrorist actions include the following; Bombings, airline attacks, weapons of mass destruction (WMD) attacks, infrastructure attacks, cyber-terrorism, agro-terrorism, arson, kidnappings, and assassinations.

Domestic terrorism is another form of threat which comes from white supremacists, black separatists, animal rights / environmental terrorists, anarchists, antiabortion extremists, and self-styled militia. According to the FBI, international terrorism has been a major challenge for the United States. This threat can be categorized into three groups; loosely affiliated extremists operating under the radical jihad movement, formal terrorist organizations, and state sponsors of terrorism. The different types of foreign terrorist organizations are listed in the State Hazard Mitigation Plan update of 2013.

After the attacks on September 11, 2001, parts of 22 domestic agencies were consolidated into one department, the U.S. Department of Homeland Security (DHS), to protect the nation against future terrorist threats. Depending on the necessity communities may receive assistance from state and federal agencies operating within the existing Integrated Emergency Management System. FEMA is responsible for supporting state and local response to the consequences of terrorist attacks.

#### **Historical Statistics**

Montgomery County has potential targets for terrorist activities. These may include, but are not limited to; Federal, state, county and municipal government facilities and structures; Military installations; HAZMAT Facilities; Medical facilities; Religious facilities; Businesses and manufacturing centers; Airports, railroads, highways and navigable rivers; Pipelines, Power Plants, Public Utilities, Landmarks, and large public gatherings; and Agriculture.

There are 9 Homeland Security regions in the State of Missouri with Montgomery County being part of Region F. Region F has completed a Threat and Hazard Identification and Risk

Assessment (THIRA) which is updated annually. Currently, there are no terrorism incidents identified within the county.

### **Location**

Montgomery County is susceptible to this hazard. No parts of the county are exempt from this hazard.

### **Probability of Future Occurrence**

The probability of future occurrence is “Low”.

**Low** – The hazard has little or no chance of happening (less than 1% chance of occurrence in any given year).

### **Magnitude / Severity**

The severity of a terrorist attack could vary from high to low depending on the attack. If the attack is on a building those inside would likely be killed or injured. But if the attack is on a large urban area’s water supply, it would affect large number of people. Therefore, the Magnitude / Severity is considered to be as being “High”.

**High** – Deaths and major injuries and damage will likely occur.

## **3.2.16 Transportation Disruption**

### **Hazard Description**

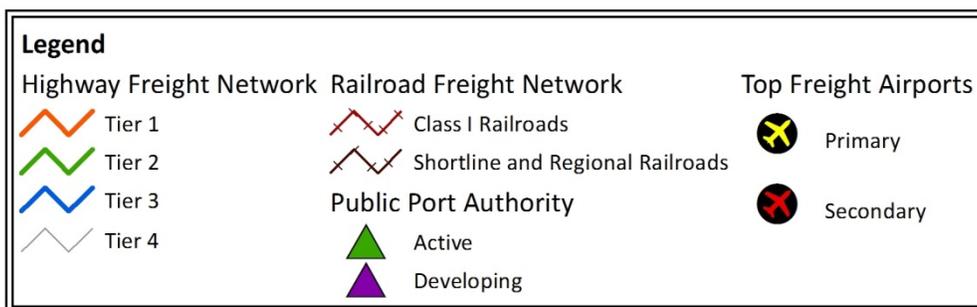
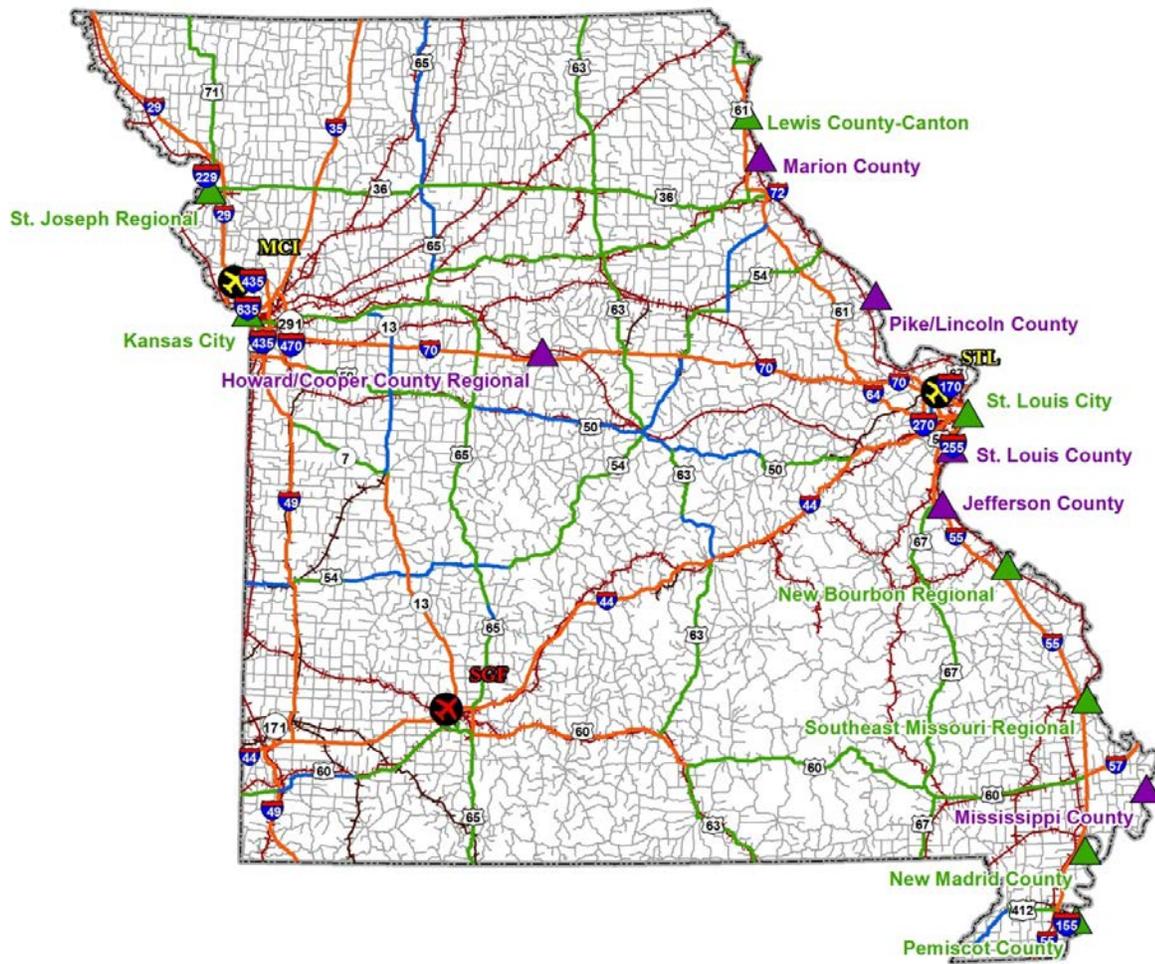
For the purpose of this plan, mass transportation is defined as the means, or system, that transfers large groups of individuals from one place to another. This profile addresses only transportation accidents involving people, not materials. Thus, mass transportation accidents include public airlines, railroad passenger cars, metro rail travel, tour buses, city bus lines, school buses, riverboat casinos, and other means of public transportation. This hazard addresses only those accidents that involve passenger air, road, or rail travel that results in accident death or injury.

Interstate 70 is the only interstate facility in the county and comprises of four lanes through the with traffic volumes reaching 29,400 to 42,400 vehicles. State Highway 19 is a two lane minor arterial and traffic volumes range from 2,800 to 5,400 daily vehicles. State Highway 94 is a two lane minor arterial and traffic volumes range from 1,600 to 7,100 daily vehicles.

There is one Class I Railroad running through the county; Norfolk Southern Railway (NS). Although no passenger service is offered in the county, Amtrak offers scheduled service to the south of the region across the Missouri River in both Washington and Herman on the Union Pacific line.

OATS Inc. founded in 1971, which is one of the largest public transportation providers in the nation, is a private, not-for profit organization serving 87 of Missouri's 114 counties. In the past year OATS operated in Montgomery County with a total of 4,171 one-way trips and a total of 53,497 miles. The majority of para-transit services within the county are needs-specific services offered by an array of non-profit human service providers. These services are generally in-house and are limited to the clients or customers of the particular agency, though OATS often provides transportation services for agencies without in-house transportation options.

Map 3.14; Freight Networks of Missouri



## Historical Statistics

The table below shows the fatality Rates by Mode of Travel, 2003 – 2008 (Average Deaths per 100 Million Passenger Miles) Highway Vehicle Occupants and Transit Passengers.

**Table 3.22; National Fatality Rates by Mode of Travel**

Type of Vehicle	Death Rate Per 100M Miles
Highway Vehicles	1.42
Commuter rail	0.06
Rail transit	0.02
Amtrak	0.03
Bus	0.05

*Source: State Hazard Mitigation Plan 2013*

## Location

Montgomery County is susceptible to this hazard. No parts of the county are exempt from this hazard.

## Probability of Future Occurrence

The probability of future occurrence is “High”.

**High** – The probability is considered sufficiently high to assume that the event will occur (between 10% and 100% chance of occurrence within any given year).

## Magnitude / Severity

The magnitude / severity is “High”

**High** – Deaths and major Injuries and damage will likely occur.

### 3.2.17 Utility Failures

#### Hazard Description

This hazard may include electrical power, natural gas, public water supplies, and communications systems. Utility systems exist everywhere and are subject to damage from digging, fire, traffic accidents, and severe weather, including flooding, earthquake, and other day-to-day events.

Utility interruptions can occur in any part of the state at any time of year. Harsh weather conditions such as lightning strikes, high winds, heavy rain, and ice storms can cause trees to

fall and damage electric power lines and equipment or gas lines. The National Weather Service produces an Ice Impact Index to estimate the potential utility interruptions based on the weather conditions prior to an ice storm. The index ranges from 1 to 5 and increases in severity as it increases in number, estimating that the potential for longer outages increases as the conditions worsen. Earthquakes are another natural hazard that can lead to utility service interruption failure.

### **Historical Statistics**

On January 30, 2002, a severe ice storm struck portions of western and northern Missouri. This hazard was referred as the worst in Missouri's history which left devastated and darkened homes and businesses. Ice accumulations were over an inch and covered all the objects that were at or below freezing. Further, the weight of the ice broke utility poles, conductors, tree limbs and other objects that could not withstand the weight of the ice. The ice storm of 2005 with 2-6 inches snow caused 2 deaths.

Utility failures could be localized. These failures impact generally on the very young or elderly, who are more prone to health risks that are associated with resultant loss of heating / cooling systems and with the loss of medical equipment that requires a power source.

### **Location**

Montgomery County is susceptible to this hazard. No parts of the county are exempt from this hazard.

### **Probability of Future Occurrence**

Because utilities exist throughout the county and are vulnerable to interruptions or failures, there is a high probability that this hazard may occur at anytime or anyplace throughout the state. The probability of future occurrence is "High".

**High** – The probability is considered sufficiently high to assume that the event will occur (between 10% and 100% chance of occurrence in any given year).

### **Magnitude / Severity**

The degree of severity of these day-to-day events may be considered Moderate. Therefore, the magnitude / severity is "Moderate".

**Moderate** – Injuries to personnel and damage to property and the environment.

### 3.3 Vulnerability Assessment

**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)(C):** [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 floods.

#### Methodology

The vulnerability assessment further defines and quantifies populations, buildings, and other community assets at risk to natural and manmade 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 is divided into three parts:

- **Section 3.3.1 Community Assets** identifies the structures and critical facilities for Montgomery County.
- **Section 3.3.2 Vulnerability Assessment** describes the vulnerability to damage from natural hazards. The base for the vulnerability assessment for this update will include the Missouri State Hazard Mitigation Plan 2013

#### 3.3.1 Community Assets

##### Critical Facilities and Infrastructure

A critical facility may be defined as one that provides essential public safety or mitigation functions during response or recovery operations. The table below shows an inventory of critical facilities and infrastructure (based on available data from the county and State of Missouri) in Montgomery County.

**Table 3.3.1; Critical Facilities and Infrastructure of Montgomery County**

	Bellflower	High Hill	Jonesburg	Middletown	Montgomery City	New Florence	Rhineland	Wellsville	Total
Airports	--	--	--	--	1	--	--	--	1
Dams	--	--	1	1	1	1	--	--	4
Elder Care Facility/ Long Term Care	--	--	1	--	3	1	--	1	6
Health Care Facility	--	--	--	--	--	--	--	--	--
Fire Stations	1	--	1	1	1	1	1	1	7
EMS Stations					1				
Schools	1		1	1	4			2	8
Police stations	1	1	1	1	1	1	1	1	8

**Source: Boonslick Regional Planning Commission, 2014**

The next table provides specific information on the facilities requiring special consideration in Montgomery County. Citizens that reside in these facilities are considered special needs and may require additional assistance in the event of a natural hazard or emergency event.

**Table 3.3.2; Montgomery County Facilities Requiring Special Consideration**

<b>Montgomery County Facilities Requiring Special Consideration</b>			
<b>Name</b>	<b>Address</b>	<b>City/District</b>	<b>Population</b>
<b>Grades K-12:</b>			
Bellflower Elementary School	406 S Walnut St	Bellflower	141
Jonesburg Elementary School	106 Smith Rd	Jonesburg	144
Montgomery County R-2 High School	394 N Highway 19	Montgomery City	440
Montgomery Elementary School	817 N Harper	Montgomery City	301
Montgomery Middle School	418 N Highway 19	Montgomery City	352
Immaculate Conception Catholic School	407 W Third St	Montgomery City	
Wellsville-Middletown R-1 High School	900 Burlington Rd	Wellsville	288
Wellsville Elementary	900 Burlington Rd	Wellsville	134
Middletown Elementary	218 South St	Middletown	80
Gasconade County R-1 School	164 Highway 100 West	Hermann	
<b>Preschool and Daycare Facilities:</b>			
Brenda Korman	720 Highway K	Rhineland	
Laura's Daycare	205 Arlington St	Jonesburg	
Shirley Henke	235 E Spinsby St	Montgomery City	
Immaculate Daycare	407 W Third St	Montgomery City	
Children First	1060 N Walker	Montgomery City	
Jesus Little Lambs Childcare	102 Chamberlain Dr	Wellsville	
Evelyn Kempf	519 W sixth St	Montgomery City	
Wee Care	747 n Sturgeon St	Montgomery City	
Jonesburg Methodist	112 Moriarty St	Jonesburg	
<b>Nursing/Residential Facilities:</b>			
Ashbury Heights	625 W.Second	Montgomery City	12
Jonesburg Care Center	308 Cedar Av	Jonesburg	90 beds
Lyons Court	117 N Lyons Court	Montgomery City	6 beds
Montgomery City Assisted Living	230 Pickering St	Montgomery City	36 beds
New Florence Care Center	515 Picnic St	New Florence	120 beds
Gamma Lodge Nursing Center	250 E Locust St	Wellsville	120 beds

Source: Boonslick Regional Planning Commission, 2014

Government facilities are shown in the next table.

**Table 3.3.3; Government Owned Structures in Montgomery County**

<b>Location</b>	<b>Structure and Address</b>
Bellflower	City Hall
Bellflower	Police department, 100 S Main St
Bellflower	Fire station, 211 S Main St
Bellflower	Community Building
Bellflower	U.S. Post Office

<b>Location</b>	<b>Structure and Address</b>
Big Spring	Fire station, 758 S Highway 19
High Hill	City Hall
High Hill	Police department, 50 N Hickory St
Jonesburg	City Hall, 106 W Booneslick Rd
Jonesburg	Police department, 104 W Booneslick Rd
Jonesburg	Jonesburg-High Hill fire station, 109 Third St
Jonesburg	Community Hall, 111 First St
Jonesburg	2 City Warehouses, 306 W. Lion St
Middletown	County sheriff substation
Middletown	Fire station, 15 S Cherry St
Middletown	Community Building
Middletown	U.S. Post Office
Montgomery City	City Hall
Montgomery City	Police department, 723 N Sturgeon St
Montgomery City	Fire station, 123 E Third St
Montgomery City	Library
Montgomery City	Animal Shelter
Montgomery City	Sewage Treatment Plant
Montgomery City	Water Plant 2
Montgomery City	County Courthouse, Sheriff, Jail, Communications Center, Road and Bridge Dept., MU Extension Center, 211 E Third St
Montgomery City	Montgomery Ambulance, 911 Benton St
Montgomery City	U.S. Post Office
New Florence	City Hall, police department, 217 Main St
New Florence	Fire station, 201 E Mortimer St
New Florence	Water, Sewer, Gas Department
New Florence	U.S. Post Office
Rhineland	Village Office
Rhineland	County sheriff substation
Rhineland	Fire station, 110 Lewis St
Rhineland	Water Department
Rhineland	U.S. Post Office
Wellsville	City Hall
Wellsville	Police, fire, water, sewer, street departments, 200 W Hudson St
Wellsville	Public Library
Wellsville	Filtering Station
Wellsville	U.S. Post Office

*Source: Booneslick Regional Planning Commission, 2014*

### Other Assets

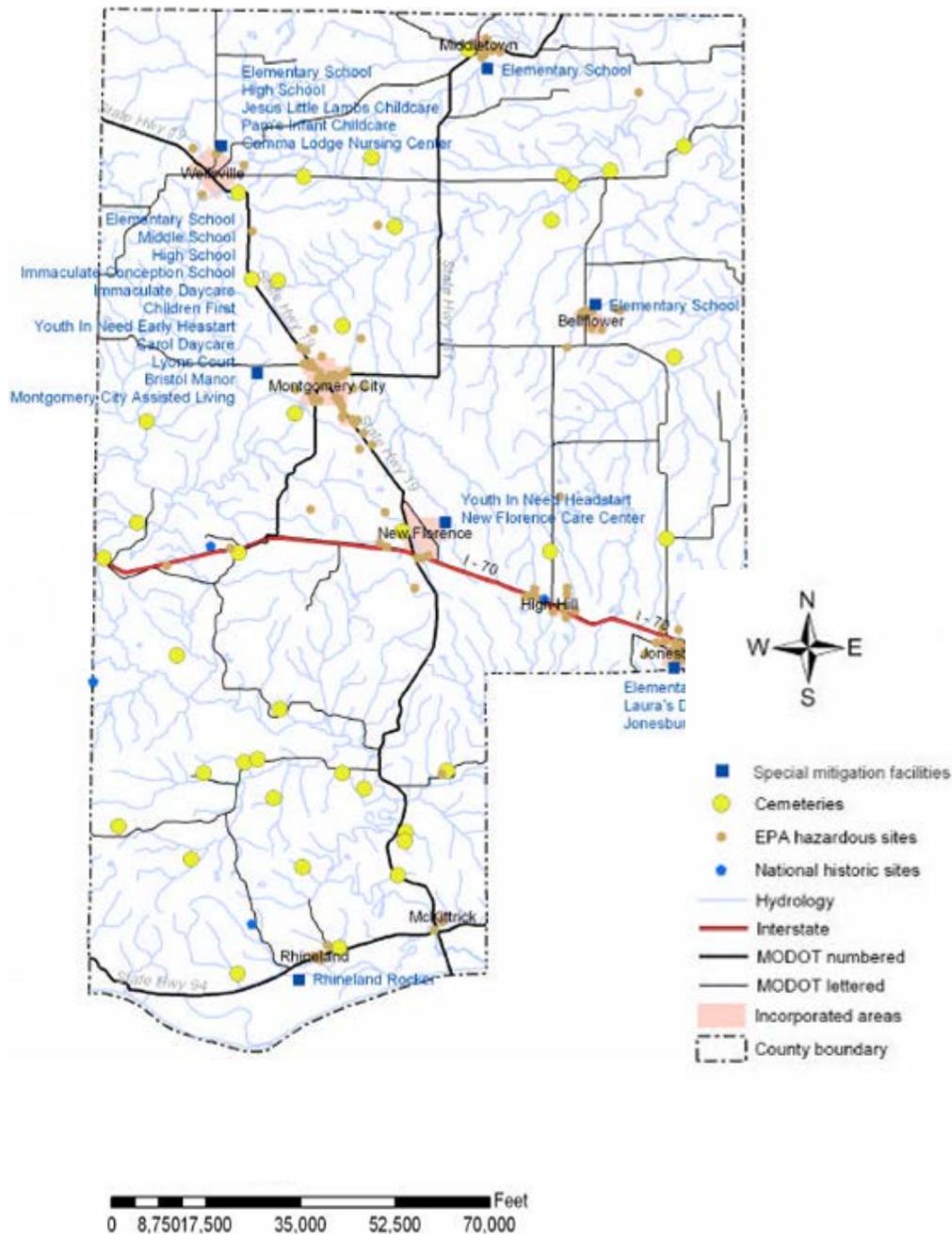
Assessing the vulnerability of Montgomery County to disaster also involves an inventory of natural, historic, cultural, and economic assets located in the planning area.

In Montgomery County, specific assets include the following:

- Six protection areas maintained by Missouri department of Conservation (MDR); the Danville Conservation Area, the Baldwin Annex and the Thornhill / Schulze Annex (2,655 acres) are two miles southeast of Interstate 70 at the Highway 161 exit. The Marshall I. Diggs Conservation Area lies three miles west of Wellsville off Route ZZ. Grand Bluffs is just north of Highway 94 on County Road 291. Wellsville Lake is southwest of Wellsville off Highway 19.
- The DNR's Graham Cave State Park near Danville above the Loutre River is a popular recreation area as well as an historical and archaeological site. Lions Park is located in High Hill.
- Endangered or threatened species within Montgomery County include the bald eagle, Indiana bat, and the pallid sturgeon. No plant species currently are listed for the county.
- Historic sites include 38 cemeteries as well as Mount Horeb Baptist Church near Mineola, High Hill School, Shrine of Our Lady of Sorrows in Starkenburg, the Sylvester Marion Baker and Frances Anne Stephens House in Montgomery City, and Graham Cave near Danville.
- There are 136 EPA sites in Montgomery County. Some sites are unverified. All are either contaminated or regulated due to the risk of contamination. The sites include 65 above-ground or underground fuel tanks, various types of automobile sites, five cemeteries, the Middletown Schools well, four private wells, a fire station, the Montgomery City lagoon, a golf course, two florists, a Laundromat, a crematory, four electrical substations and two veterinary sites.

Map 3.3.1 shows the community facilities and critical facilities located in Montgomery County.

**Map 3.3.1; Montgomery County Community and Critical Facilities**



Source: Boonslick Regional Planning Commission, 2014

### Section 3.3.2 Vulnerability Assessment

#### 3.3.2.1 Vulnerability by Hazard

The base for the vulnerability assessment for this update will include the Missouri State Hazard Mitigation Plan 2013. The State Plan vulnerability analysis is mostly based on Hazus-MH risk

assessment. Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. Hazus is used for mitigation recovery as well as preparedness and response.

## Countywide Natural Hazards

### Drought

With our research through local resources, no records were found to indicate loss of lives or property including livestock and crops. Per the State Plan, insured crop losses throughout the State of Missouri as a result of drought conditions for the fifteen year period of 1998-2012 totaled \$1,530,919,292. Drought had the highest dollar amount losses for insured crops in Missouri during period (USDA). The State Plan points out that due to availability excellent agricultural insurance data, the impacts of drought have been assessed through the vantage point of agricultural losses.

**Table 3.3.2.1; Crop Insurance Summary for Montgomery County**

Total crop insurance paid for drought damage 1998-2012	\$27,336,579
Annualized crop insurance claims/drought damage	\$1,822,439
Crop exposure (2007 Census of agriculture)	\$39,049,000

*Source: Missouri Hazard Mitigation Plan, 2013*

### Earthquake

In the State Plan, Hazus 2.1 was used to analyze vulnerability and estimate losses to earthquakes. All Hazus analyses were run using an enhanced, Level 2 inventory database comprised of updated demographic and aggregated data based on the 2010 census. Montgomery County ranked 64 in the state in loss ratio.

**Table 3.3.2.2; Earthquake Loss Summary for Montgomery County**

Building loss total	\$78,000
Income loss total	\$22,000
Total economic loss to buildings	\$100,000

*Source: Missouri Hazard Mitigation Plan, 2013*

In the State Plan, a second scenario based on an event with a 2% probability of exceedance in 50 years, was done to model a worst case scenario. The methodology is based on probabilistic seismic hazard shaking grids developed by the U.S. Geological Survey (USGS) for the National Seismic Hazard Maps that are included with Hazus.

**Table 3.3.2.3; 2% Earthquake Loss Summary for Montgomery County**

Structural damage	\$11,721
Non structural damage	\$31,627
Contents damage and inventory loss	\$11,688
Income loss	\$14,505
Total economic loss to buildings	\$69,521

**Extreme Heat**

No data exists for extreme heat losses for property in Montgomery County. However, statewide data is available. According to the USDA Risk Management Agency, insured crop losses through the state of Missouri as a result of excessive heat for the eleven year period of 1998 – 2008 totaled \$13,751,457. Excessive heat ranked 6<sup>th</sup> in the state of insured crop losses. From 2000 to 2010 drought and heat were the source of about 31% of the crop losses in Missouri by indemnity payments (Milholin 2012). In addition, hot winds in Missouri totaled \$885.893 in insured losses from the same timeframe. A significant heat wave in 1980 resulted in 295 heat-related deaths (Missouri DHSS, 2013). The Bureau of Environmental Epidemiology attributes 1-3 deaths in Montgomery County due to extreme heat for the 2000 – 2013 period.

**Hail**

The NCDC reported 79 hail events in Montgomery County from January 1994 through December of 2013. These events caused a reported \$5,000 in crop damages and \$6,000 in property damages. The table below shows the hail event summary taken from the Missouri Hazard Mitigation Plan from 2013.

**Table 3.3.2.4; Hail Loss Summary for Montgomery County**

Total Hail Incidents	Total Hail Loss	Total Crop Insurance Paid
65	\$5,500	\$363,767

*Source: Missouri Hazard Mitigation Plan, 2013*

**Thunderstorm and High Wind**

During the 19-year period from 1994 through December 2013, there were 68 thunderstorms and wind events recorded by NCDC. Sixty-three were reported as thunderstorms, 2 as strong wind events, and 3 as high wind events. According to NCDC, these events contributed to 1 injury, \$57.2K personal property damage, and \$2K in crop damage. The following two tables were

taken from the 2013 Missouri Hazard Mitigation Plan and show Wind Loss and Building and Crop exposure for Montgomery County.

**Table 3.3.2.5; Wind Loss Summary for Montgomery County**

Total Wind Incidents	60
Total Wind Property Loss	\$51,200
Crop Insurance Paid for Wind Damage	\$45,370

*Source: Missouri Hazard Mitigation Plan, 2013*

**Table 3.3.2.6; Building and Crop Exposure for Montgomery County**

Housing Units Per Square Mile	7.4
Total Building Exposure	\$1,254,588,000
Crop Exposure (2007 Census of Agriculture)	\$39,049,000

*Source: Missouri Hazard Mitigation Plan, 2013*

**Tornado**

Of the 12 tornadoes reported by NCDRC between January 1994 and December 2013 most impacted areas near Bellflower, Jonesburg and New Florence. Historical data from 1994 through 2013 shows 12 tornado events contributing to 1 injury and \$1.125K in property damage. No deaths were reported.

**Table 3.3.2.7; Tornado Probability and Potential Loss for Montgomery County**

Average Number of Tornadoes Per Year	16
Likelihood of Occurrence	26.02%
Probability Rating	2
Total Exposure	\$1,254,588,000
Annualized Historic Loss	\$36,523
Loss Ratio	.003%
Total Vulnerability	Moderate

*Source: Missouri Hazard Mitigation Plan, 2013*

**Wild Fire**

NCDA reports no wildfires for Montgomery County. However, according to the Missouri Department of Conservation Forest Fire Reporting mechanism, 887 acres were burned in Montgomery County from January 1, 1994 through December 31, 2013. During that period, 12 residences and 13 outbuildings were threatened resulting in 2 residences being destroyed along

with 1 outbuilding. Causes vary significantly and range from Arson to Miscellaneous to Unknown, to Debris. Debris burning is the most common “known” cause cited.

**Table 3.3.2.8; Tornado Probability and Potential Loss**

Number of Wildfires 2004-2012	140
Average Number of Wildfires per Year	15.6
Likelihood of Occurrence Rating	1
Acres Burned	626.84
Average Acres Burned per Year	70
Average Acres Burned Rating	1
Total Buildings Damaged	0
Overall Vulnerability	1

Source: Missouri Hazard Mitigation Plan, 2013

### Winter Weather

Since November 2006 Montgomery County received two presidential major disaster declarations and five USDA declarations for winter storms. The NCDC reports in October of 2014 that there were 33 winter storm events in Montgomery County between 1994 and August of 2014. No deaths or property / crop damage was reported.

**Table 3.3.2.9; Winter Weather Loss Summary for Montgomery County**

Property Loss	\$3,203,263
Crop Insurance Paid	\$158,582
Annualized Loss	\$176,939.21

Source: Missouri Hazard Mitigation Plan, 2013

## Jurisdiction Specific Natural Hazards

### Dams

In Montgomery County dam failure presents a hazard to some unincorporated portions of the county and to the residents of the City of Middletown. Fortunately, so far no lives have been lost in the county due to the failure of a dam. But that doesn’t mean it cannot happen.

**Table 3.3.2.10; Vulnerability Analysis for failure of State-Regulated Dams**

Class 1	2
Class 2	3
Class 3	6
Total	11

Estimated # of buildings vulnerable	35
Average exposure value per structure (\$)	93,275
Estimated total potential building exposure (\$)	5,362,186
Estimated total population exposure	28
Estimated building losses (\$)	2,681,093

*Source: Missouri Hazard Mitigation Plan, 2013*

### **Floods / Flash Floods / Levee Failure**

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. Flash flooding can occur virtually anywhere in the State experiencing an abundance of rainfall in a very short time span, as with the November 1993 flood disaster and floods of 1998 and 1999. The backing up of tributary stream flows creates flooding problems along the Mississippi River, especially in the southern area of the State where the land tends to be very flat and at low elevations. Even though many flood control projects have been implemented and directly aid in flood prevention, the State is still flood-prone due to its geography and location. In addition, thousands of other Missouri residents are at risk to the dangers of flash flooding from rapidly rising creeks and tributaries, storm water runoff, and other similar flooding events.

The following information from the State Plan was derived from inventory data associated with FEMA's loss estimation software Hazus 2.1. Building inventory counts are based on the 2010 census. Inventory values reflect 2010 valuations, based on RSMeans (a supplier of construction cost information) replacement costs.

**Table 3.3.2.11; Building Valuation for Montgomery County**

Estimated population (2010 Census): 12,236		
HAZUS-MH 2.1	Building Count	Valuation
Residential	6,119	\$945,296
Commercial	339	\$134,444
Industrial	121	\$70,508
Agriculture	125	\$18,469
Religious	35	\$18,109
Government	36	\$27,143
Education	9	\$40,619
Total	6,784	\$1,254,588

*Source: Missouri Hazard Mitigation Plan, 2013*

The State plan analyzed flood losses and the degree of severity using a consistent methodology. The Hazus analysis conducted by the State plan provides number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory. The primary indicators used to assess flood losses were- direct building losses combined with income losses; loss ratio of the direct building losses compared to overall building inventory and population displaced by the flood and shelter needs.

**Table 3.3.2.12; Repetitive Loss Properties**

# of repetitive loss properties	Number of losses	Total paid
1	2	\$42,083.91

*Source: Missouri Hazard Mitigation Plan, 2013*

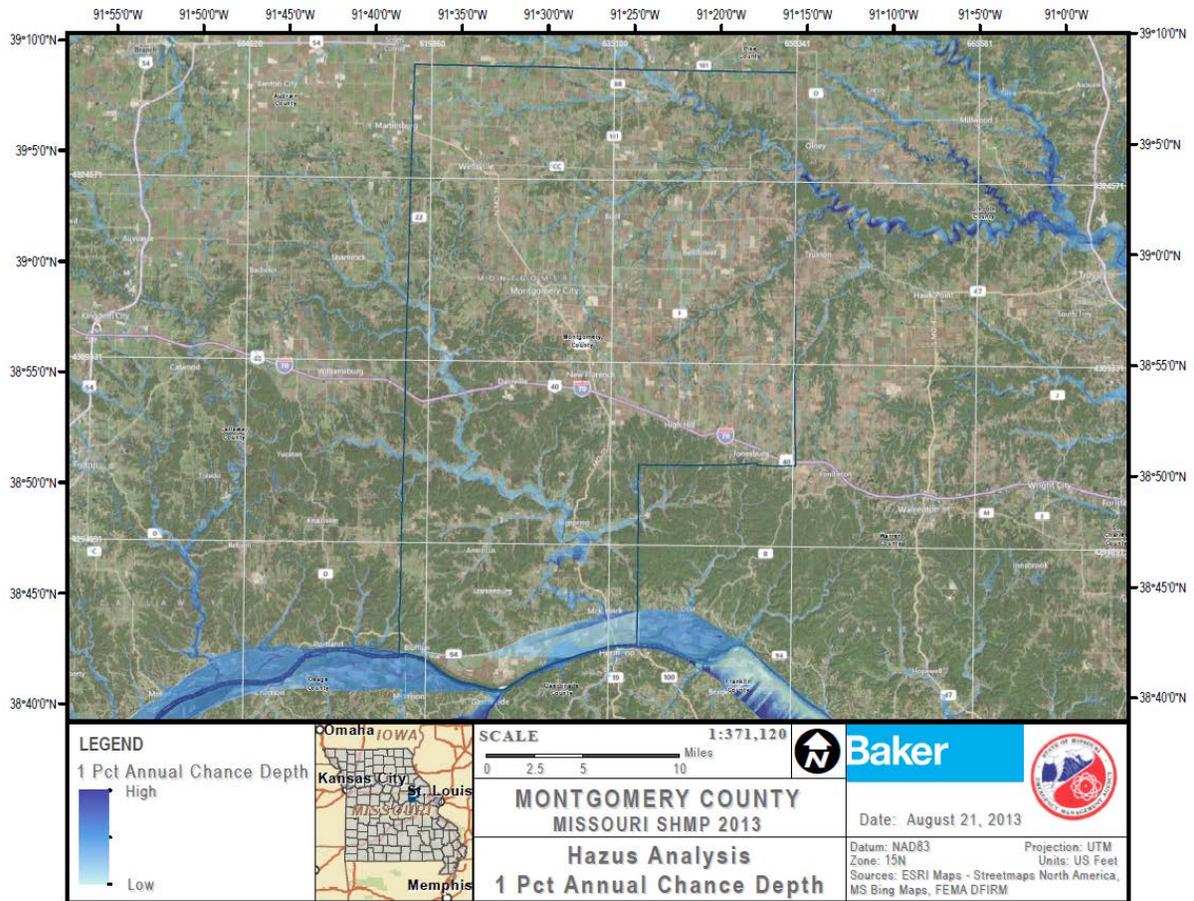
**Table 3.3.2.12; Damages & Losses**

Structural damage	Contents damage	Inventory loss	Total direct loss	Total income loss	Total direct and income loss
\$5,789,916.94	\$7,150,829.27	\$481,150.96	\$13,421,897.17	\$178,166.78	\$13,600,063.94

*Source: Missouri Hazard Mitigation Plan, 2013*

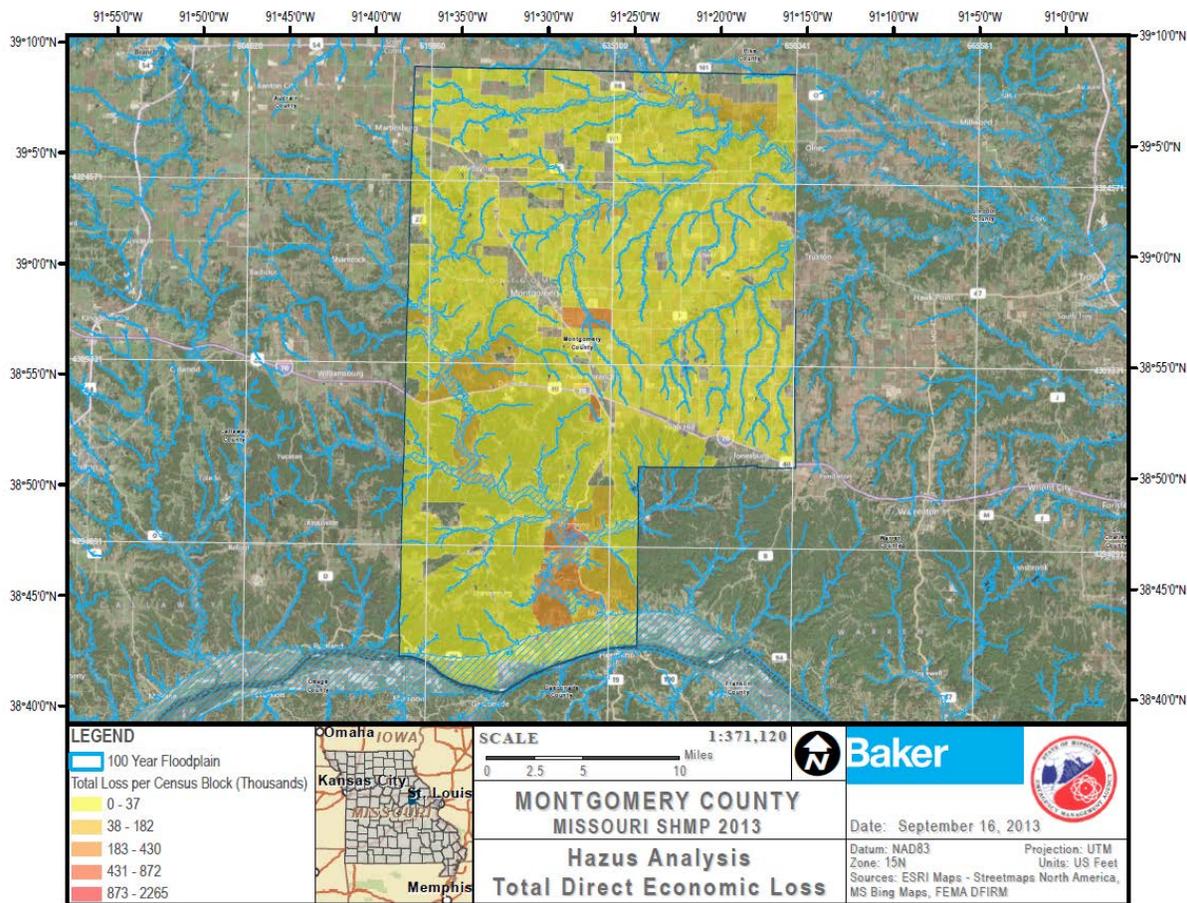
Per the State plan, there are about 498 displaced households and 31 people requiring shelter for Montgomery County.

Figure 3.3.2; Hazus Analysis (1% annual chance depth)



Source: SEMA, 2014

**Figure 3.3.3; Total Losses in Montgomery County (HAZUS Software)**



Source: SEMA, 2014

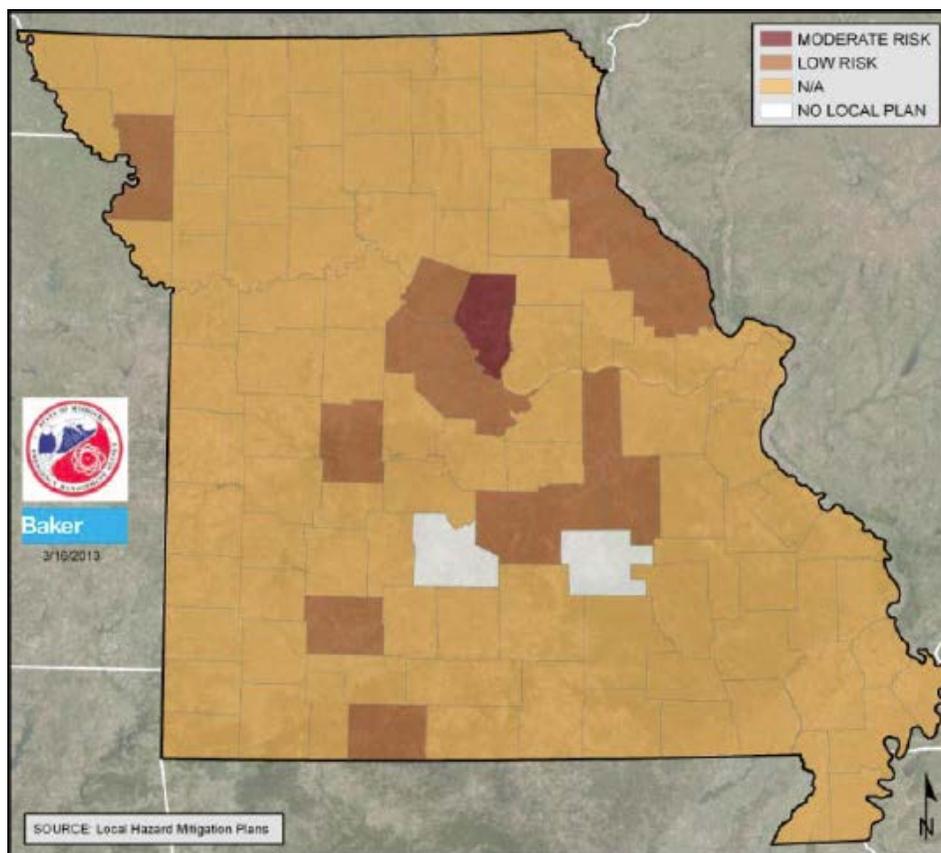
### Levee Failure

Given the numerous levee systems constructed along the main stems and tributaries of the Missouri River, the State of Missouri is highly susceptible to catastrophic levee failure and/or overtopping. Not counting the great flood of 1993, for the 70-year period from 1942 to 2012 for which levee failure statistics are available, over 100 levee failures /over-toppings were recorded. In the flood of 1993 alone; 840, or over 55% of the levees in the State sustained significant damages. This translates to an overall high probability of 1% annual chance flood levee failures in any given year. Although Montgomery County doesn't have any known levees with reference to providing 100-year of greater flood protection, there is always a risk of this hazard happening along the floodplain areas.

**Sink Holes**

Sink Holes historically have not had major impacts on development nor have they caused serious damage within the state nor in Montgomery County. Nevertheless, this could change with the increasing growth that is taking place in counties such as Montgomery located in sink hole susceptible regions of Missouri. Sinkholes located in floodplains can absorb floodwaters but make detailed flood hazard studies difficult to model. As per the State plan, there are 4 sinkholes in Montgomery County and it doesn't pose a risk as shown in the figure below.

**Figure 3.3.4; Sinkhole Risk Map**



*Source: Missouri Hazard Mitigation Plan, 2013*

## SECTION 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.**

The mitigation strategy section was developed through a collaborative process and consists of general goal statements to guide the jurisdictions in efforts to lessen disaster impacts as well as specific mitigation actions that can be put in place to directly reduce vulnerability to hazards and losses.

### 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 Hazard Mitigation Planning Committee which includes representatives from individual jurisdictions and other entities reviewed the plan's existing goals and achieved consensus that the three goals remain valid for the updated plan during the kickoff meeting. The Goals of the mitigation strategy are listed below, in no particular order:

**Goal 1:** Protect the lives and livelihoods of all citizens.

**Goal 2:** Employ sustainable principles and practices to enhance mitigation effectiveness.

**Goal 3:** Ensure continued operation of government and emergency functions during a disaster.

### 4.2 Identification and Analysis of Mitigation Actions

**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.**

FEMA defines mitigation as "a sustained action taken to reduce or eliminate the long-term risk to people and property from hazards and their effects". This section of the plan focuses on the mitigation strategies developed to reduce risk for both the natural and man-made hazards included in this plan. Each of the mitigation action plans identified in the 2009 updated plan were

reviewed for relevance and updated with progress made for each action plan (Table 4.2). Completed actions were removed from Table 4.2 and can now be found in Table 4.3; Completed Goals, Objectives, and Action Plans.

Mitigation efforts can be classified into the 6 categories discussed below.

- Prevention tools can include regulatory methods such as planning and zoning, building regulations, open space planning, land development regulations, and stormwater management.
- Property protection measures reduce the risk of building damage through acquisition of land, relocation of buildings, modifying at-risk structures, and flood-proofing at-risk structures.
- Natural resource protection can reduce hazard impacts through measures such as erosion and sediment control or wetlands protection.
- Emergency services measures include warning, response capacity, critical facilities protection, and health and safety maintenance.
- Structural mitigation controls natural hazards through projects such as reservoirs, levees, diversions, channel modifications and storm sewers.
- Public information includes providing hazard maps and information, outreach programs, real estate disclosure, technical assistance and education.

The status on the existing mitigation activities were discussed prior to the HMPC meetings with the Montgomery County EMD and the County Commissioners and then brought before the committee as a whole. During the kickoff meeting, a list of the 2009 action plans were submitted to the committee in order to develop new ideas. The committee achieved consensus that the existing action plans remain valid for the updated plan with little tweaking required.

Table 4.1 shows the Ongoing goals, objectives, and action plans (existing & proposed) for Montgomery County. Table 4.2 shows completed Goals, Objectives, and Action Plans.

**Table 4.1; Ongoing Goals, Objectives, and Action Plans**

<b>Goals, Objectives, and Action Plans</b>
<b>Goal #1: Protect the lives and livelihoods of all citizens.</b>
<b>1.1 Provide sufficient warning systems.</b>

<b>Goals, Objectives, and Action Plans</b>
<ul style="list-style-type: none"> <li>- <b>Identify geographic areas and develop a plan to implement needed systems.</b> <i>Ongoing. Research determined that much of the county's unincorporated areas are without a warning system as are several cities and villages. It was determined that the cost/benefit of installing sirens throughout the county is prohibitive.</i></li> <li>- <b>Develop emergency warning systems (proposed 2009)</b> <i>Ongoing. The county implemented an automated telephone dialing system to alert all subscribed citizens to all hazards. The cities of Middletown, Montgomery City, Rhineland, and Bluffton have installed siren systems.</i></li> <li>- <b>Improve NOAA All Hazards radio communication (proposed 2009)</b> <i>Ongoing. County EMA director continues to communicate to public during public meetings and through local media to convey the value of NOAA weather radios. Radios are available through the EMA office at cost. Some radios have been provided to local nursing homes and similar agencies at no cost.</i></li> </ul>
<p><b>1.2 Decrease the occurrence and impact of flooding.</b></p> <ul style="list-style-type: none"> <li>- <b>Promote environmentally-sound watershed and stormwater practices to decrease flash flooding.</b> <i>Ongoing. The Army Corps of Engineers are consulted as opportunities become available to reduce practices that lead to flash flooding for levee and drainage projects. In addition, wet lands were created at the Chris Bond Bridge at Hermann with help from the Department of Conservation.</i></li> <li>- <b>Review and revise flood-fighting plans.</b> <i>Ongoing. Plans are reviewed regularly by the Tri-county levee district</i></li> <li>- <b>Strengthen floodplain regulations.</b> <i>Ongoing. Regulations are reviewed every 4 years.</i></li> <li>- <b>Improve drainage of roadways in flashflood areas (proposed 2009)</b> <i>Ongoing. Flood prone areas are continually reviewed by cognizant officials and reported to road and bridge authorities who implement improved drainage as appropriate.</i></li> <li>- <b>Encourage local communities to include stormwater controls in their subdivision regulations (proposed 2009)</b> <i>Ongoing. State and federal regulations are enforced throughout the county. City ordinances vary widely.</i></li> </ul>
<p><b>1.3 Increase knowledge of safety measures among employers and the public.</b></p> <ul style="list-style-type: none"> <li>- <b>Develop hazard area maps and promote their use by the public.</b> <i>Ongoing. Various maps are updated periodically and are available to the public at the county courthouse EMA office. Maps available include Ameren EPZ and flood zone maps, water and sewer maps, ambulance and fire district maps. In addition, Planning and Zoning issues building permits that insure home owners provide proof that they reside outside established flood zones and comply with flood plain ordinance.</i></li> <li>- <b>Consider additional training for emergency management personnel.</b> <i>Ongoing. EMA and county and city first responders receiving EMPG grant funds use an Office of Homeland Security planning program to create training plans which include classroom instruction and drills including Ameren/FEMA drills, health department drills, law enforcement drills and fire department drills.</i></li> <li>- <b>Identify ways to promote FEMA safety tips and mitigation techniques (proposed 2009).</b> <i>Ongoing. Display ads, public notices, and news releases are used routinely throughout the year to call the public's attention to safety tips and mitigation methodologies utilizing local media.</i></li> </ul>

<b>Goals, Objectives, and Action Plans</b>
<ul style="list-style-type: none"> <li>- Monitor development in special flood hazard areas to ensure compliance with local flood plain management ordinances (proposed 2009). <i>Ongoing. Planning and zoning prohibits building in flood plain without permit and, if required, plans to construct and elevated structure.</i></li> <li>- To provide earthquake preparedness and safety literature each year (proposed). <i>Ongoing. Earthquake literature is available to the public at the EMA office. All the School Districts perform earthquake drills annually as well as include in the district Emergency Preparedness Plans. EMA does earthquake drills once every year</i></li> </ul>
<p><b>1.4 Increase and maintain appropriate emergency equipment.</b></p> <ul style="list-style-type: none"> <li>- Review and upgrade policies for identifying and budgeting additional emergency equipment. <i>Ongoing. Equipment procured through SHSP funding is inventoried and audited by Missouri's Office of Homeland Security. Gaps in equipment are identified annually through the Threat and Hazard Identification and Risk Assessment (THIRA) process. Equipment procured through other revenue sources is inventoried by the procuring agency.</i></li> <li>- Review and upgrade critical infrastructure backup equipment. <i>Ongoing. Equipment procured through SHSP funding is inventoried and audited by Missouri's Office of Homeland Security. Gaps in equipment are identified annually through the Threat and Hazard Identification and Risk Assessment (THIRA) process. Equipment procured through other revenue sources is inventoried by the procuring agency.</i></li> <li>- Promote fire-resistant construction materials. <i>Ongoing. Montgomery City has enacted building codes that promote fire resistant materials to be used in building construction. EMD continues to work with fire districts to encourage additional cities to enact similar ordinances.</i></li> </ul>
<p><b>1.5 Protect residential structures.</b></p> <ul style="list-style-type: none"> <li>- Identify and use existing mechanisms to promote NFIP policies and earthquake/seismic insurance. <i>Ongoing. County administers the floodplain management program and provides information on floodplain permit and building requirements through brochures, press releases and public notices.</i></li> <li>- Encourage all building owners to invest in retrofit techniques by providing FEMA articles via local newspapers &amp; Chamber of Commerce (proposed 2009). <i>Ongoing. County administers the floodplain management program and provides information on floodplain permit and building requirements through brochures, press releases and public notices.</i></li> </ul>
<p><b>1.6 Protect large employment and commercial facilities.</b></p> <ul style="list-style-type: none"> <li>- Consider known hazards when identifying a site for new facilities and systems (proposed 2009). <i>Ongoing. Develop community mitigation projects and programs in all economic and community development projects planned for the county including site selection and environmental assessment.</i></li> <li>- Encourage tornado safe rooms. <i>Ongoing. Efforts continue to promote safe rooms through press releases and public notices and presentations are various community events.</i></li> <li>- Encourage up-to-date commercial and industrial disaster plans that are coordinated with community disaster plans.</li> </ul>

<b>Goals, Objectives, and Action Plans</b>	
<p><i>Ongoing. Development of community mitigation projects and programs in all economic and community development projects planned for the county including site selection and environmental assessment continue</i></p> <ul style="list-style-type: none"> <li>- Encourage operation and infrastructure backup systems for commercial and industrial businesses.</li> </ul> <p><i>Ongoing. Development of community mitigation projects and programs in all economic and community development projects planned for the county including site selection and environmental assessment continue</i></p> <ul style="list-style-type: none"> <li>- Use the Disaster-Resistant Jobs Plan to assist with disaster planning.</li> </ul> <p><i>Ongoing. Development of community mitigation projects and programs in all economic and community development projects planned for the county including site selection and environmental assessment continue</i></p>	
<p><b>1.7 Identify populations with special needs or those who may be more vulnerable to the impacts of disasters or hazard events.</b> (proposed 2009)</p> <ul style="list-style-type: none"> <li>- Develop and maintain an inventory of special needs and vulnerable populations <i>Ongoing. Coordination continues between cities and county. Senate Bill 40 administrator and EOC staff to ensure safety of disabled residents. Promote "who to call" to obtain help.</i></li> <li>- Enhance warning systems and notifications for special populations. <i>Ongoing. TDY is available for hearing impaired to facilitate their listening to automated alerts. Alerts are also available on computers and mobile devices.</i></li> </ul>	
<p><b>1.8 Reduce the disruption to transportation infrastructure from hazard events, by reducing the vulnerability of transportation infrastructure to hazard events.</b> (proposed 2009)</p> <ul style="list-style-type: none"> <li>- Maintain inventory of vulnerable infrastructure. <i>Ongoing. Office of Home Land Security updates the information.</i></li> </ul>	
<p><b>Goal #2: Manage growth through sustainable principles and practices.</b></p> <p><b>2.1 Reduce and prevent degradation of, or conflicts with, natural resources.</b></p> <ul style="list-style-type: none"> <li>- Upgrade rural water/sewer systems to DNR standards.</li> <li>- <i>Ongoing. Water systems have been updated in select areas such as service to CertainTEED manufacturing facility in Jonesburg; Montgomery City installed new water distribution system for a portion of the city; and a new source of water has been implemented from Mark Twain Lake. Wellsville is currently working on making improvements to their sewer system. Two additional water mains are also running down routes B and Old Williamsburg Road near Montgomery City.</i></li> <li>- Resolve any existing environmental conflicts and take steps to prevent future conflicts. <i>Ongoing. No known issues exist. Ad hoc issues such as highway spills are worked through mutual aid agreements with St. Charles, Boone County, and Cole County Hazmat teams.</i></li> </ul>	
<p><b>2.2 Promote sustainable planning, development and construction practices.</b></p> <ul style="list-style-type: none"> <li>- Promote building codes in incorporated areas that currently do not have such regulations. <i>Ongoing. There has been limited success in getting cities to enact codes.</i></li> <li>- Implement measures to increase the county's Community Rating System (CRS status). <i>Ongoing. Cognizant authorities at every opportunity communicate the advantages of enacting floodplain management practices that exceed Federal requirements.</i></li> <li>- Facilitate rainwater percolation in the groundwater supply. <i>Continue to search for cognizant agencies and funding.</i></li> </ul>	
<p><b>Goal #3: Ensure continued operation of government and emergency functions in a disaster.</b></p>	

<b>Goals, Objectives, and Action Plans</b>
<p><b>3.1 Strengthen critical structures and infrastructures.</b></p> <ul style="list-style-type: none"> <li>- Review and upgrade appropriate emergency backup systems. <i>Ongoing. Backup systems and processes are reviewed annually.</i></li> <li>- Maintain essential public services (proposed 2009). <i>Ongoing. Mutual Aid agreements, equipment sharing, Road and bridge, dispatch. EMS, Fire etc.</i></li> <li>- Ensure all Class C dams have an Emergency operations plan and support periodic inspections of the dams (proposed 2009). <i>Ongoing. Emergency plans on file for MC dams.</i></li> <li>- Maintain an inventory of levees in the County (proposed 2009). <i>Ongoing. Inventory is complete and updated annually. Corps inventory is completed every two years.</i></li> </ul>
<p><b>3.2 Strengthen multi-jurisdictional cooperation among emergency agencies.</b></p> <ul style="list-style-type: none"> <li>- Identify, review, and implement mechanisms to foster collaboration among jurisdictions, agencies and special districts. <i>Ongoing. Mutual aid agreements and regional Threat and Hazard Identification and Risk Assessment planning documents receive annual review and updating.</i></li> <li>- Improve planning, funding, and response coordination (proposed 2009). <i>Ongoing. Emergency Operations Plans, Mutual aid agreements, and regional THIRA planning documents receive annual review and updating. Participation continues at a high rate within the region's RHSOC organization.</i></li> </ul>

**Table 4.2; Completed Goals, Objectives, and Action Plans**

<b>Goals, Objectives, and Action Plans</b>
<p><b>Goal #1: Protect the lives and livelihoods of all citizens.</b></p>
<p><b>1.2 Decrease the occurrence and impact of flooding.</b></p> <ul style="list-style-type: none"> <li>- Encourage owners/occupants in hazard areas to participate in mitigation policy formulation (complete 2014). Complete. Visual inspections confirm that Planning and Zoning regulations have cleared all known flood plain areas of legal residents.</li> <li>- Target any remaining repetitive flood loss properties for buyout (complete 2014). Complete. There are just two repetitive loss properties, both located in Rhineland. Property owners were made aware of buy-out options.</li> </ul>
<p><b>1.4 Increase and maintain appropriate emergency equipment.</b></p> <ul style="list-style-type: none"> <li>- Identify and encourage wildfire buffer zones around residential subdivisions (complete 2014)</li> </ul>
<p><b>1.7 Identify populations with special needs or those who may be more vulnerable to the impacts of disasters or hazard events.</b></p> <ul style="list-style-type: none"> <li>- Provide shelter homes in case of emergency (complete 2014)</li> </ul>
<p><b>1.8 Reduce the disruption to transportation infrastructure from hazard events, by reducing the vulnerability of transportation infrastructure to hazard events.</b></p> <ul style="list-style-type: none"> <li>- Utilize County road right of ways as firebreaks and snow storage (complete 2014)</li> <li>- Maintain an inventory of traffic incidents (complete 2014)</li> </ul>
<p><b>Goal #2: Manage growth through sustainable principles and practices.</b></p>
<p><b>2.1 Reduce and prevent degradation of, or conflicts with, natural resources.</b></p> <ul style="list-style-type: none"> <li>- Upgrade rural water/sewer systems to DNR standards (complete 2014)</li> </ul>

<b>Goals, Objectives, and Action Plans</b>
<ul style="list-style-type: none"> <li>- Resolve any existing environmental conflicts and take steps to prevent future conflicts (complete 2014)</li> </ul>
<p><b>2.2 Promote sustainable planning, development and construction practices.</b></p> <ul style="list-style-type: none"> <li>- Promote building codes in incorporated areas that currently do not have such regulations (complete 2014)</li> <li>- Facilitate rainwater percolation in the groundwater supply (complete 2014)</li> </ul>
<p><b>Goal #3: Ensure continued operation of government and emergency functions in a disaster.</b></p> <p><b>3.1 Strengthen critical structures and infrastructures.</b></p> <ul style="list-style-type: none"> <li>- Review and upgrade appropriate emergency backup systems (complete 2014)</li> <li>- Maintain essential public services (complete 2014)</li> <li>- Ensure all Class C dams have an Emergency operations plan and support periodic inspections of the dams (complete 2014)</li> <li>- Maintain an inventory of levees in the County (complete 2014)</li> </ul>
<p><b>3.2 Strengthen multi-jurisdictional cooperation among emergency agencies.</b></p> <ul style="list-style-type: none"> <li>- Identify, review, and implement mechanisms to foster collaboration among jurisdictions, agencies and special districts (complete 2014)</li> <li>- Improve planning, funding, and response coordination (complete 2014)</li> </ul>

### 4.3 Implementation of Mitigation Actions

**44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.**

The methodology used to prioritize the action plans include the STAPLEE analysis from the 2009 update, mitigation effectiveness criteria and time frame for implementation.

The Disaster Mitigation Act regulations state that benefit-cost review is the primary method by which mitigation projects should be prioritized. The STAPLEE analysis for this update remains the same as the 2009 plan as there were no new action plans included. A scoring methodology for likelihood of lives saved and the reduction of disaster damages were added as well as a timeline for implementation.

**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?

## Action Plan Prioritization Methodology

### STAPLEE Analysis Criteria

Each “X” for the STAPLEE analysis shown in Table 4.3 indicates the action would have a positive effect on each of the seven individual STAPLEE criteria listed above. Each of the “X” is given a rating of positive one. Mitigation Effectiveness and Priority / Time Frame for Implementation are evaluated per the factors below.

### Mitigation Effectiveness Criteria

- *Will the implemented action result in saved lives?* This was evaluated based on the likelihood of lives saved (0 being low; 5 being high)
- *Will the implemented action result in a reduction of disaster damages?* This was evaluated based on relative reduction of disaster damages (0 being low; 5 being high)

The scores for STAPLEE, Likelihood of Lives Saved and Reduction of Disaster Damages are summed to arrive with a total score.

### Priority / Time Frame for Implementation

- *High Priority:* Begin implementation process within 2 years
- *Medium Priority:* Begin implementation process within 5 years
- *Low Priority:* Begin implementation process within 10 years

The priority for each action plan was reviewed using the following criteria:

1. If the Likelihood of Lives Saved and / or the Reduction of Disaster Damages scores were high and the anticipated cost in labor and dollars were relatively small, the priority was rated HIGH.
2. If the Likelihood of Lives Saved and / or the Reduction of Disaster Damages scores were moderate and the anticipated cost in labor and dollars were relatively moderate, the priority was rated MEDIUM.

3. If the Likelihood of Lives Saved and / or the Reduction of Disaster Damages scores were Low and the anticipated cost in labor and dollars were relatively High, the priority was rated LOW.

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis							Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E					
		Name of the jurisdiction											0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
<b>Goal #1: Protect the lives and livelihoods of all citizens.</b>																
<b>1.1 Provide sufficient warning systems.</b>																
Identify geographic areas and develop a plan to implement needed systems	All	County and Cities	County and City officials	Grants, local funds, Ameren UE (gifted)	X	X	X	X	X	X		6	4	0	10	Low
Develop emergency warning systems	All	County and Cities	County and City officials	Local funds (Phone alert is \$7K per year, siren around \$20K per year)	X	X	X	X	X	X		6	4	1	11	High
Improve NOAA All Hazards radio communication	All	County and Cities	County EMD	Self-funded and partially self-sustaining.	X	X	X	X	X	X		6	4	1	11	High
<b>1.2 Decrease the occurrence and impact of flooding.</b>																
Promote environmentally-sound watershed and storm water practices to decrease flash flooding	Flooding	Flashflood areas	USACE, County Flood Plain Coordinator, MDC	Grants	X	X				X	X	4	0	2	6	Medium
Review and revise flood-fighting plans	Floods	Floodplain areas	Board	Local funds	X	X	X	X	X		X	6	2	2	10	High
Strengthen floodplain regulations	Floods	Floodplain areas	EMA and FEMA	Local funds	X	X			X	X	X	5	2	3	10	Medium

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis							Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E					
		Name of the jurisdiction											0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
Improve drainage of roadways in flashflood areas	Floods	Floodplain areas	County Road and Bridges, Cities, MoDOT	Local funds & grants	X	X			X	X	X	5	3	3	11	High
Encourage local communities to include storm water controls in their subdivision regulations	Floods	Floodplain areas	Cities	Local funds & grants	X	X			X	X	X	5	0	1	6	High
<b>1.3 Increase knowledge of safety measures among employers and the public.</b>																
Develop hazard area maps and promote their use by the public	All	All	EMA, Planning and Zoning, County and city building inspectors	Local funds	X	X	X	X	X	X		6	3	3	12	High
Consider additional training for emergency management personnel	All	County and City first responders	EMD	Local funds & grants	X	X	X	X	X		X	6	4	4	14	High

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis								Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E						
		Name of the jurisdiction												0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
Identify ways to promote FEMA safety tips and mitigation techniques	All	County and Cities	EMD	Local funds	X	X	X		X			X	5	1	1	7	High
Monitor development in special flood hazard areas to ensure compliance with local flood plain management ordinances	Flood	Floodplain areas	Flood plain coordinator	Local funds & grants	X	X	X		X			X	5	1	3	9	High
To provide earthquake preparedness and safety literature each year	Earthquake	Cities and County School Districts	EMD	Local funds	X	X	X	X	X			X	6	5	2	13	High
<b>1.4 Increase and maintain appropriate emergency equipment.</b>																	
Review and upgrade policies for identifying and budgeting additional emergency equipment	All	Cities and County	EMD	Grant, EMPG, or SHSP	X	X	X	X	X	X			6	4	4	14	High
Review and upgrade critical infrastructure backup equipment	All	Cities and County	EMD	Grant, EMPG, or SHSP	X	X	X	X	X				5	5	4	14	Medium
Promote fire-resistant construction materials	Wildfire	County and cities	Fire Protection Districts, Cities, EMD	Local funds			X				X	X	3	2	4	9	High

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis								Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E						
		Name of the jurisdiction											0-5 points "0" being low; "5" being high			High= 2 yr Medium=5 yr Low= 10 yr	
<b>1.5 Protect residential structures.</b>																	
Identify and use existing mechanisms to promote NFIP policies and earthquake/seismic insurance	Earthquake and flood	Cities and County	Floodplain Administrator, Planning and Zoning, and EMD	Local funds & grants	X	X	X	X	X	X	X	7	0	5	12	Medium	
Encourage all building owners to invest in retrofit techniques by providing FEMA articles via local newspapers & Chamber of Commerce	Earthquake and flood	Cities and County	Floodplain coordinator EMD	Local funds & grants			X			X	X	3	2	5	10	Medium	
<b>1.6 Protect large employment and commercial facilities.</b>																	
Consider known hazards when identifying a site for new facilities and systems	All	Cities and County	Economic Development, Planning and Zoning	Local funds	X	X		X	X	X		5	3	3	11	Low	
Encourage tornado safe rooms	Thunderstorms, High winds, Hail, and Tornado	Cities and County	EMD	Local funds	X	X	X					3	5	2	10	Low	
Encourage up-to-date commercial and industrial disaster plans that are coordinated with community disaster plans	All	Cities and County	Economic Development	Local funds	X	X		X		X	X	5	3	3	11	Low	

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis							Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E					
		Name of the jurisdiction											0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
Encourage operation and infrastructure backup systems for commercial and industrial businesses	All	Cities and County	Economic Development	Local funds	X	X		X		X	X	5	1	5	11	Low
Use the Disaster-Resistant Jobs Plan to assist with disaster planning	All	Cities and County	Economic Development	Local funds	X	X		X		X	X	5	0	5	10	Low
<b>1.7 Identify populations with special needs or those who may be more vulnerable to the impacts of disasters or hazard events</b>																
Develop and maintain an inventory of special needs and vulnerable populations	All	County and Cities	EM, Senate Bill 40 administrator, Health Department	Local funds & grants	X	X			X	X		4	5	0	9	High
Enhance warning systems and notifications for special populations	All	County and Cities	Emergency Responders	Local Funds	X	X			X	X		4	5	2	11	High
<b>1.8 Reduce the disruption to transportation infrastructure from hazard events, by reducing the vulnerability of transportation infrastructure to hazard events.</b>																
Maintain inventory of vulnerable infrastructure	All	Cities and County	EMD	Local funds	X	X			X	X		4	5	4	13	High

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis								Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E						
		Name of the jurisdiction												0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
<b>Goal #2: Manage growth through sustainable principles and practices.</b>																	
<b>2.1 Reduce and prevent degradation of, or conflicts with, natural resources.</b>																	
Upgrade rural water/sewer systems to DNR standards	Drought	Jonesburg Montgomery City, Wellsville	DNR, Water districts	Local, state & federal grants	X	X	X	X	X	X	X	7	1	1	9	Low	
Resolve any existing environmental conflicts and take steps to prevent future conflicts	Hazardous waste	County and Cities	Health Dept.,	Local funds	X	X		X	X		X	5	3	2	10	Low	
<b>2.2 Promote sustainable planning, development and construction practices.</b>																	
Promote building codes in incorporated areas that currently do not have such regulations	Earthquake, storms	County and Cities	Local	Local funds	X	X		X			X	4	4	4	12	Medium	
Implement measures to increase the county's Community Rating System (CRS) status	Floods	County and Cities	Floodplain coordinator	Local funds & grants	X	X			X	X	X	5	0	3	8	Low	
Facilitate rainwater percolation in the groundwater supply	Drought, Flooding	County and Cities	EMD	Local funds & grants	X	X	X		X	X	X	6	1	3	10	Low	
<b>Goal #3: Ensure continued operation of government and emergency functions in a disaster.</b>																	
<b>3.1 Strengthen critical structures and infrastructures.</b>																	

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis								Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E						
		Name of the jurisdiction												0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
Review and upgrade appropriate emergency backup systems	All	County and Cities	County department heads	Local funds	X	X	X	X	X	X		6	4	5	15	High	
Maintain essential public services	All	County and Cities	County department heads	Local funds	X	X	X	X	X	X	X	7	5	4	16	High	
Ensure all Class C dams have an Emergency operations plan and support periodic inspections of the dams	Dams	Unincorporated areas	EMD	Local funds	X	X	X	X	X	X	X	7	3	4	14	Medium	
Maintain an inventory of levees in the County	Levees	County	EMD & Tri County Levee District, Army Corps of Engineers	Local funds	X	X	X	X		X	X	6	2	2	10	Low	
<b>3.2 Strengthen multi-jurisdictional cooperation among emergency agencies.</b>																	
Identify, review, and implement mechanisms to foster collaboration among jurisdictions, agencies and special districts	All	Cities and County	EMD	Local funds & grants	X	X	X		X	X	X	6	4	4	14	High	

Goals, Objectives, and Action Plans	Hazards Addressed	Jurisdiction	Lead organizer	Funding Sources	STAPLEE Analysis							Total	Likelihood of Lives Saved	Reduction of Disaster Damages	TOTAL	PRIORITY Timeframe for Implementation
					S	T	A	P	L	E	E					
		Name of the jurisdiction											0-5 points "0" being low; "5" being high		High= 2 yr Medium=5 yr Low= 10 yr	
Improve planning, funding, and response coordination	All	Cities and County	EMD	Local funds & grants	X	X	X	X	X	X	X	7	4	4	15	High



## **SECTION 5- Plan Maintenance Process**

This section provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses the process of continued public involvement.

### **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.**

#### **5.1.1 Hazard Mitigation Planning Committee**

With adoption of this plan, the Montgomery County Hazard Mitigation Planning Committee (HMPC) will be tasked with monitoring, evaluating, and maintaining the plan. BRPC coordinates with the County Emergency Management Director and the participating jurisdictions during the plan maintenance process. The HMPC expressed interest in meeting annually to review and update potential changes to the plan that may be incorporated into the next update process. This step will keep hazard mitigation planning at the forefront of the community and facilitate subsequent updates to the plan.

During the plan maintenance process, the committee will review each goal and objective to determine their relevance to changing situations in the county, as well as changes in State or Federal policy, and to ensure that they are addressing current and expected conditions. The committee also will review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will 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.

#### **5.1.2 Plan Maintenance Schedule**

In conjunction with the other participating jurisdictions and additional jurisdictions that may choose to participate in the future, a five-year written update of the plan will be submitted to the

State Emergency Management Agency, and FEMA Region VII per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000 and adopted by participating jurisdictions within a five-year period from the final approval of this plan unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

### 5.1.3 Plan Maintenance Process

Plan maintenance will involve the following process:

- Consider changes in vulnerability due to action implementation
- Document any new hazards that may arise
- Incorporate growth and development-related changes to inventories
- Document areas where mitigation actions were not effective

Changes will be made to the plan to accommodate actions that have failed or are not considered feasible after a review of their adherence to established criteria, time frame, community priorities, and/or funding resources. Updating of the plan will be enacted through written changes and submissions, as BRPC deems appropriate and necessary, and as approved by the Montgomery County Board of Commissioners and the governing boards of the other participating jurisdictions.

The following table lists the recommendations for developing future plans.

**Table 5.1 Recommended data for future plans**

<b>Type</b>	<b>Recommended data for future plans</b>
Dam failure	Additional data on dam inundation maps
Floods	Additional data on specific flash flooding events for the entire county.
Levee failure	Additional data on specific levee failure events for the entire county.
Loss estimates	Dollars values of loss estimates for all the natural hazards
Mitigation Strategy	Developing quantifiable data for use in evaluating action plans.

## 5.2 Incorporation into Existing Planning Mechanisms

**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.**

Where possible, plan participants will use existing plans and / or programs to implement hazard mitigation actions. Based on the capability assessments of the participating jurisdictions, communities in Montgomery County will continue to plan and implement programs to reduce loss of life and property from hazards. This plan builds upon the momentum developed through previous related planning efforts and mitigation programs, and recommends implementing actions, where possible, through the following means:

- Montgomery County Comprehensive Plan 1995 (County is working on the update)
- Montgomery County Emergency Operations Plan 2014 - The incorporated parts include hazard analysis section, and Elder Care/Long Term Care Facilities in Montgomery County.
- Comprehensive Economic Development Strategy 2014
- Regional Transportation Plan

The governing bodies of the jurisdictions adopting this plan will encourage all other relevant planning mechanisms under their authority to consult this plan to ensure minimization of risk to natural hazards as well as coordination of activities.

### 5.3 Continued Public Involvement

**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.]**

The general public will be encouraged to attend Hazard Mitigation Planning Committee meetings through media coverage, published notices, reminders or announcements at civic meetings, and possibly public speaking engagements. Boonslick Regional Planning Commission will continue to host any hazard mitigation announcements or information, as well as a copy of the latest plan will be posted on the BRPC website ([www.boonslick.org](http://www.boonslick.org)).

A public hearing(s) to receive public comment on plan maintenance and updating will be held during the update period. When the HMPC reconvenes for the update, it will coordinate with all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan. Public notice will be posted and public participation will be invited, at a minimum, through available website postings and press releases to local media outlets.

