DRAFT

MACOUPIN COUNTY
Multi-Jurisdictional
All Hazards Mitigation Plan






PARTICIPANTS

Benld, City of
Brighton, Village of
Bunker Hill, City of
Carlinville, City of
Gillespie, City of
Girard, City of

Macoupin County
Mount Olive, City of
Royal Lakes, Village of
Staunton, City of
Virden, City of
Wilsonville, City of

NOVEMBER 2018

The five year update of this Plan must be completed on or before (date).

ACKNOWLEDGEMENTS

Updating the Macoupin County Multi-Jurisdictional All Hazards Mitigation Plan would not have been possible without the input of dedicated individuals serving the participating jurisdictions and Macoupin County. Their contributions have made this updated Plan the definitive source for information on natural and man-made hazards, their impacts and the options identified to eliminate or reduce these impacts on current and future generations.

Understanding how mitigation actions can reduce the risk to life and property helped participating jurisdictions to identify nearly 100 new mitigation project and activities and convinced three new municipalities to participate in this Plan update. The projects and activities identify will help pave the way to protect residents now and in the future.

Photographs and historic news articles identifying storm damage are often difficult to find. A special thanks is extended to James Pitchford, Macoupin County Emergency Management Agency Coordinator, for combing through his records and providing photographs and historic news articles for this Plan update. These articles and photographs provide a glimpse into the scope of the damages sustained as a result of natural hazard events experienced in Macoupin County.

As this Plan is updated, we hope that future generations will continue to build on this document with more information and photographs.

Cover photographs were provided courtesy of James Pitchford, Coordinator, Macoupin County Emergency Management Agency.

From top to bottom and left to right:

- *April 19, 2011 EF3 tornado damage near Girard*
- *October 2, 2014 flash flood damage in unincorporated Macoupin County*
- *May 20, 2013 EF2 tornado damage in Mount Olive*
- *March 8, 2009 thunderstorm with straight-line winds blew three empty rail cars off the Union Pacific rail line north of Standard City*
- *March 27, 2009 mine subsidence damage at Benld Elementary School*
- *September 2, 2010 catastrophic dam failure at Virden Recreation Club Lake Dam northwest of Virden*

MACOUPIN COUNTY MULTI-JURISDICTIONAL ALL HAZARDS MITIGATION PLAN

MACOUPIN COUNTY, ILLINOIS

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Researched and written for the Macoupin County Multi-Jurisdictional
All Hazards Mitigation Planning Committee
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American Environmental Corporation

1.0 INTRODUCTION

1.0 INTRODUCTION

Each year natural hazards (i.e., severe thunderstorms, tornadoes, severe winter storms, flooding, etc.) cause damage to property and threaten the lives and health of the residents of Macoupin County. Since 1982, Macoupin County has had five federally-declared disasters. **Figure 1** identifies each declaration including the year the disaster was declared and the type of natural hazard that triggered the declaration.

Figure 1
Federal Disaster Declarations: Macoupin County

Declaration #	Year	Natural Hazard(s) Covered by Declaration
674	1982	severe storms; flooding
684	1983	severe storms; tornadoes; flooding
1416	2002	severe storms; tornadoes; flooding
1681	2007	severe ice storm
1800	2008	severe storms; flooding

In the last 10 years alone (2008 – 2017), there have been 59 thunderstorms with damaging winds, 40 severe storms with hail 1 inch in diameter or greater, 20 excessive heat events, 15 flash floods, 14 severe winter storms, 8 tornadoes, 4 mine subsidence events, 2 extreme cold events, 1 drought, 1 dam failure and 1 earthquake felt by residents in the County.

While natural hazards cannot be avoided, their impacts can be reduced through effective hazard mitigation planning. This prevention-related concept of emergency management often receives the least amount of attention, yet it is one of the most important steps in creating a hazard-resistant community.

What is hazard mitigation planning?

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural and man-made hazards. This process helps the County and participating jurisdictions reduce their risk from natural and man-made hazards by identifying vulnerabilities and developing mitigation actions to lessen and sometimes even eliminate the effects of a hazard. The results of this process are documented in an all hazards mitigation plan.

Why update an all hazards mitigation plan?

By updating and adopting an all hazards mitigation plan, participating jurisdictions become eligible to apply for and receive federal hazard mitigation funds to implement mitigation actions identified in the plan. These funds can help provide local government entities with the opportunity to complete mitigation projects that would not otherwise be financially possible.

The federal hazard mitigation funds are made available through the Disaster Mitigation Act of 2000, an amendment to the Robert T. Stafford Disaster Relief and Emergency Assistance Act, which provides federal aid for mitigation projects, but only if the local government entity has a Federal Emergency Management Agency (FEMA) approved hazard mitigation plan.

How is this plan different from other emergency plans?

An all hazards mitigation plan is aimed at identifying projects and activities that can be conducted prior to a natural or man-made disaster, unlike other emergency plans which provide direction on how to respond to a disaster after it occurs. This is the first time that Macoupin County has updated its hazard mitigation plan since the original plan was prepared in 2010. This update describes in detail the actions that can be taken to help reduce or eliminate damages caused by specific types of natural and man-made hazards.

1.1 PARTICIPATING JURISDICTIONS

Recognizing the benefits of having an all hazards mitigation plan, the Macoupin County Board authorized the update of the Macoupin County Multi-Jurisdictional All Hazards Mitigation Plan (hereto referred to as the Plan). The County then invited all the local government entities within Macoupin County to participate. **Figure 2** identifies the participating jurisdictions that are represented in the updated Plan.

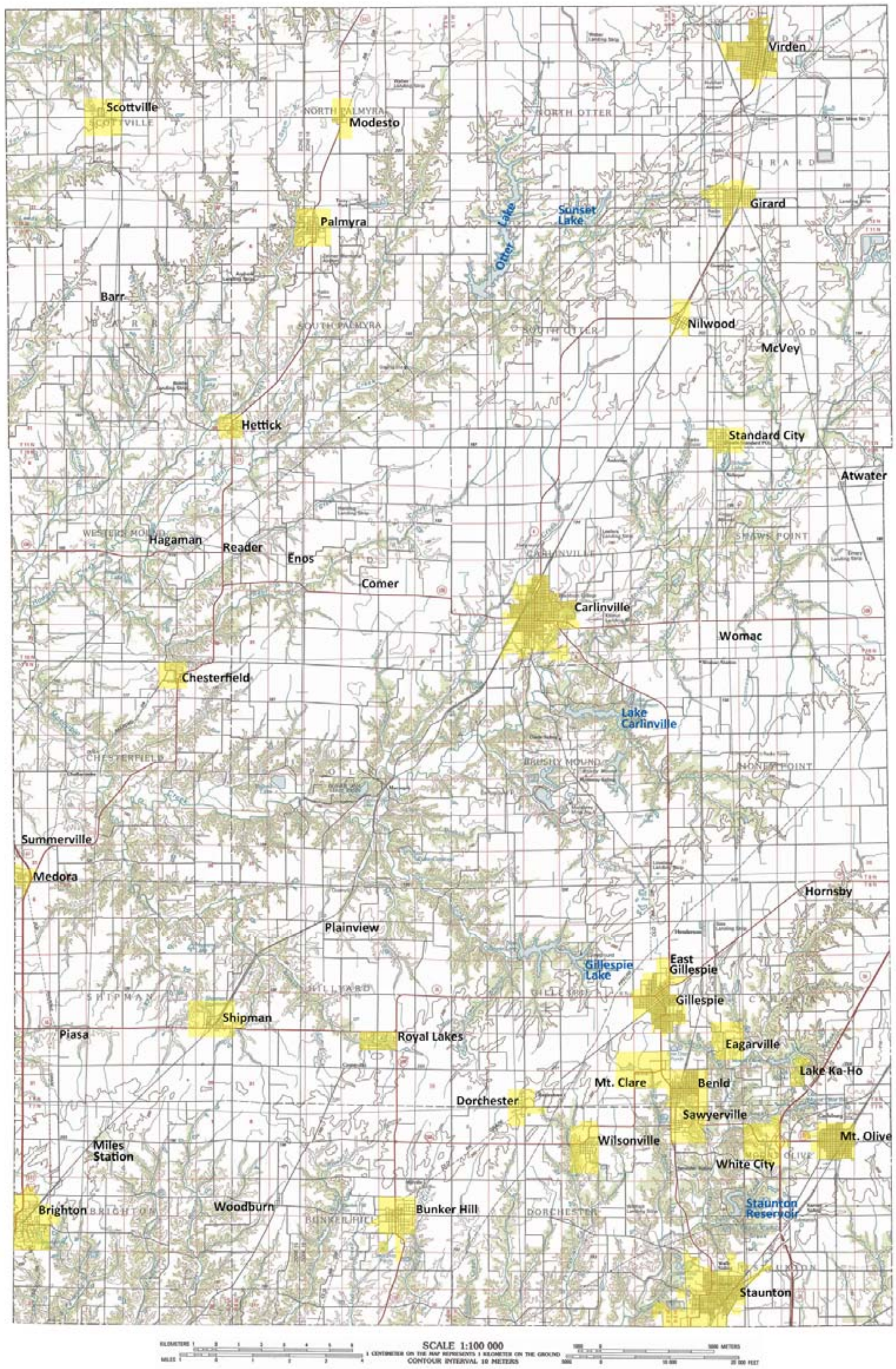
Figure 2 Participating Jurisdictions Represented in the Plan	
❖ Benld, City of	❖ Macoupin County
❖ Brighton, City of	❖ Mount Olive, City of
❖ Bunker Hill, City of	❖ Royal Lakes, Village of
❖ Carlinville, City of	❖ Staunton, City of
❖ Gillespie, City of	❖ Virden, City of
❖ Girard, City of	❖ Wilsonville, Village of

1.2 DEMOGRAPHICS

Macoupin County is located in west-central Illinois and covers approximately 868 square miles. **Figure 3** provides a location map of Macoupin County and the participating municipalities. The topography is generally flat to gently sloping. The County is bounded to the north by Morgan and Sangamon Counties, to the east by Montgomery County, to the south by Madison County and to the west by Jersey and Greene Counties. The County seat is located in Carlinville.

Agriculture is the major enterprise in Macoupin County. According to the 2012 Census of Agriculture, there were 1,190 farms in Macoupin County occupying approximately 79% (438,592 acres) of the total land acreage in the County. The major crops include corn, soybeans, hay and wheat while the major livestock includes cattle, turkeys, hogs and sheep. The County ranks 13th in the State for corn, 21st for soybeans, 22nd for hay and silage, and 26th for wheat and winter wheat. In terms of livestock, the County ranks 13th in State for cattle and calves, 14th for turkeys, 21st for sheep and lambs and 45th for hogs and pigs. Macoupin County ranks in the top 30 Illinois counties for both livestock and crop cash receipts.

Figure 3
Location Map



Source: U.S. Geological Survey, Topographic Map - Macoupin County, Illinois, 39089-C8-CM-100, 1995.

The largest employment industry in Macoupin County is healthcare/social assistance followed by retail trade and manufacturing, according to the Illinois Department of Commerce and Economic Opportunity. Educational services and construction round out the top five employment sectors.

Figure 4 provides demographic data on the County and each of the participating municipalities along with information on housing units and assessed values. The assessed values are for all residential structures and associated buildings (including farm homes and buildings associated with the main residence.) The assessed value of a residence in Macoupin County is approximately one-third of the market value.

Figure 4
Demographic Data by Participating Jurisdiction

Participating Jurisdiction	Population (2010)	Projected Population (2025)	Total Area (Sq. Miles) (2010)	Number of Housing Units (2010)	Housing Unit Density (Units/ Sq. Mile)	Total Assessed Value of Housing Units (2016)
Macoupin County (unincorporated)	15,477	14,634	838.109	6,771	8	$123,784,264
Benld	1,556	1,471	1.060	750	708	$6,854,981
Brighton	1,946	1,840	1.913	920	491	$20,287,777
Bunker Hill	1,774	1,677	1.286	745	591	$14,609,440
Carlinville	5,917	5,595	2.995	2,615	873	$42,997,637
Gillespie	3,319	3,138	1.455	1,519	1,044	$20,462,096
Girard	2,103	1,988	0.935	941	---	$13,417,628
Mount Olive	2,099	1,985	1.156	984	853	$13,184,308
Royal Lakes	197	186	0.512	108	---	$678,864
Staunton	5,139	4,859	3.090	2,343	765	$44,835,564
Virden	3,274	3,096	1.827	1,599	875	$21,305,655
Wilsonville	586	554	0.982	264	---	$2,426,704

Sources: Duncan, Pete, Macoupin County Clerk & Recorder.
Illinois Department Public Health, Population Projects for Illinois Counties 2010 to 2025.
U. S. Census Bureau, 2010 Census U.S. Gazetteer Files.
U.S. Census Bureau, American FactFinder.

1.3 LAND USE AND DEVELOPMENT TRENDS

Population growth and economic development are two major factors that trigger changes in land use. Macoupin County is largely rural with a population that has remained fairly stable. Between 2000 and 2010 the population decreased by 2.6% from 49,019 to 47,765. Since 1960, the County's population has experienced modest increases and decreases, except between 1970 and 1980 when the population increased by 9.8%. All of the participating municipalities, with the exception of Benld, Brighton, Carlinville, Royal Lakes and Staunton, have experienced declines in their populations since 2000.

Land use in Macoupin County is primarily agricultural. As discussed in the previous section, approximately 79% of the land within the County is used for farming practices. Agriculture is a and will continue to be a major enterprise within the County and a vital part of the County's economy.

There are no large-scale economic development initiatives underway in the County. Substantial changes in land use (from forested and agricultural land to residential, commercial and industrial) are not anticipated within the County in the immediate future. No sizeable increases in residential or commercial/industrial developments are expected within the next five years.

2.0 PLANNING PROCESS

2.0 PLANNING PROCESS

The Macoupin County Multi-Jurisdictional All Hazards Mitigation Plan (the Plan) was updated through the Macoupin County Multi-Jurisdictional All Hazards Mitigation Planning Committee (Planning Committee). The Plan was prepared to comply with the Disaster Mitigation Act of 2000 and incorporates the Federal Emergency Management Agency's (FEMA) 10-step planning process approach. **Figure 5** provides a brief description of the process utilized to prepare this Plan.

Figure 5
Description of Planning Process

Tasks	Description
Task One: Organize	The Planning Committee was formed with broad representation and specific expertise to assist the County and the Consultant in updating the Plan.
Task Two: Public Involvement	Early and ongoing public involvement activities were conducted throughout the Plan's development to ensure the public was given every opportunity to participate and provide input.
Task Three: Coordination	Agencies and organizations were contacted to identify plans and activities currently being implemented that impact or might potentially impact hazard mitigation activities.
Task Four: Risk Assessment	The Consultant identified and profiled the natural and man-made hazards that have impacted the County and conducted a vulnerability assessment to evaluate the risk to each participating jurisdiction.
Task Five: Goal Setting	After reviewing existing plans and completing the risk assessment, the Consultant assisted the Planning Committee in updating the goals and objectives for the Plan.
Task Six: Mitigation Activities	The participating jurisdictions were asked to identify mitigation actions that had been started and/or completed since the original Plan was adopted. In addition they were also asked to identify any new mitigation actions based on the results of the risk assessment. The new mitigation actions were then analyzed, categorized and prioritized.
Task Seven: Draft Plan	The updated draft Plan summarized the results of Tasks One through Six. In addition, it described the responsibilities to monitor, evaluate and update the Plan. The updated draft Plan was reviewed by the participants and a public forum was held to give the public an additional opportunity to provide input. Comments received were incorporated into the updated draft Plan and submitted to the Illinois Emergency Management Agency (IEMA) and FEMA for review and approval.
Task Eight: Final Plan	Comments received from IEMA and FEMA were incorporated in to the final updated Plan. The final updated Plan was then submitted to the County and participating jurisdictions for adoption. The Plan will be reviewed periodically and updated again in five years.

The Plan update and development was led at the staff level by James Pitchford, Macoupin County Emergency Management Agency Coordinator. American Environmental Corp. (AEC), an environmental consulting firm, with experience in hazard mitigation, risk assessment and public involvement, was employed to guide the County and participating jurisdictions through the planning process.

Participation in the planning process, especially by the County and local government representatives, was crucial to the update and development of the Plan. To ensure that all participating jurisdictions took part in the planning process, participation requirements were established. Each participating jurisdiction agreed to satisfy the following requirements in order to be included in the updated Plan. All of the participating jurisdictions met the participation requirements.

- Attend Planning Committee meetings.
- Submit a list of documents (i.e., plans, studies, reports, maps, etc.) relevant to the all hazard mitigation planning process.
- Identify and submit a list of critical infrastructure and facilities.
- Review the risk assessment and provide information on additional events and damages.
- Participate in the update of the mitigation goals.
- Submit a list of mitigation actions started and/or completed since the adoption of the original Plan.
- Identify and submit a list of new mitigation actions.
- Review and comment on the updated draft Plan.
- Formally adopt the updated Plan.
- Where applicable, incorporate the updated Plan into existing planning efforts.
- Participate in the updated Plan maintenance.

2.1 PLANNING COMMITTEE

As previously mentioned, at the start of the planning process, the Macoupin County Multi-Jurisdictional All Hazards Mitigation Planning Committee was formed to update the hazard mitigation plan. The Planning Committee included representatives from each participating jurisdiction, as well as economic development, emergency services (ambulance, fire, and law enforcement) and healthcare.

Figure 6 details the entities represented on the Planning Committee and the individuals who attended on their behalf. The Planning Committee was chaired by the Macoupin County Emergency Management Agency.

Additional technical expertise was provided by the staff at the Illinois Emergency Management Agency Hazard Mitigation Unit, the Illinois Department of Natural Resources Office of Water Resources, the Illinois Environmental Protection Agency, the Illinois State Water Survey, the Illinois State Geological Survey, and the University of Illinois.

Figure 6
Macoupin County Planning Committee Member Attendance Record

Representing	Name	Title	9/14/2017	1/23/2018	5/1/2018	8/7/2018	11/14/2018
American Environmental Corporation	Bostwick, Andrea	Senior Project Manager	X	X	X	X	
American Environmental Corporation	Krug, Zach	Environmental Specialist		X	X	X	
American Environmental Corporation	Michaud, Greg	Emergency Management Services Manager	X				
Benld, City of	Cooper, Lance	Alderman		X			
Benld, City of	Frensko, Brian	Alderman		X			
Benld, City of	Kelly, Jim	Mayor		X	X		
Brighton, Village of	Bramley, John	Parks Committee Member		X			
Brighton, Village of	Roberts, Michael	President		X			
Bunker Hill, City of	Phelps, Betty	Mayor	X				
Bunker Hill, City of	Sloan, Drew	Police Chief/ESDA Coordinator			X	X	
Carlinville, City of	Shipley, Aaron	EMA Coordinator	X	X		X	
Dorchester Township	Willhoit, Bob	Supervisor	X	X	X		
Gillespie, City of	Brickey, Diana	Alderman	X				
Gillespie, City of	Holesko, George	EMA Coordinator		X	X	X	
Girard, City of	Earley, John	Emergency Manager	X	X	X	X	
Macoupin County - Assessment Offic	Bresnan, John	Supervisor of Assessments		X	X	X	
Macoupin County - Clerk's Office	Duncan, Pete	County Clerk	X	X	X	X	
Macoupin County - Coroner's Office	Targhetta, Brad	Coroner		X			
Macoupin County - EMA	Pitchford, James	Coordinator	X	X	X	X	
Macoupin County - ETSB	Lewis, Susan	Administrative Assistant	X				
Macoupin County - Public Health Department	Boehler, Tiffany	Emergency Preparedness Coordinator	X	X	X		
Macoupin County - Public Health Department	Tarro, Kent	Director	X	X			
Macoupin County - Sheriff's Office	Kahl, Shawn	Sheriff	X				
Macoupin Family Practice Centers	Henricks, Jennifer	Administrator	X				
Mount Olive, City of	Spaller, Matt	Police Chief			X	X	
Royal Lakes, Village of	Huddleston, Parkeoka	President	X				
Royal Lakes, Village of	Jefferson, Karl Sr.	Trustee	X				
Royal Lakes, Village of	Stockard, Lena	Village Clerk	X				
Royal Lakes, Village of	Triplett, Vickie	Treasurer	X				
Staunton, City of	Neuhaus, Craig	Mayor		X	X	X	
Staunton, City of	Scroggins, Ray	Alderman		X	X		
Staunton Volunteer Fire Department	Alexander, Russell	Assistant Chief	X				
Virden, City of	Dodd, Chris	Alderman	X	X	X		
Virden, City of	Mottershaw, Gary	Alderman	X	X	X	X	
Virden, City of	Murphy, George	Mayor	X				
West Central Development Council, Inc.	Cavanaugh, Michael	Deputy Director	X				
Wilsonville, Village of	Veres, Annetta	President		X			
Wilsonville, Village of	Rhodes, Jeff	Alderman		X			

Mission Statement

Over the course of the first two meetings, the Planning Committee developed a mission statement that described their objectives for the Plan update.

"The mission of the Macoupin County Multi-Jurisdictional All Hazards Mitigation Plan Committee is to develop a mitigation plan that can reduce the negative impacts of natural and man-made hazards on citizens, infrastructure, private property and critical facilities."

Planning Committee Meetings

The Planning Committee met five times between September, 2017 and November, 2018. **Figure 6** identifies the representatives present at each meeting. **Appendices A** and **B** contain copies of the attendance sheets and meeting minutes for each meeting. The purpose of each meeting, including the topics discussed, is provided below.

First Planning Committee Meeting – September 14, 2017

The purpose of this meeting was to explain the planning process to the Planning Committee members and give them a brief overview of what an all hazards mitigation plan is and why it needs to be updated. Drafts of the mission statement and mitigation goals were presented for review. Committee members were asked to identify of any natural or man-made hazard events that have occurred within the County since the original Plan was completed.

Representatives for the County and the participating jurisdictions were asked to complete the forms entitled "List of Existing Planning Documents", "Critical Facilities" and "Identification of Severe Weather Shelters" and return them at the next meeting. Copies of a hazard events questionnaire and citizen questionnaire were also distributed.

Second Planning Committee Meeting – January 23, 2018

At the second Planning Committee meeting portions of the updated natural hazard risk assessment section were presented for review. The Planning Committee discussed the draft mission statement and updated mitigation goals and finalized both.

Committee members were asked to identify any mitigation projects and activities their jurisdictions had started and/or completed since the original Plan was completed in 2010. Ideas for new potential mitigation projects and activities were presented. Representatives for the County and the participating jurisdictions were asked to complete the forms entitled "Existing Mitigation Project/Activity Status" and "New Hazard Mitigation Projects" and return them at the next meeting.

Third Planning Committee Meeting – May 1, 2018

The purpose of the third Planning Committee meeting was to review the man-made hazards risk assessment and discuss the vulnerability assessment for tornadoes and floods. The Planning Committee also reviewed and approved the updated mitigation project prioritization methodology and discussed how the mitigation projects and activities identified by the participating jurisdictions would be presented in the updated Plan.

Fourth Planning Committee Meeting – August 7, 2018

At the fourth meeting the updated mine subsidence risk assessment section was presented for review. The Planning Committee members also reviewed the draft jurisdiction-specific mitigation action tables which identified and prioritized the new and existing mitigation projects and activities provided by the participants. Members were given the opportunity to add additional projects and activities to their tables. The sections outline the mitigation strategy, plan maintenance and adoption were also reviewed.

Fifth Planning Committee Meeting – November 14, 2018

The purpose of the fifth Planning Committee meeting was to provide the public an opportunity to provide comments on the draft updated Plan.

2.2 PUBLIC INVOLVEMENT

To engage the public in the planning process, a comprehensive public involvement strategy was developed. The strategy was structured to engage the public in a two-way dialogue, encouraging the exchange of information throughout the planning process. A mix of public involvement techniques and practices were utilized to:

- disseminate information;
- identify additional useful information about natural hazard occurrences and impacts;
- assure that interested residents would be involved throughout the updated Plan's development; and
- nurture ownership of the updated Plan, thus increasing the likelihood of adoption by the participating jurisdictions.

The dialogue with the public followed proven risk communication principles to help assure clarity and avoid overstating or understating the impacts posed by the natural and man-made hazards identified in the updated Plan. The following public involvement techniques and practices were applied to give the public an opportunity to access information and participate in the dialogue at their level of interest and availability.

Citizen Questionnaire

The citizen questionnaire created to gather facts and gauge public perceptions about natural hazards. The questionnaire was made available at the offices of participating jurisdictions. A copy of the questionnaire is contained in **Appendix C**.

A total of 22 questionnaires were completed and returned to the Planning Committee. The questionnaires were filled out by residents of unincorporated Macoupin County as well as all of the participating municipalities, with the exception of Brighton. These responses provide useful information to decision makers as they deliberate how best to disseminate information about natural hazards and how residents can protect themselves and their property.

Additionally, these results provide an indication as to the types of projects that are most likely to receive public support. A review of the questionnaires revealed the following:

- Respondents felt that severe storms (thunderstorms, hail, lightning and heavy rain), severe winter storms (snow, sleet, ice and/or extreme cold) and excessive heat were the most frequently encountered natural hazards in Macoupin County. This is consistent with the weather records compiled for the County and as described in this updated Plan.
- Electronic media (internet and social media) and mailings were identified as the most effective means of disseminating information about natural hazards. Of the electronic media choices, the internet was recognized as the most favored means of dissemination followed closely by social media (Facebook, Twitter, etc.). Radio, newspaper and television also received strong support among respondents.
- Four (4) categories of mitigation projects and activities were felt to be most needed. The following identifies each category and provides the percentage of support received:

- maintain power during storms by burying power lines, trimming trees and/or purchasing backup generators (75%)
- sirens and other alert systems (60%);
- maintain roadway passages during snow storms and heavy rains (55%);
- retrofit critical facilities (public water supplies, schools, sewage treatment facilities, bridges, hospitals and other important services) to reduce potential damages (55%).

FAQ Fact Sheet

A "Frequently Asked Questions" fact sheet was created and disseminated to explain what an all hazards mitigation plan is and briefly describe the planning process. The fact sheet was made available at the government offices of participating jurisdictions. A copy of the fact sheet is contained in **Appendix D**.

Press Releases

Press releases were prepared and submitted to local print media outlets prior to each Planning Committee meeting. The releases announced the purpose of the meetings and how the public could become involved in the updated Plan's development. **Appendix E** contains a list of the print media outlets that received the press releases while copies of the releases and any news articles published can be found in **Appendix F**.

Planning Committee Meetings

All of the meetings conducted by the Planning Committee were open to the public and publicized in advance to encourage public participation. At the end of each meeting, time was set aside for public comment. In addition, Committee members were available throughout the planning process to talk with residents and local government officials and were responsible for relaying any concerns and questions voiced by the public to the Planning Committee.

Public Forum

The final meeting of the Planning Committee, held on November 14, 2018, was conducted as an open-house public forum. The open-house format was chosen for this forum instead of a hearing to provide greater convenience for residents who wished to participate. Residents were able to come and go at any time during the forum, reducing conflicts with business, family, and social obligations.

At the forum, residents were able to review a draft of the updated Plan; meet with representatives from the County, the participating jurisdictions and the Consultant; ask any questions; and provide comments on the draft updated Plan. Individuals attending the public forum were provided with a two-page handout summarizing the planning process and a comment sheet that could be used to provide feedback on the draft updated Plan. **Appendices G** and **H** contain copies of these materials.

Public Comment Period

After the public forum, the draft updated Plan was made available for public review and comment through November 30, 2018 at the Macoupin County Emergency Management

Agency's Office and on the County's website. Residents were encouraged to submit their comments electronically, by mail or through representatives of the Planning Committee.

Results of Public Involvement

The public involvement strategy implemented during the planning process created a dialogue among participants and interested residents, which resulted in many benefits, a few of which are highlighted below.

- *Acquired additional information about natural hazards*. Verifiable hazard event and damage information was obtained from participants that presents a clearer assessment of the extent and magnitude of natural hazards that have impacted the County. This information included details about thunderstorms with damaging winds, hail, severe winter storms and tornadoes not available from state and federal databases.
- *Increased awareness of the impacts associated with natural hazard events within the County*. Understanding how mitigation actions can reduce risk to life and property helped generate ***98 new mitigation projects and activities*** at the local level that had not been previously identified in any other planning process. In addition, three municipalities (Benld, Brighton and Mount Olive) chose to participate in the Plan update.

2.3 PARTICIPATION OPPORTUNITIES FOR INTERESTED PARTIES

Businesses, schools, not-for-profit organizations, neighboring counties, and other interested parties were provided multiple opportunities to participate in the planning process. Wide-reaching applications were combined with direct, person-to-person contacts to reach anyone who might have an interest or possess information which could be helpful in updating the Plan.

Not-For-Profit & Other Organizations

Representatives from those segments of the emergency services and economic development community who had the most interest in natural hazard events were invited to serve on the Planning Committee. Input was sought from the American Red Cross and West Central Development Council, Inc. Both served in advisory roles to the Planning Committee.

Neighboring Counties

An announcement was sent to EMA/ESDA offices in neighboring counties inviting them to participate in the mitigation planning process. **Appendix I** contains a copy of the invitation memo.

2.4 INCORPORATING EXISTING PLANNING DOCUMENTS

As part of the planning process, each participating jurisdiction was asked to identify and provide existing documents (plans, studies, reports and technical information) relevant to the updated Plan. **Figure 7** summarizes the availability of existing planning documents by participating jurisdiction. These documents were reviewed and incorporated into the Plan whenever applicable.

Figure 7
Existing Planning Documents by Participating Jurisdiction

Existing Planning Documents	Participating Jurisdiction											
	Macoupin County	Benld	Brighton	Bunker Hill	Carlinville	Gillespie	Girard	Mount Olive	Royal Lakes	Staunton	Virden	Wilsonville
Plans												
Comprehensive Plan			X									
Emergency Management Plan	X		X	X						X		
Land Use Plan			X							X		
Codes & Ordinances												
Building Codes		X	X		X	X						
Drainage Ordinances		X								X	X	
Historic Preservation Ordinance										X		
Subdivision Ordinance(s)	X	X	X	X	X	X				X	X	
Zoning Ordinances		X	X		X	X				X		
Maps												
Existing Land Use Map			X							X		
Infrastructure Map			X	X		X				X	X	
Zoning Map		X	X		X	X				X		
Flood-Related												
Flood Ordinance(s)			X		X	X				X		
Flood Insurance Rate Maps	X				X	X				X		
Repetitive Flood Loss List												
Elevation Certificates for Buildings												

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3.0 RISK ASSESSMENT

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Risk assessment is the process of evaluating the vulnerability of people, buildings and infrastructure in order to estimate the potential loss of life, personal injury, economic injury and property damage resulting from natural and man-made hazards. This section summarizes the results of the risk assessment conducted on the natural and man-made hazards in Macoupin County. The information contained in this section was gathered by evaluating local, state and federal records from the last 67 years.

This risk assessment identifies the natural and man-made hazards deemed most important to the County and includes a profile of each that identifies past occurrences, the severity or extent of the hazard, and the likelihood of future occurrences. It also provides a vulnerability analysis which identifies the impacts to public health and property, evaluates the assets of the participating jurisdictions (i.e., residential buildings, critical facilities and infrastructure) and estimates the potential impacts each natural hazard would have on the health and safety of the residents as well as buildings, critical facilities and infrastructure. Where applicable, the differences in vulnerability between participating jurisdictions are described.

One of the responsibilities of the Planning Committee was to review the natural and man-made hazards included in the original Plan and decide if additional hazards should be included in the Plan update. Over the course of the first two meetings, the Planning Committee members discussed their experiences with natural and man-made hazard events and reviewed information on various hazards.

After discussing the hazards, the Committee chose not to add any additional natural hazards (i.e., landslides, etc.) to those included in the original Plan. The topography of Macoupin County is not conducive to experiencing landslide problems due to its generally level to gently sloping nature and absence of major river valleys. The closest areas to Macoupin County where landslides problems have been identified are areas along steeper sloped river valleys to the west and southwest. The Committee also chose not to include wildfires in the Plan update due to their limited impact on the people and infrastructure within the County. Historical data indicates that wildfires have been virtually non-existent in the area. No documentation was found and none of the Planning Committee members could remember any of the events occurring.

The following identifies the hazards included in this updated Plan:

- severe storms (thunderstorms, hail, lighting & heavy rain)
- severe winter storms (snow, ice & extreme cold)
- excessive heat
- floods
- tornadoes
- drought
- mine subsidence
- earthquakes
- dams
- man-made hazards including:
  - hazardous substances (generation, transportation & storage/handling)
  - waste disposal
  - hazardous materials incidents
  - waste remediation
  - terrorism

The subsequent sections provide detailed information on each of the selected natural and man-made hazards. The sections are color coded and ordered by the frequency with which the natural hazard has previously occurred within the County, starting with severe storms (thunderstorms, hail, lightning and heavy rain). Each natural hazard section contains three subsections: identifying the hazard, profiling the hazard and assessing vulnerability.

3.1 SEVERE STORMS (THUNDERSTORMS, HAIL, LIGHTNING & HEAVY RAIN)

IDENTIFYING THE HAZARD

What is the definition of a severe storm?

The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) defines a "severe storm" as any thunderstorm that produces one or more of the following:

- winds with gust of 50 knots (58 mph) or greater;
- hail that is at least one inch in diameter (quarter size) or larger; and/or
- a tornado.

While severe storms are capable of producing deadly lightning, the NWS does not use lightning to define a severe storm. However, a discussion of lightning is included in this section because it is capable of causing extensive damage. For the purposes of this report, tornadoes and flooding are categorized as separate hazards and are not discussed under severe storms.

What is a thunderstorm?

A thunderstorm is a rain shower accompanied by lightning and thunder. An average thunderstorm is approximately 15 miles in diameter, affecting a relatively small area when compared to winter storms or hurricanes, and lasts an average of 30 minutes. Thunderstorms can bring heavy rain, damaging winds, hail, lightning and tornadoes.

There are four basic types of thunderstorms: single-cell, multi-cell, squall line, and supercell. The following provides a brief description of each.

Single-cell Thunderstorm

Single cell storms are small, weak storms that only last about ½ hour to an hour and are not usually considered severe. They are typically driven by heating on a summer afternoon. Occasionally a single cell storm will become severe, but only briefly. When this happens, it is called a pulse severe storm.

Multi-cell Thunderstorm

Multi-cell storms are the most common type of thunderstorms. A multi-cell storm is organized in clusters of at least two to four short-lived cells. Each cell usually lasts 30 to 60 minutes while the system as whole may persist for many hours. Multi-cell storms may produce hail, strong winds, brief tornadoes, and/or flooding.

Squall Line

A Squall line is a group of storms arranged in a line, often accompanied by "squalls" of high wind and heavy rain. The line of storms can be continuous or there can be gaps and breaks in the line. Squall lines tend to pass quickly and can be hundreds of miles long but are typically only 10 to 20 miles wide. A "bow echo" is a radar signature of a squall line that "bows out" as winds fall behind the line and circulation develops on either end.

<u>*Supercell Thunderstorm*</u>

Supercell storms are long-lived (greater than one hour) and highly organized storms that feed off a rising current of air (an updraft). The main characteristic that sets a supercell storm apart from other thunderstorm types is the presence of rotation in the updraft. The rotating updraft of a supercell (called a mesocyclone when visible on radar) helps a supercell storm produce extreme weather events. Supercell storms are potentially the most dangerous storm type and have been observed to generate the vast majority of large and violet tornadoes, as well as downburst winds and large hail.

Despite their size, all thunderstorms are dangerous and capable of threatening life and property. Of the estimated 100,000 thunderstorms that occur each year in the United States, roughly 10% are classified as severe.

What kinds of damaging winds are produced by a thunderstorm?

Aside from tornadoes, thunderstorms can produce straight-line winds. A straight-line wind is defined as any wind produced by a thunderstorm that is not associated with rotation. There are several types of straight-line winds including downdrafts, downbursts, microbursts, gust fronts and derechos.

Damage from straight-line winds is more common than damage from tornadoes and accounts for most thunderstorm wind damage. Straight-line wind speeds can exceed 87 knots (100 mph), produce a damage pathway extending for hundreds of miles and can cause damage equivalent to a strong tornado.

The NWS measures a storm's wind speed in knots or nautical miles. A wind speed of one knot is equal to approximately 1.15 miles per hour. **Figure 8** shows conversions from knots to miles per hour for various wind speeds.

Figure 8
Wind Speed Conversions

Knots (kts)	Miles Per Hour (mph)	Knots (kts)	Miles Per Hour (mph)
50 kts	58 mph	60 kts	69 mph
52 kts	60 mph	65 kts	75 mph
55 kts	63 mph	70 kts	81 mph
58 kts	67 mph	80 kts	92 mph

What is hail?

Hail is precipitation in the form of spherical or irregular-shaped pellets of ice that occur within a thunderstorm when strong rising currents of air (updrafts) carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice.

Hailstones grow by colliding with supercooled water drops. The supercooled water drops freeze on contact with ice crystals, frozen rain drops, dust, etc. Thunderstorms with strong updrafts continue lifting the hailstones to the top of the cloud where they encounter more supercooled water and continue to grow. Eventually the updraft can no longer support the weight of the hail or the updraft weakens and the hail falls to the ground.

In the United States, hail causes more than $1 billion in damages to property and crops annually. Hail has been known to cause injuries, although it rarely causes fatalities or serious injury.

How is the severity of a hail event measured?

The severity or magnitude of a hail event is measured in terms of the size (diameter) of the hailstones. The hail size is estimated by comparing it to known objects. **Figure 9** provides descriptions for various hail sizes.

Figure 9
Hail Size Descriptions

Hail Diameter (inches)	Description	Hail Diameter (inches)	Description
0.25 in.	pea	1.75 in.	golf ball
0.50 in.	marble/mothball	2.50 in.	tennis ball
0.75 in.	penny	2.75 in.	baseball
0.88 in.	nickel	3.00 in.	tea cup
1.00 in.	quarter	4.00 in.	grapefruit
1.50 in.	ping pong ball	4.50 in.	softball

Source: NOAA, National Severe Storm Laboratory.

Hail size can vary widely. Hailstones may be as small as 0.25 inches in diameter (pea-sized) or, under extreme circumstances, as large as 4.50 inches in diameter (softball-sized). Typically hail that is one (1) inch in diameter (quarter-sized) or larger is considered severe.

The severity of a hail event can also be measured or rated using the TORRO Hailstorm Intensity Scale. This scale was developed in 1986 by the Tornado and Storm Research Organisation of the United Kingdom. It measures the intensity or damage potential of a hail event based on several factors including: maximum hailstone size, distribution, shape and texture, numbers, fall speed and strength of the accompanying winds.

The Hailstorm Intensity Scale identifies ten different categories of hail intensity, H0 through H10. **Figure 10** gives a brief description of each category. This scale is unique because it recognizes that, while the maximum hailstone size is the most important parameter relating to structural damage, size alone is insufficient to accurately categorize the intensity and damage potential of a hail event.

It should be noted that the typical damage impacts associated with each intensity category reflect the building materials predominately used in the United Kingdom. These descriptions may need to be modified for use in other countries to take into account the differences in building materials typically used (i.e., whether roofing materials are predominately shingle, slate or concrete, etc.).

Figure 10
TORRO Hailstorm Intensity Scale

Intensity Category		Typical Hail Diameter millimeters (approx.)*	Typical Hail Diameter inches (approx.)*	Description	Typical Damage Impacts
H0	Hard Hail	5 mm	0.2”	pea	no damage
H1	Potentially Damaging	5-15 mm	0.2” – 0.6”	pea / mothball	slight general damage to plants, crops
H2	Significant	10-20 mm	0.4” – 0.8”	dime / penny	significant damage to fruit, crops, vegetation
H3	Severe	20-30 mm	0.8” – 1.2”	nickel / quarter	severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40 mm	1.0” – 1.6”	half dollar / ping pong ball	widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50 mm	1.2” – 2.0”	golf ball	wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60 mm	1.6” – 2.4”	golf ball / egg	bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75 mm	2.0” – 3.0”	egg / tennis ball	severe roof damage, risk of serious injuries
H8	Destructive	60-90 mm	2.4” – 3.5”	tennis ball / tea cup	severe damage to aircraft bodywork
H9	Super Hailstorms	75-100 mm	3.0” – 4.0”	tea cup / grapefruit	extensive structural damage, risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	> 100 mm	> 4.0”	softball	extensive structural damage, risk of severe or even fatal injuries to persons caught in the open

* Approximate range since other factors (i.e., number and density of hailstones, hail fall speed and surface wind speed) affect severity.

Source: Tornado and Storm Research Organisation, TORRO Hailstorm Intensity Scale Table.

What is lightning?

Lightning, a component of all thunderstorms, is a visible electrical discharge that results from the buildup of charged particles within storm clouds. It can occur from cloud-to-ground, cloud-to-cloud, within a cloud or cloud-to-air. The air near a lightning strike is heated to approximately 50,000°F (hotter than the surface of the sun). The rapid heating and cooling of the air near the lightning strike causes a shock wave that produces thunder.

Lightning on average causes 60 fatalities and 400 injuries annually in the United States. Most fatalities and injuries occur when people are caught outdoors in the summer months during the afternoons and evenings. In addition, lightning can cause structure and forest fires. Many of the wildfires in the western United States and Alaska are started by lightning. According to the NWS lightning strikes cost more than $1 billion in insured losses each year.

Are alerts issued for severe storms?

Yes. The NWS Weather Forecast Office in St. Louis, Missouri is responsible for issuing ***severe thunderstorm watches*** and ***warnings*** for Macoupin County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watch.** A severe thunderstorm watch is issued when conditions are possible in or near the watch area. Individuals should stay alert for the latest weather information and be prepared to take shelter.
- **Warning.** A severe thunderstorm warning is issued when a severe thunderstorm is approaching or occurring. Warnings indicate imminent danger to life and property for those who are in the path of the storm and individuals should seek safe shelter.

PROFILING THE HAZARD

When have severe storms occurred previously? What is the extent of these previous severe storms?

Figures 11, **12**, and **13** located at the end of this section, summarize the previous occurrences as well as the extent or magnitude of severe storm events recorded in Macoupin County. The severe storm events are separated into four categories: thunderstorms with damaging winds, hail, lightning and heavy rain. Severe storms are the most frequently occurring natural hazard in Macoupin County.

Thunderstorms with Damaging Winds

NOAA's Storm Events Database and Planning Committee member records were used to document 177 reported occurrences of thunderstorms with damaging winds in Macoupin County between 1970 and 2017. Of the 177 occurrences, 146 had reported wind speeds of 50 knots or greater. There were 31 occurrences, however, where the wind speed was not recorded.

Severe Storms Fast Facts – Occurrences

Number of recorded Thunderstorms with Damaging Winds (1970 – 2017): ***177***

Number of recorded Severe Hail Events (1955 – 2017): ***117***

Number recorded of Lightning Strike Events (2001 – 2017): ***6***

Highest Recorded Wind Speed: ***91 knots (May 20, 2013)***

Largest Hail Recorded: ***3.00 inches (April 9, 2015)***

Most Likely Month for Thunderstorms with Damaging Winds to Occur: ***May***

Most Likely Month for Severe Hail to Occur: ***May***

Most Likely Time for Thunderstorms with Damaging Winds to Occur: ***Afternoon/Early Evening***

Most Likely Time for Severe Hail to Occur: ***Afternoon***

The highest wind speed recorded in Macoupin County occurred in Mt. Olive on May 20, 2013 when winds reached 91 knots (105 mph) during a thunderstorm event. Thunderstorms with damaging winds have been *recorded* in every participating municipality within the County on multiple occasions, with exception of Royal Lakes. This does not indicate that thunderstorms with damaging winds have never occurred within Royal Lakes, it simply means that the events were not recorded.

Figure 14 charts the reported occurrences of thunderstorms with damaging winds in Macoupin County by month. Of the 177 events, 132 (75%) took place in April, May, June and July making this the peak period for thunderstorms with damaging winds in Macoupin County. Of those 132 events, 40 (30%) occurred during May, making this the peak month for thunderstorms with damaging winds.

Figure 14
Thunderstorms with Damaging Winds by Month
1970 – 2017

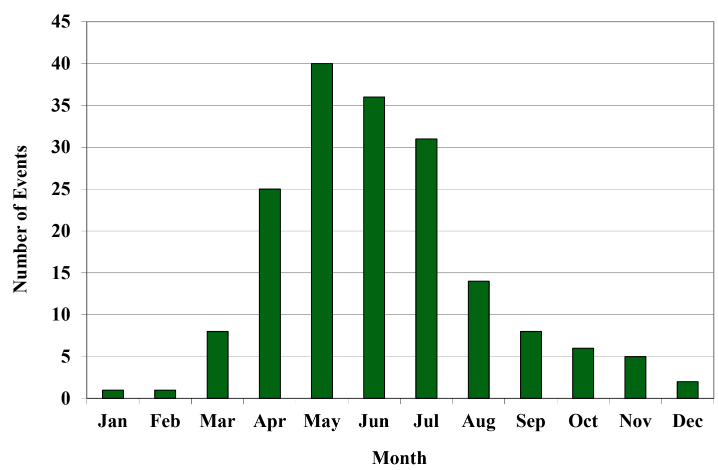
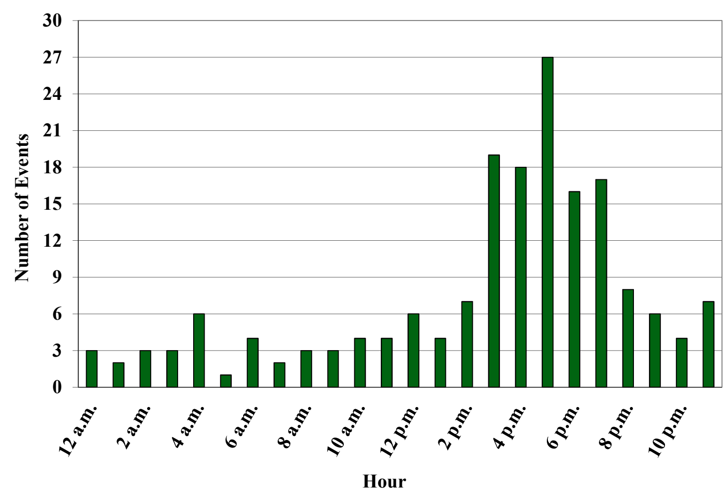


Figure 15 charts the reported occurrences of thunderstorms with damaging winds by hour. Of the 177 occurrences, approximately 79% of all thunderstorms with damaging winds occurred during the p.m. hours, with 105 of the events (76%) taking place between 3 p.m. and 9 p.m.

Figure 15
Thunderstorms with Damaging Winds by Hour
1970 – 2017



Hail

NOAA's Storm Events Database and Planning Committee member records were used to document 117 reported occurrences of severe storms with hail one (1) inch in diameter or greater in Macoupin County between 1955 and 2017. Of the 117 occurrences, 68 produced hailstones 1.50 inches or larger in diameter.

The largest hail stones documented in Macoupin County measured 3.00 inches in diameter (tea cup-sized) and fell on April 9, 2015 in Gillespie. Hail one (1) inch in diameter or greater has been *recorded* at least once in every participating municipality.

Figure 16 charts the reported occurrences of hail by month. Of the 117 occurrences, 96 (82%) took place in April, May and June making this the peak period for hail in Macoupin County. Of the 96 events, 44 (46%) occurred during May, making this the peak month for hail events.

Figure 16
Hail Events by Month
1955 – 2017

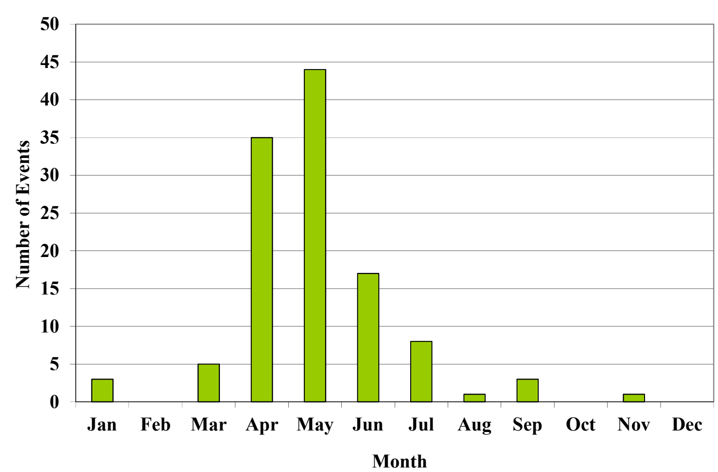
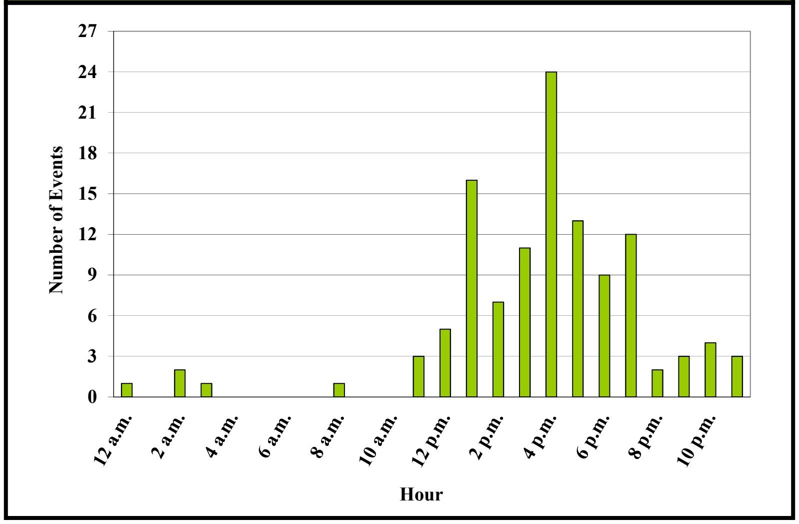


Figure 17 charts the reported occurrences of hail by hour. Approximately 93% of all the hail events occurred during the p.m. hours, with 77 of the events (73%) taking place between 1 p.m. and 7 p.m.

Lightning

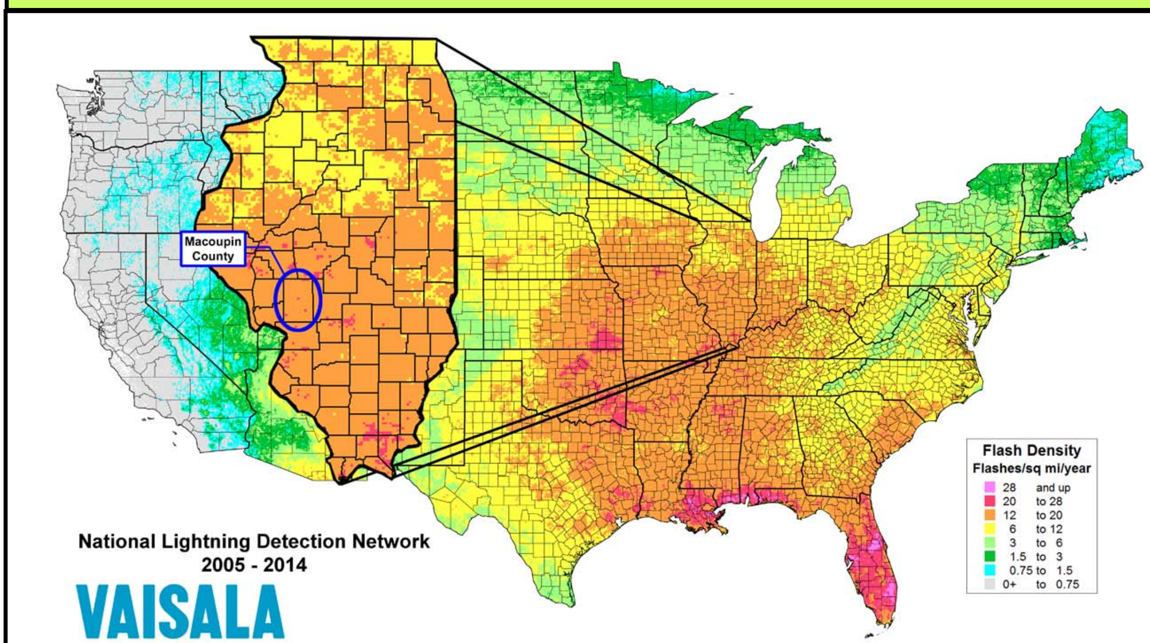
While lightning strike events occur regularly across central Illinois, NOAA's Storm Events Database only identified six recorded occurrences of lightning strikes in Macoupin County between 2001 and 2017. This is almost certainly due to the rural nature of the County. Three of the events took place during September while the remaining three events took place in different months between April and August. Five of the six events occurred during the p.m. hours.

Figure 17
Hail Events by Hour
1955 – 2017



According to data from Vaisala's National Lightning Detection Network, Macoupin County averaged at least 16 cloud-to-ground lightning flashes per square mile annually between 2005 and 2014. **Figure 18** illustrates the cloud-to-ground lightning flash density (number of cloud-to-ground flashes per square mile) by county for the continental United States. In comparison, Illinois averaged 14.1 cloud-to-ground lightning flashes per square mile between 2006 and 2015, ranking it eighth in the Country for lightning flash density.

Figure 18
Cloud-to-Ground Lightning Flash Density: Continental United States



Heavy Rain

While heavy rain events occur on a fairly regular basis across central Illinois, NOAA's Storm Events Database does not include any *recorded* heavy rain events for Macoupin County. This may be due in part to a lack of uniform reporting guidelines for heavy rain events.

What locations are affected by severe storms?

Severe storms affect the entire County. A single severe storm event will generally extend across the entire County and affect multiple locations. The *2013 Illinois Natural Hazard Mitigation Plan* prepared by the Illinois Emergency Management Agency (IEMA) classifies Macoupin County's hazard rating for severe storms as "severe." (IEMA's hazard rating system has five levels: low, guarded, elevated, high and severe.)

What is the probability of future severe storm events occurring?

Thunderstorms with Damaging Winds

Macoupin County has had 177 verified occurrences of thunderstorms with damaging winds between 1970 and 2017. With 177 occurrences over the past 48 years, Macoupin County should expect to experience at least three thunderstorm with damaging winds each year. There were nine years over the last 20 years where multiple (three or more) thunderstorms with damaging winds occurred. This indicates that the probability that multiple thunderstorms with damaging winds may occur during any given year within the County is 42%.

A Thunderstorm with damaging winds destroyed two storage sheds near Nilwood on May 19, 2017.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

Hail

There have been 117 verified occurrences of hail one (1) inch in diameter or greater between 1955 and 2017. With 117 occurrences over the past 63 years, Macoupin County should expect to experience at least one severe storm with hail each year. There were 17 years over the last 63 years where two or more hail events occurred. This indicates that the probability that more than one severe storm with hail may occur during any given year within the County is 27%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to severe storms?

Yes. All of Macoupin County is vulnerable to the dangers presented by severe storms due to the topography of the region and its location in relation to the movement of weather fronts across west-central Illinois. Since 2008, Macoupin County has recorded 59 thunderstorms with damaging winds and 40 severe storms with hail one (1) inch in diameter or greater.

Figure 19 details the number thunderstorms with damaging winds and hail events that were recorded in or near each participating municipality. Two of the six lightning strikes recorded occurred in a participating municipality, with both occurring in Staunton.

Figure 19
Verified Severe Storm Events by Participating Municipality

Participating Municipality	Number of Events	
	Thunderstorm & High Wind	Severe Hail
Benld	6	1
Brighton	14	11
Bunker Hill	19	24
Carlinville	29	15
Gillespie	12	9
Girard	13	2
Mt. Olive	6	6
Royal Lakes	1	1
Staunton	13	5
Virden	10	4
Wilsonville	3	1

Figure 20
Verified Severe Storm Events in Unincorporated Macoupin County

Unincorporated Area	Number of Events	
	Thunderstorm & High Wind	Severe Hail
Atwater	1	2
Beaver Dam State Park	2	1
Comer	1	1
Hettick	1	0
Hornsby	1	1
McVey	1	0
Otter Lake	0	1
Piasa	3	0
Plainview	4	0
Sunset Lake	0	2
Womac	5	2
Woodburn	6	7

Of the participating municipalities, Carlinville and Bunker Hill have had more recorded occurrences of thunderstorms with damaging winds and the greatest number of recorded hail events than any of the other municipalities.

Figure 20 details the number of thunderstorms with damaging winds and hail events that were recorded in or near unincorporated areas of Macoupin County. One of the six recorded lightning strikes occurred in unincorporated Macoupin County at Sunset Lake.

What impacts resulted from the recorded severe storms?

Severe storms as a whole have caused an estimated $6,506,000 in recorded property damages. The following provides a breakdown of impacts by category.

Areas in and around Girard sustained damage as a result of a May 25, 1989 thunderstorm with damaging winds. Several cars were destroyed when trees fell onto them.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

While severe summer storms frequently occur in Macoupin County, the number of injuries and fatalities is low. Carlinville area Hospital in Carlinville as well as hospitals in Carrollton (Greene County), Jerseyville (Jersey County), Litchfield and Hillsboro (Montgomery County) and Jacksonville (Morgan County) as well as regional centers in Springfield (Sangamon County) and the Metro East St. Louis area (Madison County) are equipped to provide care to persons injured during a severe storm. Consequently, the risk or vulnerability to public health and safety from severe storms is low.

Appendix J contains select historic news articles and photographs provided Macoupin County EMA Coordinator James Pitchford that show the extent of the property damage sustained during the May 25, 1989 severe storm event.

Thunderstorms with Damaging Winds

Data obtained from NOAA's Storm Events Database and Planning Committee member records indicates that between 1970 and 2017, 14 of the 177 thunderstorms with damaging winds caused $246,000 in property damage. Damage information was either unavailable or none was recorded for the remaining 163 reported occurrences.

NOAA's Storm Events Database documented three injuries as a result of two separate thunderstorm with damaging winds events. The following provides a brief description of each event.

- On May 25, 1989 two people sustained minor injuries when a thunderstorm with straight-line winds overturned and destroyed their mobile home in Girard.
- The driver of a semi suffered minor injuries on May 23, 2011 when a thunderstorm with damaging winds blew his semi off Interstate 55 just south of the Staunton Exit and into a ditch.

Severe Storms Fast Facts – Impacts/Risk

Thunderstorms with Damaging Winds Impacts
- Total Property Damage: ***$246,000***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Total Crop Damage: ***n/a***
- Injuries: ***3***
- Fatalities: ***n/a***

Severe Hail Impacts
- Total Property Damage: ***$6,160,000***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Total Crop Damage: ***n/a***
- Injuries: ***6***
- Fatalities: ***n/a***

Lightning Strike Impacts
- Total Property Damage: ***$100,000***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Total Crop Damage: ***n/a***
- Injuries: ***n/a***
- Fatalities: ***3***

Severe Storms Risk/Vulnerability to:
- Public Health & Safety: ***Low***
- Buildings/Infrastructure/Critical Facilities: ***Medium/High***

* Infrastructure/Critical Facilities Damage totals are included in the Total Property Damage amounts.

Hail

Data obtained from NOAA's Storm Events Database and Planning Committee member records indicates that between 1955 and 2017, five of the 117 hail events caused $6,160,000 in property damage. Damage information was either unavailable or none was recorded for the remaining 112 reported occurrences.

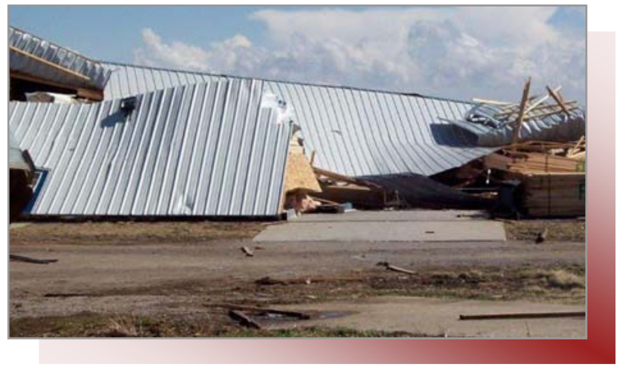
NOAA's Storm Events Database documented six injuries as a result of a May 25, 1989 hail event in Carlinville. Detailed information on the type and severity of the injuries was unavailable.

Lightning

Data obtained from NOAA's Storm Events Database indicates that between 2001 and 2017 one lightning strike event caused $100,000 in property damage. Damage information was either unavailable or none was recorded for the remaining five reported occurrences.

NOAA's Storm Events Database documented three fatalities as a result of three separate lightning strike events. The following provides a brief description of each event.

- On April 10, 2001 a 49-year old woman as struck and killed by lightning while working outside her home at Sunset Lake west of Girard. The woman was planting flowers and had knelt down at the edge of the Lake to dip some water out when the lightning struck.
- A man was struck and killed by lightning while working on the roof in the Sawyerville area on September 6, 2001. A group of workers saw the storm approaching and were climbing off the roof, however the last man did not make it off in time.
- On September 19, 2015 an 89-year old man died in his home from smoke inhalation due to a fire that started as the result of a lightning strike. The man was found in the rubble of the home which was completely destroyed by the fire.



A Thunderstorm with damaging winds destroyed several outbuildings at a farm west of Carlinville in 2013.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

What other impacts can result from severe storms?
In Macoupin County, the greatest risk to health and safety from severe storms is vehicle accidents. Hazardous driving conditions resulting from severe storms (i.e., wet pavement, poor visibility, high winds, etc.) can contribute to accidents that result in injuries and fatalities. Traffic accident data assembled by the Illinois Department of Transportation from 2011 through 2015 indicates that wet road surface conditions were present for 10.8% to 15.0% of all crashes recorded annually in the County.

While other circumstances cause wet road surface conditions (i.e., melting snow, condensation, light showers, etc.), law enforcement officials agree that hazardous driving conditions caused by severe storms add to the number of crashes. **Figure 21** provides a breakdown by year of the number of crashes and corresponding injuries and fatalities that occurred when wet road surface conditions were present.

Figure 21
Severe Weather Crash Data for Macoupin County

Year	Total # of Crashes	Presence of Wet Road Surface Conditions		
		# of Crashes	# of Injuries	# of Fatalities
2011	793	119	37	0
2012	732	79	16	1
2013	644	70	24	0
2014	760	97	32	1
2015	759	111	27	0
Total:	**3,688**	**476**	**136**	**2**

Source: Illinois Department of Transportation.

Are existing buildings, infrastructure and critical facilities vulnerable to severe storms?

Yes. All existing buildings, infrastructure and critical facilities located in Macoupin County and the participating municipalities are vulnerable to damage from severe storms. Structural damage to buildings is a relatively common occurrence with severe storms. Damage to roofs, siding, awnings and windows can occur from hail, flying and falling debris and high winds. Lightning strikes can damage electrical components and equipment (i.e., appliances, computers etc.) and can cause fires that consume buildings. If the roof is compromised or windows are broken, rain can cause additional damage to the structure and contents of a building.

Infrastructure and critical facilities tend to be just as vulnerable to severe storm damage as buildings. The infrastructure and critical facilities that are the most vulnerable to severe storms are related to power distribution and communications. High winds, lightning and flying and falling debris have the potential to cause damage to communication and power lines; power substations; transformers and poles; and communication antennas and towers.

A 2013 severe storm brought down power lines west of Carlinville.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

The damage inflicted by severe storms often leads to disruptions in communication and creates power outages. Depending on the damage, it can take anywhere from several hours to several days to restore service. Power outages and disruptions in communications can impair vital services, particularly when backup power generators are not available. Many of the participating municipalities acknowledged the need for emergency backup generators to allow continued operation of critical facilities such as municipal buildings, police and fire stations, warming/cooling centers, storm shelters and lift stations.

In addition to affecting power distribution and communications, debris and flooding from severe storms can block state and local roads hampering travel. When transportation is disrupted, emergency and medical services are delayed, rescue efforts are hindered and government services can be affected.

Based on the frequency with which severe storms occur in Macoupin County, the amount of property damage previously reported and the potential for disruptions to power distribution and communication; the risk or vulnerability to buildings, infrastructure and critical facilities from severe storms is medium to high.

Are future buildings, infrastructure and critical facilities vulnerable to severe storms?

Yes and No. While four of the participating municipalities have building codes in place that will likely help lessen the vulnerability of new buildings and critical facilities to damage from severe storms, the County and the other seven municipalities do not. In addition, infrastructure such as new communication and power lines will continue to be vulnerable to severe storms as long as they are located above ground. High winds, lightning and flying and falling debris can disrupt power and communication. Steps to bury all new lines would eliminate the vulnerability, but this action would be cost prohibitive in most areas.

What are the potential dollar losses to vulnerable structures from severe storms?

Unlike other natural hazards, such as tornadoes, there are no standard loss estimation models or methodologies for severe storms. With only 20 of the 300 recorded events listing property damage numbers for all categories of severe storms, there is no way to accurately estimate future potential dollar losses. Since all existing structures within Macoupin County are vulnerable to damage, it is highly probable that there will be future dollar losses from severe storms.

Figure 11
(Sheet 1 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
6/20/1970	3:20 p.m.	Scottville^	n/a	n/a	n/a	n/a	n/a	
3/14/1971	9:10 p.m.	Scottville^	n/a	n/a	n/a	n/a	n/a	
11/15/1973	4:45 a.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
4/18/1975	6:10 p.m.	Scottville	56 kts	n/a	n/a	n/a	n/a	
3/26/1976	10:30 p.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
3/28/1977	10:13 a.m.	Palmyra	n/a	n/a	n/a	n/a	n/a	
4/7/1980	11:15 p.m.	Shipman	n/a	n/a	n/a	n/a	n/a	
7/5/1980	2:00 a.m.	Medora	n/a	n/a	n/a	n/a	n/a	- a falling tree crushed a pickup truck - cemetery tombstones were also damaged by falling trees
9/16/1980	5:00 p.m.	Royal Lakes Carlinville^	n/a	n/a	n/a	n/a	n/a	<u>Royal Lakes</u> - 2 mobile homes were destroyed and 5 were overturned - power failures occurred
6/7/1982	9:00 a.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
8/5/1983	4:05 p.m.	Bunker Hill	n/a	n/a	n/a	n/a	n/a	
4/29/1984	7:10 p.m.	Carlinville^	50 kts	n/a	n/a	n/a	n/a	
4/29/1984	8:00 p.m.	Carlinville^	n/a	n/a	n/a	n/a	n/a	
4/23/1985	5:00 p.m.	Gillespie	52 kts	n/a	n/a	n/a	n/a	
7/28/1986	1:15 a.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
7/6/1987	3:00 p.m.	Womac^	56 kts	n/a	n/a	n/a	n/a	
7/9/1987	5:21 p.m.	Carlinville	70 kts	n/a	n/a	n/a	n/a	
5/8/1988	5:15 p.m.	Mt. Olive	n/a	n/a	n/a	n/a	n/a	
10/17/1988	11:00 a.m.	Gillespie	n/a	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 2 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/25/1989	12:35 a.m.	Girard	n/a	2	0	$70,000	n/a	Event Description Provided Below ***Appendix J*** contains historic news articles and photographs

<u>Oak Leaf Country Club</u>
- the new bridge sustained tree damage
- 2 individuals (the Country Club's caretakers) sustained minor injuries when their mobile home was overturned and destroyed by straight-line winds

<u>Girard area</u>
- a two-story brick home sustained major structural damage when its roof was momentarily lifted
- a 25-foot section of hedge row was uprooted
- two small animal outbuildings were flattened

<u>Girard</u>
- winds blew out the block foundation of a garage
- windows were shattered in a home
- the roof of a mobile home was damaged
- a central air conditioning unit was moved at another home
- Barrett Park playground equipment was damaged by fallen trees
- a 40-foot refrigerated van was overturned

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/25/1989	1:25 p.m.	Girard	n/a	0	0	n/a	n/a	a 12' x 30' section of roof was stripped down to the rafters at the Girard Fire House
5/25/1990	9:50 p.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
12/14/1990	10:30 p.m.	Carlinville^	n/a	n/a	n/a	n/a	n/a	
10/4/1991	6:37 p.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
7/2/1992	4:10 p.m.	Bunker Hill	n/a	n/a	n/a	n/a	n/a	
7/2/1992	4:50 p.m.	Palmyra	n/a	n/a	n/a	n/a	n/a	
7/2/1992	5:54 p.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
7/2/1992	7:30 p.m.	Brighton	52 kts	n/a	n/a	n/a	n/a	
7/2/1992	7:50 p.m.	Carlinville	n/a	n/a	n/a	n/a	n/a	
7/2/1992	8:10 p.m.	Gillespie	n/a	n/a	n/a	n/a	n/a	
7/11/1992	7:50 p.m.	Shipman^	n/a	n/a	n/a	n/a	n/a	
Subtotal:				**2**	**0**	**$70,000**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11 (Sheet 3 of 21) Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County 1970 – 2017								
Date(s)	**Start Time**	**Location(s)**	**Magnitude (Knots)**	**Injuries**	**Fatalities**	**Property Damage**	**Crop Damage**	**Description**
6/16/1994	6:15 p.m.	Mt. Olive	n/a	n/a	n/a	n/a	n/a	winds blew down numerous power lines and several trees
6/23/1994	5:40 p.m.	Staunton	n/a	n/a	n/a	n/a	n/a	winds blew down a large tree as well as some tree limbs
11/20/1994	7:10 p.m.	Beaver Dam State Park	n/a	n/a	n/a	$900	n/a	- large trees were downed - a sign was damage
6/8/1995	6:25 a.m.	Brighton	52 kts	n/a	n/a	n/a	n/a	winds broke off numerous tree limbs
6/8/1995	6:38 a.m.	Brighton	65 kts	n/a	n/a	$3,500	n/a	- a tree fell and completely demolished a bandstand - wind gust knocked down numerous trees, power poles and power lines
6/8/1995	6:45 a.m.	Girard	65 kts	n/a	n/a	$400	n/a	wind gust knocked down numerous trees, power poles and power lines
6/8/1995	6:58 a.m.	Mt. Olive	65 kts	n/a	n/a	$3,300	n/a	- wind gust knocked down numerous trees, power poles and power lines - a tractor-trailer was blown off the road along Interstate 55
6/20/1995	7:00 p.m.	Girard^	n/a	n/a	n/a	$12,500	n/a	- five to six homes were damaged - power lines were blown down
7/25/1995	8:15 p.m.	Palmyra	n/a	n/a	n/a	$200	n/a	large trees were blown down
7/25/1995	8:45 p.m.	Womac	n/a	n/a	n/a	$200	n/a	large trees were blown down
5/8/1996	11:55 a.m.	Virden	45 kts	n/a	n/a	$15,000	n/a	wind gust blew 2 mobile homes off their foundations in the Whispering Pines Mobile Home Park
4/30/1997	1:30 p.m.	Medora^	52 kts	n/a	n/a	n/a	n/a	winds damaged a few outbuildings
Subtotal:				**0**	**0**	**$36,000**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 4 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
3/27/1998	6:00 p.m.	Chesterfield^	55 kts	n/a	n/a	n/a	n/a	wind gusts destroyed a storage building and blew part of the roof off a barn
4/13/1998	6:30 p.m.	Girard	68 kts	n/a	n/a	$20,000	n/a	a microburst caused damage in a six to eight block area of the City - power lines were downed - swing sets were toppled - fallen trees and limbs caused damage to several homes and vehicles
5/22/1998	3:25 a.m.	Carlinville	55 kts	n/a	n/a	n/a	n/a	wind gusts downed trees and some power lines
5/22/1998	3:30 a.m.	Gillespie	56 kts	n/a	n/a	n/a	n/a	wind gusts downed trees and some power lines
5/22/1998	3:45 a.m.	Staunton	56 kts	n/a	n/a	n/a	n/a	wind gusts downed trees and some power lines
5/22/1998	8:15 a.m.	Carlinville	55 kts	n/a	n/a	n/a	n/a	winds downed a few trees, some large limbs and a few power lines
5/22/1998	8:15 a.m.	Palmyra	55 kts	n/a	n/a	n/a	n/a	winds downed a few trees, some large limbs and a few power lines
6/12/1998	4:05 p.m.	Brighton	52 kts	n/a	n/a	n/a	n/a	winds downed trees and some power lines
6/12/1998	4:08 p.m.	Bunker Hill	52 kts	n/a	n/a	n/a	n/a	winds downed trees and some power lines
6/18/1998	7:55 p.m.	Girard	51 kts	n/a	n/a	n/a	n/a	
6/18/1998	8:16 p.m.	Girard	53 kts	n/a	n/a	n/a	n/a	wind gusts downed some power lines
7/22/1998	4:30 p.m.	Atwater	56 kts	n/a	n/a	n/a	n/a	wind gust damaged trees and outbuildings
Subtotal:				**0**	**0**	**$20,000**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 5 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
11/10/1998	4:36 a.m.	Carlinville	56 kts	n/a	n/a	n/a	n/a	wind gusts downed trees and power lines blocking a few roads
11/10/1998	4:45 a.m.	Nilwood	58 kts	n/a	n/a	$50,000	n/a	winds damaged a grain elevator, some mobile homes, outbuildings and the roof of the Town Hall
6/1/1999	6:45 p.m.	Bunker Hill	60 kts	n/a	n/a	n/a	n/a	wind gusts downed some trees
8/23/1999	7:25 p.m.	Palmyra	55 kts	n/a	n/a	n/a	n/a	wind gusts downed some power lines
4/20/2000	4:25 a.m.	Modesto	50 kts	n/a	n/a	n/a	n/a	debris picked up by wind gusts broke some windows at a home
6/20/2000	8:45 p.m.	Staunton	52 kts	n/a	n/a	n/a	n/a	winds downed power lines
6/23/2000	5:53 p.m.	Virden	56 kts	n/a	n/a	n/a	n/a	winds downed trees and power lines
6/24/2000	2:15 p.m.	Carlinville	56 kts	n/a	n/a	n/a	n/a	winds downed power lines on the north side of the City
7/5/2000	4:25 p.m.	Carlinville[^]	52 kts	n/a	n/a	n/a	n/a	the local power company reported power lines down just west of the City
7/18/2000	7:20 p.m.	Bunker Hill	51 kts	n/a	n/a	n/a	n/a	
8/7/2000	7:00 p.m.	Brighton[^]	51 kts	n/a	n/a	n/a	n/a	winds downed a large tree
8/22/2000	8:50 p.m.	Modesto[^]	55 kts	n/a	n/a	n/a	n/a	winds blew down numerous trees and power lines
8/22/2000	9:00 p.m.	Virden	55 kts	n/a	n/a	n/a	n/a	- winds blew down numerous trees and power lines - one was damaged by a downed tree - a grain bin was blown about 700 feet
8/23/2000	10:50 p.m.	Bunker Hill	55 kts	n/a	n/a	n/a	n/a	winds downed large trees
Subtotal:				**0**	**0**	**$50,000**	**$0**	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 6 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
9/9/2001	3:20 p.m.	Shipman	55 kts	n/a	n/a	n/a	n/a	- wind gusts downed an estimated 30 trees and some power lines - virtually all of the Town was without power for a while
9/6/2001	3:30 p.m.	Bunker Hill	55 kts	n/a	n/a	n/a	n/a	- wind gusts downed some trees - minor roof damage was reported
9/6/2001	4:00 p.m.	Carlinville	55 kts	n/a	n/a	n/a	n/a	wind gust downed some trees and power lines
10/24/2001	12:05 p.m.	Bunker Hill	51 kts	n/a	n/a	n/a	n/a	
10/24/2001	12:20 p.m.	Benld^	55 kts	n/a	n/a	n/a	n/a	winds damaged signs along Interstate 55
10/24/2001	12:23 p.m.	Mt. Olive	55 kts	n/a	n/a	n/a	n/a	winds downed trees and power lines
4/19/2002	5:45 p.m.	Chesterfield^	52 kts	n/a	n/a	n/a	n/a	winds severely damaged a barn and downed trees northeast of the Village
4/19/2002	6:10 p.m.	Carlinville^	52 kts	n/a	n/a	n/a	n/a	a home was damaged by a downed tree west of the City
4/19/2002	6:20 p.m.	Eagarville^	52 kts	n/a	n/a	n/a	n/a	winds downed power poles and lines
6/11/2002	3:10 p.m.	Carlinville	60 kts	n/a	n/a	n/a	n/a	winds downed trees and several billboards
6/11/2002	3:15 p.m.	Womac^	55 kts	n/a	n/a	n/a	n/a	
6/11/2002	3:15 p.m.	Brighton	55 kts	n/a	n/a	n/a	n/a	winds downed trees
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 7 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/18/2004	3:05 p.m.	Bunker Hill	55 kts	n/a	n/a	n/a	n/a	wind gusts downed some trees and power lines
5/24/2004	11:00 p.m.	Scottville^	60 kts	n/a	n/a	n/a	n/a	- the roof of a barn was blown off - a grain bin was destroyed
5/24/2004	11:05 p.m.	Modesto	60 kts	n/a	n/a	n/a	n/a	- 16 power poles were downed, with lines across IL Rte. 111 - several trees were downed blocking roads in the Village
5/24/2004	11:05 p.m.	Modesto^	60 kts	n/a	n/a	n/a	n/a	
5/24/2004	11:30 p.m.	Staunton	55 kts	n/a	n/a	n/a	n/a	downed trees and power lines blocked IL Rte. 4 in the City
5/24/2004	11:30 p.m.	Virden	55 kts	n/a	n/a	n/a	n/a	a tree was blown onto a house
5/27/2004	4:52 p.m.	Shipman	55 kts	n/a	n/a	n/a	n/a	winds downed several power lines
5/30/2004	5:00 p.m.	Bunker Hill	55 kts	n/a	n/a	n/a	n/a	- winds downed some trees and large tree limbs - a pickup truck was damaged by a large tree limb
5/31/2004	6:52 p.m.	Modesto	55 kts	n/a	n/a	n/a	n/a	the roof was blown off a shed
5/31/2004	6:55 p.m.	Modesto^	55 kts	n/a	n/a	n/a	n/a	a large utility building was destroyed
5/31/2004	7:00 p.m.	Nilwood^	55 kts	n/a	n/a	n/a	n/a	a machine shed was destroyed northwest of the Town
5/31/2004	7:00 p.m.	Virden^	55 kts	n/a	n/a	n/a	n/a	winds downed power lines south of the City
5/31/2004	7:01 p.m.	Gillespie	55 kts	n/a	n/a	n/a	n/a	winds downed power lines
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 8 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
7/5/2004	9:05 a.m.	Brighton	52 kts	n/a	n/a	n/a	n/a	winds downed a large tree
8/25/2004	5:20 p.m.	Plainview^	55 kts	n/a	n/a	n/a	n/a	10 trees were damaged at a home with some pushed over and others with large branches broken
8/25/2004	5:25 p.m.	Gillespie^	55 kts	n/a	n/a	n/a	n/a	winds pushed over soybeans in a field
6/8/2005	3:00 p.m.	Medora	54 kts	n/a	n/a	n/a	n/a	- half of the roof shingles on the Post Office were blown off - the roof a home along IL Rte. 111 was damaged - a tree limb crashed through the window of a home - a large bay door at H&H Auto was blown in - a semi-trailer was blown over in a parking lot
6/8/2005	3:20 p.m.	Sawyerville	54 kts	n/a	n/a	n/a	n/a	winds damaged the roof of the Post Office
6/10/2005	3:15 p.m.	Gillespie	55 kts	n/a	n/a	n/a	n/a	- wind gust toppled the concession stand and crow's nest at the High School football field - some tree and large tree limbs took out power lines resulting in half the town losing power for several hours
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 9 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
6/13/2005	5:00 p.m.	Bunker Hill	60 kts	n/a	n/a	n/a	n/a	winds downed trees, power lines and blew shingles off of roofs
6/13/2005	5:05 p.m.	Wilsonville^	60 kts	n/a	n/a	n/a	n/a	winds downed trees and crops west of the Village
6/13/2005	5:15 p.m.	Benld	55 kts	n/a	n/a	n/a	n/a	winds downed trees, power lines and caused minor roof damage
8/13/2005	4:05 p.m.	Bunker Hill	55 kts	n/a	n/a	n/a	n/a	winds downed large tree limbs and power lines
8/13/2005	4:10 p.m.	Benld	55 kts	n/a	n/a	n/a	n/a	winds downed large tree limbs and power lines
9/19/2005	6:25 p.m.	Nilwood	57 kts	n/a	n/a	n/a	n/a	winds downed several large trees
4/2/2006	4:20 p.m.	Medora^	55 kts	n/a	n/a	n/a	n/a	a couple of mobile homes were damaged and outbuildings destroyed near the Village
4/2/2006	4:21 p.m.	Brighton	55 kts	n/a	n/a	n/a	n/a	winds downed some power poles and a couple of large trees
5/24/2006	2:55 p.m.	Virden^	61 kts	n/a	n/a	n/a	n/a	a microburst occurred east of the City along Thomasville Road - the roof of a barn and one home were partially blown off and one machine shed was damaged - numerous trees were either blown over or had numerous limbs broken
5/24/2006	4:05 p.m.	Shipman^	52 kts	n/a	n/a	n/a	n/a	several trees were blown down on Shipman Road northeast of town
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 10 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
6/22/2006	4:55 p.m.	Staunton	55 kts	0	0	n/a	n/a	- winds damaged 50 to 100 trees - 4 to 6 homes sustained some kind of structural damage due to the fallen trees and tree limbs - several power lines were blown down leaving 60 to 80 homes without power for a time
7/19/2006	5:20 p.m.	Medora^	55 kts	n/a	n/a	n/a	n/a	- numerous trees and tree limbs were blown down - several corn field were damaged
7/19/2006	5:25 p.m.	Carlinville	55 kts	n/a	n/a	n/a	n/a	winds blew down numerous tree limbs and power lines
7/19/2006	5:35 p.m.	Bunker Hill^	80 kts	n/a	n/a	n/a	n/a	a full-sized pickup truck was blown into a ditch
7/19/2006	5:40 p.m.	Brighton	52 kts	n/a	n/a	n/a	n/a	several trees and power lines were blown down
7/19/2006	5:45 p.m.	Bunker Hill	77 kts	n/a	n/a	n/a	n/a	numerous trees and tree limbs were blown down
6/1/2007	6:55 p.m.	Bunker Hill^	56 kts	n/a	n/a	n/a	n/a	a couple of power poles were reported down southeast of the City
8/16/2007	10:25 a.m.	Womac^	52 kts	n/a	n/a	n/a	n/a	numerous tree limbs were blown down
1/7/2008	6:35 p.m.	Modesto	52 kts	n/a	n/a	n/a	n/a	- numerous large tree limbs were blown down around the Village - several power lines were blown down, a few of which blocked IL Rte. 111 for a time
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 11 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/2/2008	8:20 a.m.	Staunton	56 kts	n/a	n/a	$50,000	n/a	- wind gusts downed large tree limbs, a few power lines and blew roof shingles off homes - a garage at a new home under construction was blown apart - a few cars suffered minor damage from falling tree limbs
5/31/2008	6:50 p.m.	Wilsonville	52 kts	n/a	n/a	$10,000	n/a	winds took the roof off a machine shed and tore some roof shingles and siding off a home
6/27/2008	1:20 p.m.	Mt. Clare Mt. Clare^ Gillespie^ Gillespie	56 kts	n/a	n/a	n/a	n/a	- wind blew down several trees and numerous tree limbs *Mt. Clare/Gillespie* - winds blew down several power lines and power poles
6/27/2008	1:45 p.m.	Carlinville	56 kts	n/a	n/a	n/a	n/a	winds blew down several trees, numerous tree limbs and power lines
7/12/2008	3:10 p.m.	Carlinville	52 kts	n/a	n/a	n/a	n/a	- numerous tree limbs were blown down - a 55-foot tree was blown over crashing through a fence and into a backyard - several power lines were blown down
Subtotal:				**0**	**0**	**$60,000**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 12 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
8/5/2008	5:35 p.m.	Piasa^ Shipman^ Woodburn^	65 kts	n/a	n/a	n/a	n/a	a microburst occurred just south of Shipman - numerous trees, tree limbs and power lines were blown down - a barn door blew off
8/5/2008	5:40 p.m.	Woodburn^ Bunker Hill Bunker Hill^ Staunton^	65 kts	n/a	n/a	n/a	n/a	a microburst occurred just south of Bunker Hill - numerous trees, tree limbs and power lines were blown down - small outbuildings and barns sustained minor damage *Bunker Hill area* - 3 of 4 roofs were torn off the relatively new dugouts at the High School baseball fields - a house was damaged by a fallen tree south of Bunker Hill *Woodburn* - a mobile home was damaged by two fallen trees southwest of Woodburn
8/5/2008	5:45 p.m.	Gillespie Eagarville^ Mt. Clare^ Benld^ Lake Ka-Ho^ Mt. Olive	61 kts	n/a	n/a	n/a	n/a	- numerous trees, tree limbs and power lines were blown down *Gillespie* - a large tree fell onto a house causing moderate damage
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 13 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
12/27/2008	12:30 p.m.	Girard	61 kts	n/a	n/a	$10,000	n/a	- winds blew down numerous large tree limbs with a few falling onto homes causing minor roof damage - part of the roof of a mobile home was blown off - an old barn was destroyed and 2 grain bins were damaged - Macoupin County EMA Coordinator identified $10,000 in damages sustained by this event
3/8/2009	10:30 a.m.	Comer^ Carlinville^	52 kts	n/a	n/a	n/a	n/a	numerous power poles were blown down along Bates Rd. & Lampie Rd.
3/8/2009	10:35 a.m.	Standard City^ Nilwood^ McVey^	56 kts	n/a	n/a	n/a	n/a	- several outbuildings and grain bins were destroyed west of Standard City - several power poles were snapped off along Standard City Rd. - 3 empty rail cars were blown off the train tracks north of Standard City - several small outbuildings were damaged or destroyed and power lines were downed near McVey - winds blew down a large tree at the intersection of Boston Chapel Rd. and Waggoner Rd.
Subtotal:				**0**	**0**	**$10,000**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 14 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/13/2009	10:40 p.m.	Gillespie	70 kts	n/a	n/a	n/a	n/a	a downburst wind swath caused widespread damage through the center of the City, directly south of an EF0 tornado track - numerous building had roof damage - many trees were blown over or snapped off - the Mayor confirmed the types of damages sustained
6/2/2009	2:35 p.m.	Carlinville	52 kts	n/a	n/a	n/a	n/a	winds blew down a small shed
6/19/2009	4:35 p.m.	Woodburn^	52 kts	n/a	n/a	n/a	n/a	several large tree limbs were blown down
8/19/2009	2:25 p.m.	Girard	52 kts	n/a	n/a	n/a	n/a	numerous large tree limbs and power lines were blown down through the City
5/3/2010	4:24 p.m.	Bunker Hill^ Dorchester^	52 kts	n/a	n/a	n/a	n/a	- winds blew down 15 power poles onto IL Rte. 159 just north of Mansholt Rd. closing the road for approx. 12 hours while the poles were replaced - power poles were blown down north of IL Rte. 138 on Whitefield Rd.
6/2/2010	1:15 a.m.	Brighton	52 kts	n/a	n/a	n/a	n/a	winds blew down several trees
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 15 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
7/19/2010	11:40 a.m.	Standard City^	65 kts	n/a	n/a	n/a	n/a	- winds destroyed an 80 by 60 foot pole shed near the intersection of 2400N & 1900E - debris from the shed took down power lines and became lodged in a home just east of the shed
4/15/2011	3:44 p.m.	Girard	52 kts	n/a	n/a	n/a	n/a	winds blew down a very large tree limb which landed on a house causing minor roof and siding damage
4/19/2011	4:57 p.m.	Nilwood^	56 kts	n/a	n/a	n/a	n/a	- winds blew the roofs off 2 sheds - several pieces of wood from the sheds were sticking out of the mud in a nearby corn field
4/19/2011	5:00 p.m.	Virden	52 kts	n/a	n/a	n/a	n/a	- winds blew down several large tree limbs - a barn on Union St. had its roof blown off - North Mac High School sustained minor roof and water damage
4/19/2011	5:35 p.m.	Shipman	52 kts	n/a	n/a	n/a	n/a	
4/19/2011	5:40 p.m.	Plainview	56 kts	n/a	n/a	n/a	n/a	winds blew down a large tree
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 16 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/23/2011	12:10 p.m.	Staunton^	56 kts	1	0	n/a	n/a	- winds blew over a semi in the north bound lanes of Interstate 55 just south of the Staunton; the semi ended up in a ditch about 50 feet from the highway - the driver sustained minor injuries
6/17/2011	11:45 p.m.	Modesto^	52 kts	n/a	n/a	n/a	n/a	winds blew down numerous tree limbs
9/3/2011	5:15 p.m.	Staunton	56 kts	n/a	n/a	n/a	n/a	- wind blew down several tree limbs and power lines - part of the roof of a barn was blown off
2/29/2012	2:35 a.m.	Womac^	56 kts	n/a	n/a	n/a	n/a	winds caused minor roof damage and blew down a couple of small sheds
9/5/2012	7:05 a.m.	Girard Girard^ Nilwood^ Nilwood	56 kts	n/a	n/a	n/a	n/a	*Girard* - winds blew down several trees *Nilwood* - winds snapped a power pole off at its base knocking out power to the town
9/5/2012	7:45 a.m.	Staunton	56 kts	n/a	n/a	n/a	n/a	winds blew down several trees
4/10/2013	3:12 p.m.	Woodburn^	52 kts	n/a	n/a	n/a	n/a	winds snapped off the tops of a couple of trees along Brighton Bunker Hill Rd.
4/10/2013	7:15 p.m.	Brighton	56 kts	n/a	n/a	n/a	n/a	winds uprooted a six-foot tall spruce tree and knocked a few shingles off of a nearby house
Subtotal:				**1**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 17 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
4/10/2013	7:28 p.m.	Royal Lakes^	65 kts	n/a	n/a	n/a	n/a	winds blew down a couple of two-foot diameter trees next to IL Rte. 159
4/10/2013	7:35 p.m.	Benld	61 kts	n/a	n/a	n/a	n/a	winds blew an anchored 10 x 10 foot metal shed approx. 300 feet
5/20/2013	8:32 p.m.	Plainview Shipman^ Woodburn^	50 kts	n/a	n/a	n/a	n/a	winds blew down several large tree limbs
5/20/2013	9:10 p.m.	Staunton	61 kts	n/a	n/a	n/a	n/a	- winds blew off the decorative steel portion of the roof of a grocery store causing minor leaks into the store - winds blew down several trees and power lines around the City
5/20/2013	9:10 p.m.	Dorchester	61 kts	n/a	n/a	n/a	n/a	winds snapped off a two-foot diameter tree at its base
5/20/2013	9:12 p.m.	Mt. Olive	91 kts	n/a	n/a	n/a	n/a	- winds caused minor damage to the fire station roof - a small shed behind the fire station was destroyed - several large trees were uprooted and a couple other were snapped off - a small ham radio tower behind a house was bent
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 18 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/30/2013	6:45 p.m.	Girard Girard^	56 kts	n/a	n/a	n/a	n/a	winds blew down several large trees along Emmerson Airline Rd.
5/31/2013	7:58 p.m.	Virden Virden^	78 kts	n/a	n/a	n/a	n/a	- numerous tress and tree limbs were blown down - an outbuilding on the west side of Virden had part of its roof blown off
11/17/2013	11:03 a.m.	Virden	61 kts	n/a	n/a	n/a	n/a	
6/4/2014	4:41 a.m.	Piasa	56 kts	n/a	n/a	n/a	n/a	several large trees were blown over onto IL Rte. 16
10/2/2014	9:55 a.m.	Palmyra	52 kts	n/a	n/a	n/a	n/a	winds blew down 3 power poles on IL Rte. 111
4/9/2015	5:55 p.m.	Brighton Woodburn Bunker Hill Dorchester Wilsonville Gillespie Eagarville Mt. Clare Benld Staunton	56 kts	n/a	n/a	n/a	n/a	*Brighton* - winds blew down power lines *Benld/Staunton areas* - winds downed several trees
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 19 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
7/11/2015	3:01 p.m.	Scottville^ Modesto^	52 kts	n/a	n/a	n/a	n/a	winds blew down several power lines onto Modesto-Scottville Rd.
7/13/2015	6:35 p.m.	Modesto Palmyra Girard Standard City Carlinville Hornsby^	56 kts	n/a	n/a	n/a	n/a	<u>*Modesto*</u> - numerous trees, tree limbs and power lines were blown down <u>*Palmyra*</u> - numerous trees, tree limbs and power lines were blown down <u>*Girard*</u> - numerous trees, tree limbs and power lines were blown down <u>*Carlinville*</u> - numerous trees, tree limbs and power lines were blown down - a retirement home and an apartment building sustained minor to moderate roof damage
5/7/2016	3:30 p.m.	Carlinville Beaver Dam State Park Plainview Shipman	56 kts	n/a	n/a	n/a	n/a	winds blew down several large trees
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 20 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/7/2016	3:38 p.m.	Gillespie	56 kts	n/a	n/a	n/a	n/a	- winds blew down several large trees and tree limbs - a few shingles were blown off the roof of a house
7/13/2016	2:48 p.m.	Modesto	52 kts	n/a	n/a	n/a	n/a	winds blew down several power lines
7/13/2016	2:50 p.m.	Hettick	52 kts	n/a	n/a	n/a	n/a	winds blew down several power lines
7/13/2016	2:55 p.m.	Chesterfield Chesterfield^ Carlinville^ Carlinville	56 kts	n/a	n/a	n/a	n/a	winds blew down several large trees, numerous tree limbs and power lines in the area
3/7/2017	12:45 a.m.	Bunker Hill Bunker Hill^	61 kts	n/a	n/a	n/a	n/a	<u>*Bunker Hill*</u> - winds took shingles off of roofs, knocked over fences and snapped a few small trees <u>*Bunker Hill area*</u> - some sheet metal was torn off a couple of barns
3/7/2017	12:52 a.m.	Staunton Staunton^	52 kts	n/a	n/a	n/a	n/a	<u>*Staunton*</u> - winds blew the awning off a business
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 21 of 21)
Severe Storms – Thunderstorms with Damaging Winds Reported in Macoupin County
1970 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Fatalities	Property Damage	Crop Damage	Description
4/29/0017	3:08 p.m.	Brighton Brighton^ Piasa Medora^ Medora	56 kts	n/a	n/a	n/a	n/a	<u>*Brighton/Medora area*</u> - winds blew down several trees and power lines, as well as numerous tree limbs
4/29/2017	3:55 p.m.	Virden	50 kts	n/a	n/a	n/a	n/a	
5/19/2017	4:47 a.m.	Shipman	56 kts	n/a	n/a	n/a	n/a	
5/19/2017	5:06 a.m.	Nilwood^	61 kts	n/a	n/a	n/a	n/a	two storage sheds (80' x 30' each) were destroyed
6/14/2017	12:15 p.m.	Staunton	56 kts	n/a	n/a	n/a	n/a	winds blew down several large trees as well as power lines
7/23/2017	2:30 a.m.	Brighton	56 kts	n/a	n/a	n/a	n/a	winds blew down numerous large trees around the Village
Subtotal:				**0**	**0**	**$0**	**$0**	
GRAND TOTAL:				**3**	**0**	**$246,000**	**$0**	

^ Thunderstorm with damaging winds verified in the vicinity of this location(s).

Sources: Girard Gazette.
Macoupin County Multi-Jurisdictional All Hazards Mitigation Planning Committee Member responses to Natural Hazard Events Questionnaire.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Data Publications.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

Figure 12
(Sheet 1 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
3/3/1955	7:45 p.m.	Scottville^	2.50 in.	n/a	n/a	n/a	n/a	
6/10/1963	8:15 a.m.	Virden	1.00 in.	n/a	n/a	n/a	n/a	
6/10/1963	4:30 p.m.	Nilwood^	1.00 in.	n/a	n/a	n/a	n/a	
3/29/1968	2:00 p.m.	Staunton^	1.00 in.	n/a	n/a	n/a	n/a	
5/28/1977	3:15 p.m.	East Gillespie	1.75 in.	n/a	n/a	n/a	n/a	
6/28/1980	6:25 p.m.	Staunton	1.75 in.	n/a	n/a	n/a	n/a	
4/27/1984	1:38 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
4/27/1984	1:40 p.m.	Gillespie	1.75 in.	n/a	n/a	n/a	n/a	
7/10/1986	2:05 p.m.	Staunton	1.25 in.	n/a	n/a	n/a	n/a	
7/6/1987	3:40 p.m.	Womac^	1.50 in.	n/a	n/a	n/a	n/a	
5/25/1989	11:32 a.m.	Carlinville	1.75 in.	n/a	n/a	n/a	n/a	
5/25/1989	12:53 p.m.	Carlinville	2.50 in.	6	0	$1,000,000	n/a	Event Description Provided Below ***Appendix J*** contains historic news articles and photographs

- 99% of the city had some type of damage
- windows were broken by hail and high winds all over the city
- trees and scrubs were uprooted & power lines were downed
- several buildings on the square received structural damage including:
  - 150-year old Loomis House sustained the most damage with a 10-foot gaping hole on the 4th floor
  - a large, ½ inch thick picture window at the House of Beauty shattered leaving glass everywhere and causing water damage to the store's contents
  - Office Store Co. sustained broken windows, with debris inside the store
- 30-foot tall evergreen trees were uprooted around the city square and the flag pole was bent
- approximately 55 windows, some stained glass, were destroyed on the west side of the Courthouse
- the glass door on the west side of Starr's Market shattered
- South School had approximately 50 broken windows on the west side of the building as well as minor water damage to the interior of the school
- about a dozen windows at the high school were also broken
- trees fell on homes and vehicles
- hail punched holes in siding and ripped siding off homes and garages
- a mobile home was damaged by a fallen tree
- heavy rains accompanying the storm flooded North Broad with water standing 20 feet on both side of the curbs

	Injuries	Fatalities	Property Damage	Crop Damage
Subtotal:	**6**	**0**	**$1,000,000**	**$0**

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 2 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
6/16/1994	6:29 p.m.	Womac	1.75 in.	n/a	n/a	n/a	n/a	
5/9/1995	5:15 p.m.	Carlinville	1.75 in.	n/a	n/a	n/a	n/a	
7/19/1996	7:37 p.m.	Virden	2.75 in.	n/a	n/a	n/a	n/a	
5/1/1998	4:50 p.m.	Carlinville	1.00 in.	n/a	n/a	n/a	n/a	
5/12/1998	7:06 p.m.	Modesto	1.75 in.	n/a	n/a	n/a	n/a	
5/12/1998	7:11 p.m.	Palmyra	1.25 in.	n/a	n/a	n/a	n/a	
5/12/1998	7:15 p.m.	Palmyra^	1.75 in.	n/a	n/a	n/a	n/a	
5/12/1998	10:06 p.m.	Hornsby	1.75 in.	n/a	n/a	n/a	n/a	
5/12/1998	10:16 p.m.	Bunker Hill	1.75 in.	n/a	n/a	n/a	n/a	
5/12/1998	10:20 p.m.	Bunker Hill	1.75 in.	n/a	n/a	n/a	n/a	
5/22/1998	3:30 a.m.	Mt. Olive	1.50 in.	n/a	n/a	n/a	n/a	
6/12/1998	3:44 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
6/12/1998	3:50 p.m.	Bunker Hill	1.75 in.	n/a	n/a	n/a	n/a	
6/12/1998	3:56 p.m.	Brighton^	1.00 in.	n/a	n/a	n/a	n/a	
6/12/1998	4:00 p.m.	Bunker Hill	2.00 in.	n/a	n/a	n/a	n/a	
6/12/1998	4:03 p.m.	Dorchester^	1.75 in.	n/a	n/a	n/a	n/a	
6/12/1998	4:08 p.m.	Gillespie	1.75 in.	n/a	n/a	n/a	n/a	
6/14/1998	4:55 p.m.	Mt. Clare	1.00 in.	n/a	n/a	n/a	n/a	
6/14/1998	5:02 p.m.	Staunton	1.75 in.	n/a	n/a	n/a	n/a	
6/4/1999	5:10 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
6/4/1999	5:46 p.m.	Bunker Hill	1.75 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 3 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/12/2000	4:00 p.m.	Medora^	1.00 in.	n/a	n/a	$160,000	n/a	numerous cars and some roofs were damaged
5/12/2000	4:05 p.m.	Brighton^	1.00 in.	n/a	n/a		n/a	
5/12/2000	4:11 p.m.	Shipman	1.00 in.	n/a	n/a		n/a	
5/12/2000	4:20 p.m.	Woodburn^	2.00 in.	n/a	n/a		n/a	
5/12/2000	4:30 p.m.	Bunker Hill^	2.00 in.	n/a	n/a		n/a	
5/18/2000	3:45 p.m.	Brighton^	1.00 in.	n/a	n/a	n/a	n/a	
7/5/2000	4:35 p.m.	Carlinville	1.00 in.	n/a	n/a	n/a	n/a	
7/5/2000	4:40 p.m.	Gillespie	1.75 in.	n/a	n/a	n/a	n/a	
7/17/2001	5:59 p.m.	Atwood	1.25 in.	n/a	n/a	n/a	n/a	
4/19/2002	5:05 p.m.	Palmyra^	1.00 in.	n/a	n/a	n/a	n/a	
4/24/2002	12:59 p.m.	Scottville	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2002	1:15 p.m.	Carlinville	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2002	1:17 p.m.	Medora	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2002	1:17 p.m.	Carlinville	1.75 in.	n/a	n/a	$1,000,000	n/a	Macoupin County EMA reported approx. 400 vehicles damaged by the hail across the County
4/24/2002	1:29 p.m.	Shipman	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2002	1:39 p.m.	Gillespie	2.00 in.	n/a	n/a	$2,000,000	n/a	initial reports from local insurance companies indicated at least $2 million in damages to vehicles and roofs
4/24/2002	1:40 p.m.	Gillespie	1.25 in.	n/a	n/a		n/a	
4/24/2002	1:40 p.m.	Bunker Hill^	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2002	1:42 p.m.	Gillespie	1.75 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$3,160,000**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 4 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/1/2002	12:12 p.m.	Mt. Clare	1.75 in.	n/a	n/a	n/a	n/a	
5/1/2002	12:15 p.m.	Bunker Hill^	1.75 in.	n/a	n/a	n/a	n/a	
5/1/2002	12:20 p.m.	Mt. Olive	1.75 in.	n/a	n/a	$2,000,000	n/a	roofs damaged, home siding dented, broken windows and dented vehicles
3/13/2003	12:23 a.m.	Bunker Hill^	1.75 in.	n/a	n/a	n/a	n/a	
4/4/2003	1:55 p.m.	Brighton^	1.25 in.	n/a	n/a	n/a	n/a	
4/4/2003	1:58 p.m.	Bunker Hill	1.75 in.	n/a	n/a	n/a	n/a	
4/4/2003	2:10 p.m.	Woodburn^	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2003	4:25 p.m.	Scottville^	1.75 in.	n/a	n/a	n/a	n/a	
5/9/2003	6:58 p.m.	Scottville	2.00 in.	n/a	n/a	n/a	n/a	
5/9/2003	7:00 p.m.	Modesto	2.00 in.	n/a	n/a	n/a	n/a	
5/9/2003	7:30 p.m.	Palmyra	1.75 in.	n/a	n/a	n/a	n/a	
5/9/2003	7:30 p.m.	Palmyra^	1.75 in.	n/a	n/a	n/a	n/a	
5/9/2003	7:45 p.m.	Virden^	1.75 in.	n/a	n/a	n/a	n/a	
5/9/2003	7:48 p.m.	Virden	1.25 in.	n/a	n/a	n/a	n/a	
8/2/2003	4:40 p.m.	Woodburn^	1.75 in.	n/a	n/a	n/a	n/a	
5/18/2004	2:55 p.m.	Brighton^	1.00 in.	n/a	n/a	n/a	n/a	
7/5/2004	11:18 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
4/21/2005	7:35 p.m.	Carlinville^	1.75 in.	n/a	n/a	n/a	n/a	
4/21/2005	7:35 p.m.	Carlinville^	1.00 in.	n/a	n/a	n/a	n/a	
5/19/2005	9:20 p.m.	Wilsonville	1.00 in.	n/a	n/a	n/a	n/a	
6/13/2005	4:30 p.m.	Medora^	1.00 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$2,000,000**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 5 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
5/24/2006	2:45 p.m.	Chesterfield^	1.00 in.	n/a	n/a	n/a	n/a	
5/24/2006	4:05 p.m.	Shipman^	1.00 in.	n/a	n/a	n/a	n/a	
7/19/2006	5:50 p.m.	Bunker Hill Bunker Hill^	1.00 in.	n/a	n/a	n/a	n/a	several hundred acres of corn were damaged along and west IL Rte. 159
1/7/2008	6:35 p.m.	Palmyra Otter Lake Sunset Lake Girard	1.75 in.	n/a	n/a	n/a	n/a	
1/7/2008	6:35 p.m.	Modesto	1.00 in.	n/a	n/a	n/a	n/a	
1/7/2008	6:39 p.m.	Modesto^	1.75 in.	n/a	n/a	n/a	n/a	
5/30/2008	8:08 p.m.	Shipman^ Woodburn^	1.00 in.	n/a	n/a	n/a	n/a	
5/31/2008	6:44 p.m.	Brighton^	1.75 in.	n/a	n/a	n/a	n/a	
6/19/2008	4:40 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
4/4/2010	9:45 p.m.	Standard City^	1.75 in.	n/a	n/a	n/a	n/a	
4/5/2010	2:26 p.m.	White City Mt. Olive	1.75 in.	n/a	n/a	n/a	n/a	
4/24/2010	4:05 p.m.	Brighton^	1.50 in.	n/a	n/a	n/a	n/a	
5/3/2010	4:20 p.m.	Shipman	1.00 in.	n/a	n/a	n/a	n/a	
5/3/2010	4:22 p.m.	Woodburn^ Bunker Hill	1.75 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 6 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
4/9/2011	2:50 a.m.	Virden	1.50 in.	n/a	n/a	n/a	n/a	
4/9/2011	4:05 a.m.	Girard Girard^	1.00 in.	n/a	n/a	n/a	n/a	
4/19/2011	4:45 p.m.	Carlinville	1.25 in.	n/a	n/a	n/a	n/a	
4/19/2011	5:25 p.m.	Brighton	1.00 in.	n/a	n/a	n/a	n/a	
4/19/2011	5:45 p.m.	Dorchester	1.00 in.	n/a	n/a	n/a	n/a	
5/25/2011	2:50 p.m.	Bunker Hill^	1.50 in.	n/a	n/a	n/a	n/a	
5/25/2011	3:00 p.m.	Carlinville Carlinville^	1.50 in.	n/a	n/a	n/a	n/a	
5/28/2011	1:00 p.m.	Chesterfield	1.75 in.	n/a	n/a	n/a	n/a	
5/28/2011	1:05 p.m.	Comer^ Carlinville^	2.00 in.	n/a	n/a	n/a	n/a	
5/28/2011	1:08 p.m.	Carlinville^	1.25 in.	n/a	n/a	n/a	n/a	
5/28/2011	1:21 p.m.	Atwater	1.50 in.	n/a	n/a	n/a	n/a	
3/14/2012	5:53 p.m.	Benld Benld^ Mt. Olive Mt. Olive^	1.50 in.	n/a	n/a	n/a	n/a	
4/25/2012	10:41 p.m.	Bunker Hill^	1.75 in.	n/a	n/a	n/a	n/a	
4/28/2012	8:55 p.m.	Woodburn	1.75 in.	n/a	n/a	n/a	n/a	
5/4/2012	11:19 p.m.	Gillespie^	1.00 in.	n/a	n/a	n/a	n/a	
5/28/2012	11:40 p.m.	Dorchester	1.00 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 7 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
4/10/2013	3:10 p.m.	Brighton	1.00 in.	n/a	n/a	n/a	n/a	
4/10/2013	3:30 p.m.	Brighton^ Woodburn^	1.75 in.	n/a	n/a	n/a	n/a	
4/10/2013	3:52 p.m.	Carlinville	1.00 in.	n/a	n/a	n/a	n/a	
5/20/2013	9:08 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
11/17/2013	11:12 a.m.	Gillespie^	1.00 in.	n/a	n/a	n/a	n/a	
4/28/2014	3:40 p.m.	Mt. Olive	1.00 in.	n/a	n/a	n/a	n/a	
4/9/2015	5:50 p.m.	Brighton^ Shipman Royal Lakes Dorchester Gillespie East Gillespie	3.00 in.	n/a	n/a	n/a	n/a	most of the hail was between 1 and 2 inches with 3 inch hail reported in Gillespie *Shipman* - wind driven 1 inch hail caused siding and window damage
4/9/2015	6:25 p.m.	Bunker Hill	1.00 in.	n/a	n/a	n/a	n/a	
6/25/2015	6:25 p.m.	Sunset Lake	1.00 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$0**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Figure 12
(Sheet 8 of 8)
Severe Storms – Hail Events Reported in Macoupin County
1955 – 2017

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Fatalities	Property Damage	Crop Damage	Description
3/30/2017	11:50 a.m.	Bunker Hill	1.25 in.	n/a	n/a	n/a	n/a	
4/10/2017	5:30 p.m.	Mt. Olive	1.00 in.	n/a	n/a	n/a	n/a	
9/4/2017	4:08 p.m.	Standard City^ Carlinville^	1.50 in.	n/a	n/a	n/a	n/a	
9/4/2017	4:45 p.m.	Beaver Dam State Park	1.75 in.	n/a	n/a	n/a	n/a	
9/4/2017	5:27 p.m.	Bunker Hill Bunker Hill^	2.00 in.	n/a	n/a	n/a	n/a	
Subtotal:				**0**	**0**	**$0**	**$0**	
GRAND TOTAL:				**6**	**0**	**$6,160,000**	**$0**	

^ Hail event verified in the vicinity of this location(s).

Sources: Macoupin County Enquirer.
Macoupin County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Member responses to Natural Hazard Events Questionnaire.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Data Publications.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

Figure 13
(Sheet 1 of 2)
Severe Storms – Lightning Events Reported in Macoupin County
2001 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damage	Crop Damage	Description
4/10/2001	5:15 p.m.	Sunset Lake	0	1	n/a	n/a	- a 49-year old woman was struck and killed by lightning while working outside at her home - witnesses reported that the woman was planting and watering flowers and had knelt down at the edge of the lake to dip out some water when the lightning struck
7/23/2001	4:30 p.m.	Chesterfield	0	0	$100,000	n/a	a lightning strike damaged grain bins at a grain elevator
9/6/2001	4:10 p.m.	Sawyerville	0	1	n/a	n/a	- a man was killed by a lightning strike while working on a roof - a group of workers saw the storm approaching and climbed off the roof; unfortunately the man killed was the last man and did not make it off in time
5/18/2004	3:10 p.m.	Staunton	0	0	n/a	n/a	- a lightning strike set fire to 3 large oil tanks which contains several thousand gallons of oil - it took about 45 minutes to extinguish the fire
Subtotal:			**0**	**2**	**$100,000**	**$0**	

^ Lightning strike event verified in the vicinity of this location(s).

Figure 13
(Sheet 2 of 2)
Severe Storms – Lightning Events Reported in Macoupin County
2001 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damage	Crop Damage	Description
9/19/2005	12:30 a.m.	Chesterfield	0	1	n/a	n/a	- an 89-year old man died in his home from smoke inhalation due to a fire that was started by a lightning strike - the man was found in the rubble of the home which was completely destroyed by the fire
9/19/2005	8:30 p.m.	Staunton	n/a	n/a	n/a	n/a	- lightning struck a substation causing substantial damage - power was out for much of the Village until repairs could be finished
Subtotal:			**0**	**1**	**$0**	**$0**	
GRAND TOTAL:			**0**	**3**	**$100,000**	**$0**	

ᐱ Lightning strike event verified in the vicinity of this location(s).

Sources: NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

3.2 SEVERE WINTER STORMS & EXTREME COLD

IDENTIFYING THE HAZARD

What is the definition of a severe winter storm?

A severe winter storm can range from moderate snow over a few hours to significant accumulations of sleet and/or ice to blizzard conditions with blinding, wind-driven snow that last several days. The amount of snow or ice, air temperature, wind speed and event duration all influence the severity and type of severe winter storm that results. In general there are three types of severe winter storms: blizzards, heavy snow storms and ice storms. The following provides a brief description of each type as defined by the National Weather Service (NWS).

- **Blizzards.** Blizzards are characterized by strong winds of at least 35 miles per hour and are accompanied by considerable falling and/or blowing snow that reduces visibility to ¼ mile or less. Blizzards are the most dangerous of all winter storms.
- **Heavy Snow Storms.** Heavy snow storms are generally defined as producing snowfall accumulations of four inches or more in 12 hours or less or six inches or more in 24 hours or less.
- **Ice Storms.** An ice storm occurs when substantial accumulations of ice, generally ¼ inch or more, build up on the ground, trees and utility lines as a result of freezing rain.

While extreme cold (i.e., dangerously low temperatures and wind chill values) often accompanies or is left in the wake of a severe winter storm, the NWS does not use it to define a severe winter storm. However, a discussion of extreme cold is included in this section since it has the ability to cause property damage, injuries and even fatalities (whether or not it is accompanied by freezing rain, ice or snow).

What is snow?

Snow is precipitation in the form of ice crystals. These ice crystals are formed directly from the freezing of water vapor in wintertime clouds. As the ice crystals fall toward the ground, they cling to each other creating snowflakes. Snow will only fall if the temperature remains at or below 32°F from the cloud base to the ground.

What is sleet?

Sleet is precipitation in the form of ice pellets. These ice pellets are composed of frozen or partially frozen rain drops or refrozen partially melted snowflakes. Sleet typically forms in winter storms when snowflakes partially melt while falling through a thin layer of warm air. The partially melted snowflakes then refreeze and form ice pellets as they fall through the colder air mass closer to the ground. Sleet usually bounces after hitting the ground or other hard surfaces and does not stick to objects.

What is freezing rain?

Freezing rain is precipitation that falls in the form of a liquid (i.e., rain drops), but freezes into a glaze of ice upon contact with the ground or other hard surfaces. This occurs when snowflakes descend into a warmer layer of air and melt completely. When the rain drops that result from this melting fall through another thin layer of freezing air just above the surface they become "supercooled", but they do not have time to refreeze before reaching the ground. However, because the rain drops are "supercooled", they instantly refreeze upon contact with anything that is at or below 32°F (i.e., the ground, trees, utility lines, etc.).

What is wind chill?

Wind chill, or wind chill factor, is a measure of the rate of heat loss from exposed skin resulting from the combined effects of wind and temperature. As the wind increases, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature.

The unit of measurement used to describe the wind chill factor is known as the wind chill temperature. The wind chill temperature is calculated using a formula. **Figure 22** identifies the formula and calculates the wind chill temperatures for certain air temperatures and wind speeds.

Figure 22
Wind Chill Chart

Temperature (°F)

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

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

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

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Source: NOAA, National Weather Service.

As an example, if the air temperature is 5°F and the wind speed is 20 miles per hour, then the wind chill temperature would be -15°F. The wind chill temperature is only defined for air temperatures at or below 50°F and wind speeds above three miles per hour. In addition, the wind chill temperature does not take into consideration the effects of bright sunlight which may increase the wind chill temperature by 10°F to 18°F.

Use of the current Wind Chill Temperature (WCT) index was implemented by the NWS on November 1, 2001. The new WCT index was designed to more accurately calculate how cold air feels on human skin. The new index uses advances in science, technology and computer modeling to provide an accurate, understandable and useful formula for calculating the dangers from winter winds and freezing temperatures. The former index was based on research done in 1945 by Antarctic researchers Siple and Passel.

Exposure to extreme wind chills can be life threatening. As wind chills edge toward -19°F and below, there is an increased likelihood that exposure will lead to individuals developing cold-related illnesses.

What cold-related illnesses are associated with severe winter storms?

Frostbite and hypothermia are both cold-related illnesses that can result when individuals are exposed to dangerously low temperatures and wind chills that can accompany severe winter storms. The following provides a brief description of the symptoms associated with each.

- **Frostbite.** During exposure to extremely cold weather the body reduces circulation to the extremities (i.e., feet, hands, nose, cheeks, ears, etc.) in order to maintain its core temperature. If the extremities are exposed, then this reduction in circulation coupled with the cold temperatures can cause the tissue to freeze.

  Frostbite is characterized by a loss of feeling and a white or pale appearance. At a wind chill of -19°F, exposed skin can freeze in as little as 30 minutes. Seek medical attention immediately if frostbite is suspected. It can permanently damage tissue and in severe cases can lead to amputation.

- **Hypothermia.** Hypothermia occurs when the body's temperature begins to fall because it is losing heat faster than it can produce it. If an individual's body temperature falls below 95°F, then hypothermia has set in and immediate medical attention should be sought.

  Hypothermia is characterized by uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and exhaustion. Left untreated, hypothermia will lead to death. Hypothermia occurs most commonly at very cold temperatures, but can occur at cool temperatures (above 40°F) if an individual isn't properly clothed or becomes chilled.

Are alerts issued for severe winter storms?

Yes. The NWS Weather Forecast Office in St. Louis, Missouri is responsible for issuing ***winter storm watches*** and ***warnings*** for Macoupin County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Advisories.** Winter advisories are issued for lesser winter weather events that while presenting an inconvenience, do not pose an immediate threat of injury, death or significant property damage. The following advisories will be issued when an event is occurring, is imminent or has a high probability of occurring.

- ❖ **Winter Weather Advisory.** Depending on the time of occurrence and the temperature, a winter weather advisory is issued for:
  - ❑ snowfalls of 1 to 5 inches;
  - ❑ sleet accumulations of less than ½ inch; or
  - ❑ a combination of winter precipitation which will produce hazardous conditions.
- ❖ **Freezing Rain Advisory.** A freezing rain advisory is issued when light freezing rain will produce less than ¼ inch of ice accumulation.
- ❖ **Wind Chill Advisory.** A wind chill advisory is issued when the wind chill values are expected to be between -15°F and -24°F.

➢ **Winter Storm Watch.** A winter storm watch is issued when the risk of hazardous winter weather has increased significantly and there is a strong possibility that conditions will reach warning criteria for the area within the next 12 to 48 hours.

➢ **Warnings.** Winter weather warnings are issued for events that can be life threatening. The following warnings will be issued when an event is occurring, is imminent, or has a high probability of occurring.

- ❖ **Blizzard Warning.** A blizzard warning is issued when sustained winds or frequent gusts greater than or equal to 35 mph are accompanied by falling and/or blowing snow that frequently reduces visibility to less than ¼ mile for three hours or more.
- ❖ **Ice Storm Warning.** An ice storm warning is issued when freezing rain is expected to produce ¼ inch or more of ice accumulation.
- ❖ **Winter Storm Warning.** A winter storm warning is issued when:
  - ❑ 6 inches or more of snow is expected;
  - ❑ ½ inch or more of sleet accumulations are expected; or
  - ❑ a combination of winter precipitation will produce life threatening conditions.
- ❖ **Wind Chill Warning.** A wind chill warning is issued when wind chill values are expected to be -25°F or below.

PROFILING THE HAZARD

When have severe winter storms and extreme cold occurred previously? What is the extent of these previous severe winter storms and extreme cold events?

Figures 23 and **24**, located at the end of this section, summarize the previous occurrences as well as the extent or magnitude of severe winter storms (snow & ice) and extreme cold events recorded in Macoupin County.

<u>*Severe Winter Storms*</u>

NOAA's Storm Events Data-base, NWS's COOP Data records, NOAA's Storm Data Publications and Planning Committee member records were used to document 132 reported occurrences of severe winter storms (snow, ice and/or a combination of both) in Macoupin County between 1950 and 2017. Of the 132 recorded occurrences there were:

- ❖ 102 heavy snow storms or blizzards;
- ❖ 21 combination events (freezing rain, sleet, ice and/or snow); and
- ❖ 9 ice or sleet storms.

<u>Severe Winter Storm Fast Facts – Occurrences</u>

Number of Severe Winter Storm Events Reported (1950 – 2017): ***132***

Number of Extreme Cold Events Reported (1997 – 2016): ***3***

Maximum 24 Hour Snow Accumulation: ***14.0 inches (November 5 & 6, 1951 at Medora)***

Coldest Temperature Recorded in the County: ***-23°F (February 13, 1905 at Carlinville)***

Most Likely Month for Severe Winter Storms to Occur: ***January***

Most Likely Time for Severe Winter Storms to Occur: ***Morning***

Figure 25 charts the reported occurrences of severe winter storms by month. Of the 132 events, 76 (58%) took place in January and February. Of these 76 events, 45 (53%) occurred during January, making this the peak month for severe winter storms. There were seven events that spanned two months; however for illustration purposes only the month when the event started is graphed.

Figure 25
Severe Winter Storms by Month
1950 – 2017

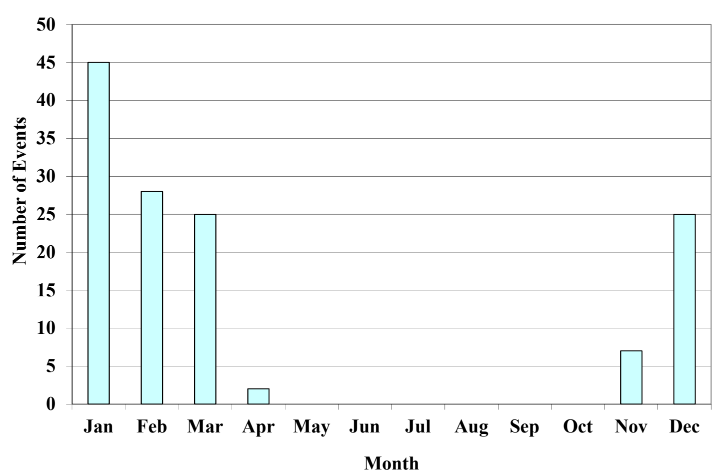
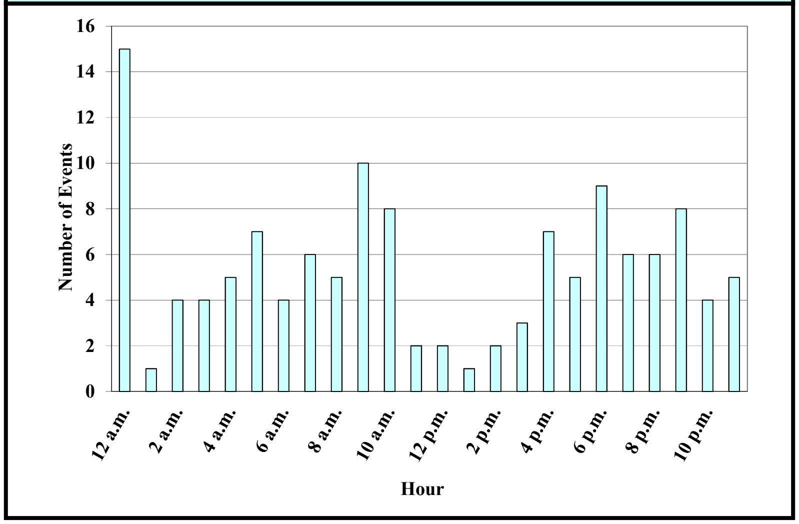


Figure 26 charts the reported occurrences of severe winter storms by hour. Of the 132 occurrences, start times were unavailable for three events. Of the remaining 129 severe winter storm events with recorded times, approximately 55% began during the a.m. hours, with 40 (56%) beginning between 6 a.m. and 11 a.m.

Figure 26
Severe Winter Storms by Hour
1950 – 2017



According to the NWS's COOP data records, the maximum 24-hour snow accumulation in Macoupin County is 14.0 inches, which occurred on November 5 & 6, 1951 at Medora.

Extreme Cold

While extreme cold events occur on a fairly regular basis across central Illinois, NOAA's Storm Events Database has only three *recorded* occurrences of extreme cold (dangerously low temperatures and wind chill values) in Macoupin County between 2000 and 2017. Two of the three events (67%) took place in January while the remaining event took place in December. Two of the three occurrences followed recorded severe winter storms.

According to the Midwestern Regional Climate Center records, the coldest temperature recorded at Virden between 1945 and 2011 was -22°F on January 17, 1977 while the coldest temperature recorded at Carlinville between 1891 and 2014 was -23°F on February 13, 1905.

What locations are affected by severe winter storms and extreme cold?

Severe winter storms and extreme cold affect the entire County. All communities in Macoupin County have been affected by severe winter storms and extreme cold. Severe winter storms and extreme cold generally extend across the entire County and affect multiple locations. The *2013 Illinois Natural Hazard Mitigation Plan* prepared by IEMA classifies Macoupin County's hazard rating for severe winter storms as "high."

Do any of the participating municipalities have designated warming centers?

Yes. Six of the eleven participating municipalities have designated warming centers. A "designated" warming center is identified as any facility that has been *formally* identified by the municipality (through emergency planning, resolution, Memorandum of Agreement, etc.) as a location available for use by residents during severe winter storms and extreme cold events. **Figure 27** identifies the location of each warming center by jurisdiction. At this time Benld, Carlinville, Royal Lakes, Virden and Wilsonville do not have any warming centers designated within their municipalities.

Figure 27
Designated Warming Centers by Participating Municipality

Name/Address	Name/Address
Brighton	*Girard*
Municipal Building, 206 S. Main St.	City Hall, 1st St. & Madison St.
St. Paul UMC Cartwright Building, 101 Green St.	*Mount Olive*
Bunker Hill	Immanuel Lutheran Church, 111 E. Main St.
Police Department, 801 S. Franklin St.	City Hall, 215 E. Main St.
Fire Protection District Building, 123 W. Warren St.	*Staunton*
Gillespie	Knights of Columbus, 20631 Staunton Rd.
Civic Center, 115 N. Macoupin St.	VFW, 120 E. Henry St.

In addition to those designated warming centers identified by the participating municipalities, the Macoupin County Public Health Department's Maple Street Clinic and the Macoupin County Transportation Building also serve as warming centers.

What is the probability of future severe winter storms occurring?

Severe Winter Storms

Macoupin County has had 132 verified occurrences of severe winter storms between 1950 and 2017. With 132 occurrences over the past 68 years, Macoupin County should expect approximately two severe winter storm each year. There were 38 years over the past 68 years where two or more severe winter storms occurred. This indicates the probability that more than one severe winter storm may occur during any given year within the County is 56%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to severe winter storms and extreme cold?

Yes. All of Macoupin County, including the participating municipalities, is vulnerable to the dangers presented by severe winter storms and extreme cold. Severe winter storms are among the most frequently occurring natural hazards in Illinois. Since 2008, Macoupin County has experienced 14 severe winter storms and two extreme cold events.

Severe winter storms have immobilized portions of the County, blocking roads; downing power lines, trees and branches; causing power outages and property damage; and contributing to vehicle accidents. In addition, the County and municipalities must budget for snow removal and de-icing of roads and bridges as well as for roadway repairs.

What impacts resulted from the recorded severe winter storms and extreme cold?

The following summarize the impacts of severe winter storms and extreme cold events recorded in Macoupin County.

While severe winter storms and extreme cold occur regularly in Macoupin County, the number of injuries and fatalities is very low. Even taking into consideration the potential for hazardous driving conditions, snow-removal related injuries and power outages that could leave individuals vulnerable to hypothermia, the risk to public health and safety from severe winter storms is seen as relatively low.

Severe Winter Storms

Data obtained from NOAA's Storm Events Database and Planning Committee member records indicates that between 1950 and 2017, two severe winter storms caused $1,200,422 in property damages. Property damage information was either unavailable or none was recorded for the remaining 130 reported occurrences of severe winter storms.

Severe Winter Storms & Extreme Cold Events
Fast Facts – Impacts/Risk

Severe Winter Storm (Snow & Ice) Impacts
- Total Property Damage: ***$1,200,422***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Injuries: ***0***
- Fatalities: ***0***

Extreme Cold Impacts
- Total Property Damage: ***n/a***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Injuries: ***0***
- Fatalities: ***1***

Severe Winter Storm Risk/Vulnerability to:
- Public Health & Safety: ***Low***
- Buildings/Infrastructure/Critical Facilities: ***Low/Medium***

* Infrastructure/Critical Facilities Damage totals are included in the Total Property Damage amounts.

In comparison, the State of Illinois has averaged an estimated $102 million annually in property damage losses from severe winter storms since 1950, ranking severe winter storms second only to flooding in terms of economic loss. While behind floods in terms of the amount of property damage caused, severe winter storms have a greater ability to immobilize larger areas, with rural areas being particularly vulnerable.

Included in the property damage total is $500,422 in property damages and emergency protective measures sustained during the winter storm that began on November 29, 2006. **Figure 28** provides a breakdown by jurisdiction. This event was part of a federally-declared disaster.

No injuries or fatalities were reported as a result of any of the recorded severe winter storms.

Extreme Cold

Damage information was either unavailable or none was recorded for any of the reported extreme cold events.

NOAA's Storm Events Database documented one fatality as a result of the December 16, 2000 extreme cold event. A 79-year old man from Springfield, suffering from early stages of dementia, left his home on the 16th and apparently became disoriented. He headed south into Macoupin County where he died from hypothermia and was found in an open field on the 20th.

What other impacts can result from severe winter storms?

In Macoupin County, vehicle accidents are the largest risk to health and safety from severe winter storms. Hazardous driving conditions (i.e., reduced visibility, icy road conditions, strong winds, etc.) contribute to the increase in accidents that result in injuries and fatalities. A majority of all severe winter storm injuries result from vehicle accidents.

Figure 28
Property Damage/Emergency Protective Measures incurred by Jurisdiction
November 29, 2006 to December 1, 2006 Winter Storm

Municipalities	
Benld	$29,973
Bunker Hill	$17,381
Carlinville	$50,627
Dorchester	$982
East Gillespie	$3,443
Gillespie	$57,330
Girard	$35,041
Hettick	$825
Medora	$5,204
Mt. Clare	$4,640
Mt. Olive	$26,177
Nilwood	$2,695
Palmyra	$2,852
Royal Lakes	$8,121
Shipman	$2,976
Staunton	$48,408
Virden	$36,749
Subtotal:	**$333,424**

Macoupin County	
County	$753
ETSB	$4,125
Highway	$19,957
Sheriff	$2,537
Subtotal:	**$27,372**

Fire Departments	
Bunker Hill	$954
Mt. Olive	$3,702
Shipman	$907
Staunton	$9,718
Unit 7	$5,279
Virden	$2,109
Subtotal:	**$22,669**

Schools	
Blackburn College	$3,786
Bunker Hill	$1,969
Gillespie	$4,585
Mt. Olive	$4,228
Staunton	$807
Subtotal:	**$15,375**

Townships	
Barr	$2,318
Bunker Hill	$7,692
Cahokia	$15,531
Carlinville	$3,641
Dorchester	$4,681
Girard	$6,157
Mt. Olive	$10,272
Nilwood	$8,075
North Otter	$5,535
North Palmyra	$3,839
Shaws Point	$4,363
South Otter	$2,723
South Palmyra	$3,312
Staunton	$20,885
West Mound	$2,558
Subtotal:	**$101,582**

Traffic accident data assembled by the Illinois Department of Transportation from 2011 through 2015 indicates that treacherous road conditions caused by snow/slush and ice were present for 6.2% to 13.3% of all crashes recorded annually in the County. **Figure 29** provides a breakdown by year of the number of crashes and corresponding injuries and fatalities that occurred when treacherous road conditions caused by snow and ice were present.

Figure 29
Severe Winter Weather Crash Data for Macoupin County

Year	Total # of Crashes	Presence of Treacherous Road Conditions caused by Snow/slush and Ice		
		# of Crashes	# of Injuries	# of Fatalities
2011	793	55	9	0
2012	732	51	13	1
2013	644	58	27	0
2014	760	101	23	1
2015	759	47	14	0
Total:	**3,688**	**312**	**86**	**2**

Source: Illinois Department of Transportation.

Persons who are outdoors during and immediately following severe winter storms and extreme cold events can experience other health and safety problems. Frostbite to hands, feet, ears and nose and hypothermia are common injuries. Treacherous walking conditions also lead to falls which can result in serious injuries, including fractures and broken bones, especially in the elderly. Over exertion from shoveling driveways and walks can lead to life-threatening conditions such as heart attacks in middle-aged and older adults who are susceptible.

Are existing buildings, infrastructure and critical facilities vulnerable to severe winter storms and extreme cold?

Yes. All existing buildings, infrastructure and critical facilities located in Macoupin County and the participating municipalities are vulnerable to damage from severe winter storms and extreme cold. The following summarize the vulnerabilities by severe winter storms and extreme cold events.

Based on the frequency with which severe winter storms and extreme cold events have occurred in Macoupin County; the amount of property damage previously reported; and the potential for disruptions to power distribution and communication, the risk or vulnerability to buildings, infrastructure and critical facilities from severe winter storms is low to medium.

Winter Storm

Structural damage to buildings caused by severe winter storms (snow and ice) is very rare, but can occur particularly to flat rooftops. Information gathered from Macoupin County residents indicates that snow and ice accumulations on communication and power lines as well as key roads presents the greatest vulnerability to infrastructure and critical facilities within the County. Snow and ice accumulations on lines often lead to disruptions in communications and create power outages. Depending on the damage, it can take anywhere from several hours to several days to restore service.

Approximately 8 inches of snow fell in Girard as a result of the March 24, 2013 heavy snow event.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

In addition to affecting communication and power lines, snow and ice accumulations on state and local roads hampers travel and can cause dangerous driving conditions. Blowing and drifting snow can lead to road closures and increases the risk of automobile accidents. Even small accumulations of ice can be extremely dangerous to motorists since bridges and overpasses freeze before other surfaces.

When transportation is disrupted, schools close, emergency and medical services are delayed, some businesses close and government services can be affected. When a severe winter storm hits there is also an increase in cost to the County and municipalities for snow removal and de-icing. Road resurfacing and pothole repairs are additional costs incurred each year as a result of severe winter storms.

Extreme Cold
Extreme cold events can also have a detrimental impact on buildings, infrastructure and critical facilities. Pipes and water mains are especially susceptible to freezing during extreme cold events. This freezing can lead to cracks or ruptures in the pipes in buildings as well as in buried service lines and mains. As a result, flooding can occur as well as disruptions in service. Since most buried service lines and water mains are located under local streets and roads, fixing a break requires portions of the street or road to be blocked off, excavated and eventually repaired. These activities can be costly and must be carried out under less than ideal working conditions.

Are future buildings, infrastructure and critical facilities vulnerable to severe winter storms and extreme cold?

Yes and No. While four of the participating municipalities have building codes in place that will likely help lessen the vulnerability of new buildings and critical facilities to damage from severe winter storms and extreme cold, the County and the other seven municipalities do not.

Infrastructure such as new communication and power lines will continue to be vulnerable to severe winter storms, especially to ice accumulations, as long as they are located above ground. Rural areas of Macoupin County have experienced extended periods without power due to severe winter storms. Steps to bury all new lines would eliminate the vulnerability, but this action would be cost prohibitive in most areas. In terms of new roads and bridges, there is very little that can be done to reduce or eliminate their vulnerability to severe winter storms.

What are the potential dollar losses to vulnerable structures from severe winter storms and extreme cold?

Unlike other natural hazards, such as tornadoes, there are no standard loss estimation models or methodologies for severe winter storms and extreme cold events. With only two of the 135 recorded events listing property damage numbers for severe winter storms and extreme cold, there is no way to accurately estimate future potential dollar losses. Since all existing structures within Macoupin County are vulnerable to damage, it is likely that there will be future dollar losses from severe winter storms and extreme cold.

Figure 23
(Sheet 1 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
12/5/1950 thru 12/7/1950	n/a	Heavy Snow	- COOP observer at Mt. Olive measured 7.4 inches of snow - COOP observer 4 miles east of Carlinville measured 5.3 inches of snow - COOP observer at Medora measured 4.5 inches of snow	n/a	n/a	n/a
11/5/1951 thru 11/6/1951	6:00 p.m.	Heavy Snow	- COOP observer at Medora measured 14.5 inches of snow in 27 hours - COOP observer at Mt. Olive measured 12.5 inches of snow - COOP observer 4 miles east of Carlinville measured 9.7 inches of snow in 20.5 hours - COOP observer at Virden measured 9.5 inches of snow	n/a	n/a	n/a
12/14/1951	4:00 a.m.	Blizzard	- COOP observer at Medora measured 5.2 inches of snow in 6 hours - COOP observer at Virden measured 4.4 inches of snow	n/a	n/a	n/a
3/1/1952 thru 3/2/1952	9:00 p.m.	Heavy Snow	- COOP observer 4 miles east of Carlinville measured 4.0 inches of snow in 11 hours - COOP observer at Medora measured 4.0 inches of snow	n/a	n/a	n/a
3/1/1953	9:00 a.m.	Heavy Snow	- COOP observer at Mt. Olive measured 8.0 inches of snow - COOP observer at Medora measured 6.0 inches of snow in 9 hours - COOP observer at Virden measured 5.9 inches of snow in 10 hours	n/a	n/a	n/a
1/29/1956	6:00 p.m.	Heavy Snow	- COOP observer 4 miles east of Carlinville measured 5.0 inches of snow in 3 hours - COOP observer 2 miles northeast of Mt. Olive measured 5.0 inches of snow - COOP observer at Medora measured 4.0 inches of snow in 8 hours	n/a	n/a	n/a
2/11/1956	2:00 a.m.	Heavy Snow	- COOP observer 2 miles northeast of Mt. Olive measured 5.0 inches of snow - COOP observer at Medora measured 4.0 inches of snow in 7 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 2 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/31/1958	10:00 a.m.	Heavy Snow	COOP observer at Medora measured 5.0 inches of snow in 8 hours	n/a	n/a	n/a
3/8/1958 thru 3/9/1958	6:00 p.m.	Heavy Snow	- COOP observer at Medora measured 5.0 inches of snow in 9.5 hours - COOP observer at Carlinville measured 4.0 inches of snow in 12 hours	n/a	n/a	n/a
11/27/1958 thru 11/28/1958	9:30 p.m.	Heavy Snow	COOP observer at Virden measured 4.6 inches of snow in 9 hours	n/a	n/a	n/a
1/20/1959 thru 1/21/1959	5:00 a.m.	Ice Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • ice accumulation of ½ to 1 inch on trees and wires • power and communication lines were heavily damaged partly by ice but mostly by falling limbs • several thousand homes without electricity for 1 to 3 days - COOP observer at Carlinville indicated the presence of sleet and glaze ice and noted that there was severe icing and much damage to utilities - COOP observer at Medora indicated the presence of sleet and glaze ice and noted that there was an ice storm and much damage - COOP observer at Virden indicated the presence of sleet and glaze ice and noted that there was freezing rain						
2/25/1960	2:30 a.m.	Heavy Snow	- COOP observer at Medora measured 6.0 inches of snow in 19.5 hours - COOP observer at Carlinville measured 4.5 inches of snow	n/a	n/a	n/a
3/2/1960 thru 3/3/1960	3:00 a.m.	Heavy Snow	- COOP observer at Medora measured 10.0 inches of snow - COOP observer at Carlinville measured 7.0 inches of snow	n/a	n/a	n/a
3/8/1960 thru 3/9/1960	2:30 p.m.	Heavy Snow	- COOP observer at Medora measured 8.5 inches of snow in 17.5 hours - COOP observer at Carlinville measured 8.0 inches of snow in 13.5 hours - COOP observer at Virden measured 6.6 inches of snow in 19 hours - COOP observer 2 miles east-northeast of Mt. Olive noted that the snow drifted and roads were blocked	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 3 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
3/15/1960 thru 3/16/1960	5:00 p.m.	Heavy Snow	- COOP observer at Medora measured 6.0 inches of snow in 12.5 hours - COOP observer at Carlinville measured 4.0 inches of snow in 12 hours - COOP observer 2 miles east-northeast of Mt. Olive noted that the snow drifted and roads were blocked	n/a	n/a	n/a
2/2/1961 thru 2/3/1961	4:00 a.m.	Heavy Snow	- COOP observer at Virden measured 9.5 inches of snow in 22 hours - COOP observer at Medora measured 8.0 inches of snow in 24 hours - COOP observer at Carlinville measured 7.5 inches of snow in 21.5 hours	n/a	n/a	n/a
1/5/1962 thru 1/6/1962	5:00 p.m.	Heavy Snow	- COOP observer at Medora measured 8.0 inches of snow - COOP observer at Virden measured 6.1 inches of snow - COOP observer at Carlinville measured 4.5 inches of snow	n/a	n/a	n/a
1/18/1962 thru 1/19/1962	7:30 p.m.	Heavy Snow	- COOP observer at Virden measured 5.1 inches of snow in 14.5 hours - COOP observer at Medora measured 4.5 inches of snow in 9 hours	n/a	n/a	n/a
12/10/1963 thru 12/11/1963	7:00 p.m.	Heavy Snow	COOP observer at Virden measured 6.5 inches of snow in 26 hours and noted that there were many auto accidents	n/a	n/a	n/a
1/11/1964 thru 1/13/1964	1:00 p.m.	Heavy Snow	- COOP observer at Virden measured 16.3 inches of snow and noted severe winds of 35 mph and the presence of 10-foot drifts - COOP observer at Medora measured 12.0 inches of snow and noted the presence of drifts 3-feet deep - COOP observer at Carlinville measured 9.5 inches of snow	n/a	n/a	n/a
2/15/1964	9:00 a.m.	Heavy Snow	- COOP observer at Medora measured 7.0 inches of snow in 12 hours - COOP observer at Carlinville measured 7.0 inches of snow in 14 hours - COOP observer at Virden measured 5.6 inches of snow in 10.5 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches or snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 4 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
3/9/1964 thru 3/10/1964	5:00 p.m.	Heavy Snow	- COOP observer at Medora measured 5.0 inches of snow in 5.5 hours - COOP observer at Carlinville measured 5.0 inches of snow in 12 hours	n/a	n/a	n/a
2/24/1965	6:00 a.m.	Heavy Snow	COOP observer at Medora measured 5.0 inches of snow in 11 hours	n/a	n/a	n/a
3/3/1965 thru 3/4/1965	8:30 p.m.	Heavy Snow	COOP observer at Medora measured 5.0 inches of snow	n/a	n/a	n/a
1/31/1966 thru 2/1/1966	10:30 p.m.	Heavy Snow	- COOP observer at Carlinville measured 6.0 inches of snow in 13.5 hours - COOP observer at Medora measured 6.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow - COOP observer 1mile south of Virden only measured 3.0 inches of snow in 18 hours but noted that school dismissed early and there was blowing and drifting all day	n/a	n/a	n/a
1/26/1967	12:00 a.m.	Ice Storm	- COOP observer at Carlinville indicated the presence of glaze ice and noted that there was a damaging ice storm - COOP observer at Medora indicated the presence of glaze ice and noted that there was damage from ice	n/a	n/a	n/a
1/12/1968 thru 1/14/1968	8:00 a.m.	Winter Storm	- COOP observer at Medora measured 10.2 inches of snow and noted there was freezing rain as well as snow on the 12th - COOP observer 1mile south-southwest of Virden only measured 9.0 inches of snow - COOP observer at Carlinville measured 7.2 inches of snow and indicated the presence of glaze ice on the 12th - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 5 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
3/11/1968 thru 3/12/1968	11:00 p.m.	Heavy Snow	COOP observer at Medora measured 7.0 inches of snow in 13 hours	n/a	n/a	n/a
2/27/1969 thru 2/28/1969	10:30 p.m.	Heavy Snow	- COOP observer at Carlinville measured 9.0 inches of snow in 19 hours - COOP observer at Medora measured 6.0 inches of snow in 12.5 hours - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 14.5 hours	n/a	n/a	n/a
3/8/1969	12:00 a.m.	Heavy Snow	- COOP observer at Carlinville measured 5.6 inches of snow in 10 hours - COOP observer at Medora measured 5.0 inches of snow in 16 hours	n/a	n/a	n/a
12/22/1969 thru 12/23/1969	7:30 p.m.	Heavy Snow	- COOP observer at Carlinville measured 5.0 inches of snow in 8 hours - COOP observer at Medora measured 5.0 inches of snow in 18 hours	n/a	n/a	n/a
4/5/1971 thru 4/6/1971	9:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 12.0 inches of snow in 22 hours - COOP observer at Carlinville measured 8.5 inches of snow in 19.5 hours - COOP observer at Medora measured 7.0 inches of snow in 21.5 hours - COOP observer 1 mile south-southwest of Virden measured 5.0 inches of snow in 15 hours	n/a	n/a	n/a
11/19/1972	12:00 a.m.	Heavy Snow	COOP observer at Carlinville measured 5.0 inches of snow in 12 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 6 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
12/11/1972 thru 12/12/1972	4:00 p.m.	Ice Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • freezing rain, sleet and snow with the heaviest glazing occurring through Central Illinois from St. Louis to Springfield to Kankakee • tree damage, downed power lines and damage to light structures was experienced • the storm indirectly caused many vehicle and pedestrian injuries and a few deaths as a result of the slippery conditions - COOP observer 1 mile north of Virden indicated the presence of glaze ice and high winds and noted freezing rain and an ice storm with caused a power outage and downed tree limbs - COOP observer at Carlinville indicated the presence of ice pellets and glazed ice and noted that this was a severe ice storm - COOP observer at Medora indicated the presence of ice pellets and glaze ice and noted that this was a damaging ice storm						
12/18/1973 thru 12/19/1973	7:00 p.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • snowfall accumulations of 10 to 18 inches • government offices, schools and industry were closed • traffic was brought to a standstill all day on the 19th • heavy snows downed power lines cutting off power to scores of homes in many areas for several hours - COOP observer at Carlinville measured 12.5 inches of snow and indicated the presence of ice pellets and glaze ice on the 18th - COOP observer 1 mile north of Virden measured 12.0 inches and indicated the presence of glaze ice and noted there was freezing rain on the 18th - COOP observer at Medora measured 11.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 9.0 inches of snow						
1/10/1974	4:00 p.m.	Winter Storm	- COOP observer at Carlinville measured 4.0 inches of snow in 5 hours and indicated the presence of glaze ice - COOP observer 1 mile north of Virden measured 4.0 inches in 6 hours - COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 7 hours - COOP observer at Medora measured 4.0 inches of snow in 8 hours and indicated the presence of glaze ice	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 7 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
2/23/1974 thru 2/24/1974	4:30 p.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 8 hours - COOP observer at Medora measured 4.0 inches of snow in 12 hours - COOP observer 1 mile north of Virden measured 4.0 inches in 10 hours and noted that there was drifting	n/a	n/a	n/a
3/23/1974	7:00 a.m.	Heavy Snow	- COOP observer at Medora measured 9.0 inches of snow in 15 hours - COOP observer at Carlinville measured 5.7 inches of snow in 8 hours - COOP observer 1 mile north of Virden measured 4.0 inches in 8 hours - COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 11 hours	n/a	n/a	n/a
2/22/1975 thru 2/24/1975	5:00 p.m.	Winter Storm	- COOP observer at Medora measured10.0 inches of snow and indicated the presence of ice pellets and glaze ice - COOP observer at Carlinville measured 5.0 inches of snow and indicated the presence of ice pellets and glaze ice - COOP observer 1 mile north of Virden measured 3.0 inches of snow and noted the presence of freezing rain some drifting of snow - COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 11 hours	n/a	n/a	n/a
11/26/1975 thru 11/27/1975	2:00 a.m.	Heavy Snow	- COOP observer at Carlinville measured 8.7 inches of snow in 19 hours - COOP observer at Medora measured 8.0 inches of snow in 21 hours - COOP observer 1 mile north of Virden measured 7.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 18 hours	n/a	n/a	n/a
3/15/1976 thru 3/16/1976	3:30 p.m.	Heavy Snow	- COOP observer at Carlinville measured 6.0 inches of snow in 13 hours - COOP observer 1 mile north of Virden measured 6.0 inches of snow - COOP observer at Medora measured 5.0 inches of snow in 14 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 8 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/4/1977	7:30 a.m.	Heavy Snow	- COOP observer 1 mile north of Virden measured 6.0 inches of snow in 11 hours - COOP observer at Carlinville measured 5.5 inches of snow in 12 hours - COOP observer at Medora measured 5.0 inches of snow in 16 hours - COOP observer 1 mile east of Mt. Olive measured 4.5 inches of snow in 9 hours	n/a	n/a	n/a
1/9/1977 thru 1/10/1977	8:00 a.m.	Blizzard	- COOP observer at Carlinville measured 5.9 inches of snow in 24.5 hours - COOP observer 1 mile north of Virden measured 4.0 inches of snow and noted strong winds and blizzard conditions - COOP observer 1 mile east of Mt. Olive measured 2.0 inches of snow	n/a	n/a	n/a
1/11/1977	9:30 a.m.	Heavy Snow	COOP observer at Medora measured 5.0 inches of snow in 14 hours	n/a	n/a	n/a
1/13/1977	5:30 a.m.	Blizzard	- COOP observer 1 mile north of Virden measured 5.0 inches of snow in 8 hours and noted blizzard conditions - COOP observer at Carlinville measured 4.0 inches of snow in 8.5 hours - COOP observer at Medora measured 4.0 inches of snow in 10 hours - COOP observer 1 mile east of Mt. Olive measured 2.0 inches of snow in 12 hours	n/a	n/a	n/a
2/26/1977	4:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 13 hours - COOP observer at Medora measured 6.0 inches of snow in 15.5 hours	n/a	n/a	n/a
11/26/1977 thru 11/27/1977	9:00 p.m.	Heavy Snow	- COOP observer 1 mile north of Virden measured 7.0 inches of snow in 14 hours	n/a	n/a	n/a
12/3/1977	12:00 p.m.	Heavy Snow	- COOP observer at Medora measured 7.0 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23 (Sheet 9 of 30) Severe Winter Storm Events Reported in Macoupin County 1950 – 2017						
Date(s)	**Start Time**	**Event Type**	**Magnitude**	**Injuries**	**Fatalities**	**Property Damages**
12/4/1977 thru 12/5/1977	8:30 p.m.	Winter Storm	- COOP observer at Medora measured 6.0 inches of snow - COOP observer at Carlinville measured 5.3 inches of snow and indicated the presence of ice pellets and glaze ice - COOP observer 1 mile north of Virden measured 4.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 3.0 inches of snow	n/a	n/a	n/a
1/12/1978	11:00 a.m.	Heavy Snow	COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow	n/a	n/a	n/a
1/13/1978 thru 1/14/1978	6:00 p.m.	Heavy Snow	COOP observer 1 mile north of Virden measured 6.0 inches of snow in 9 hours	n/a	n/a	n/a
1/16/1978	12:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 14 hours - COOP observer 1 mile north of Virden measured 6.0 inches of snow in 24 hours - COOP observer at Medora measured 5.0 inches of snow in 15 hours	n/a	n/a	n/a
1/25/1978	12:00 a.m.	Heavy Snow	COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 7 hours	n/a	n/a	n/a
2/13/1978	12:00 a.m.	Winter Storm	- COOP observer 1 mile north of Virden measured 5.0 inches of snow and the indicated the presence of glaze ice, freezing rain and winds causing the snow to drift - COOP observer at Carlinville measured 3.0 inches of snow and indicated the presence of ice pellets and glaze ice - COOP observer at Medora measured 3.0 inches of snow and indicated the presence of ice pellets - COOP observer 1 mile east of Mt. Olive indicated the presence of ice pellets and glaze ice	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 10 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
3/2/1978	3:00 a.m.	Heavy Snow	- COOP observer 1 mile north of Virden measured 8.0 inches of snow in 15 hours - COOP observer at Carlinville measured 6.0 inches of snow in 16 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 18 hours	n/a	n/a	n/a
3/6/1978 thru 3/8/1978	10:00 a.m.	Heavy Snow	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • snowfall accumulations of 5 to 17 inches • many motorists were stranded on highways in drifts up to 7 feet deep and all forms of transportation were at a standstill for a least a day • several carports and roofs collapsed under the weight of the snow - COOP observer 1 mile east of Mt. Olive measured 16.0 inches of snow - COOP observer at Carlinville measured 13.3 inches of snow - COOP observer 1 mile north of Virden measured 12.0 inches of snow - COOP observer at Medora measured 12.0 inches of snow						
Subtotal:				**0**	**0**	**$0**

<table>
<tr><th colspan="7">Figure 23
(Sheet 11 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017</th></tr>
<tr><th>Date(s)</th><th>Start Time</th><th>Event Type</th><th>Magnitude</th><th>Injuries</th><th>Fatalities</th><th>Property Damages</th></tr>
<tr><td>3/24/1978
thru
3/26/1978</td><td>3:00 a.m.</td><td>Ice Storm</td><td>Event Description Provided Below</td><td>n/a</td><td>n/a</td><td>$700,000</td></tr>
<tr><td colspan="7">- NOAA's Storm Data Publication record for this storm indicated:
• a heavy coating of ice, several inches thick in some places, and strong winds caused the worst ice storm in many years over central Illinois
• the ice and winds combined to snap power lines, break off large tree limbs, bend home TV antennas and send several tall TV and radio transmitting antennas crashing to the ground
• thousands of power poles were downed and electricity was cut off to about 1 million people
• no serious injuries or deaths were reported, but numerous traffic accidents and falls on the ice were caused by the slick conditions
• numerous small fires were started as fallen wires shorted out on buildings after power poles fell
• 24 counties were declared disaster area by the Governor
• cleanup operations too over a week
- COOP observer 1 mile north of Virden noted that a severe ice storm with damaging winds took place on the 24th & 25th and that disastrous power outages were experienced as a result
- COOP observer at Carlinville noted that ½ inch of ice covered the trees and wires on the 25th
- COOP observer at Medora noted there was a bad ice storm and that many trees were down and there was much damage
- A Virden City Alderman indicated:
• ice accumulations of 2 inches
• $700,000 in damages was experienced
• trees and vehicles were damaged, power lines and TV antennas were downed
• power was out for 2 weeks and during that time period a home burned to the ground due to lack of available water</td></tr>
<tr><td>1/26/1979
thru
1/27/1979</td><td>10:00 a.m.</td><td>Heavy Snow</td><td>- COOP observer 1 mile east of Mt. Olive measured 8.0 inches of snow in 24 hours
- COOP observer at Medora measured 7.0 inches of snow
- COOP observer at Carlinville measured 6.0 inches of snow in 14hours</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td colspan="4">Subtotal:</td><td>0</td><td>0</td><td>$700,000</td></tr>
</table>

Figure 23
(Sheet 13 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/30/1979	10:00 a.m.	Heavy Snow	COOP observer 1 mile north of Virden measured 4.0 inches of snow in 11 hours	n/a	n/a	n/a
2/8/1979	9:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow - COOP observer at Medora measured 5.0 inches of snow in 8 hours	n/a	n/a	n/a
1/30/1980	12:00 a.m.	Heavy Snow	- COOP observer at Carlinville measured 7.0 inches of snow in 22.5 hours - COOP observer 1 mile north of Virden measured 6.0 inches of snow in 21 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 16.5 hours - COOP observer at Medora measured 5.0 inches of snow in 22 hours	n/a	n/a	n/a
2/29/1980 thru 3/1/1980	4:30 p.m.	Heavy Snow	- COOP observer at Carlinville measured 5.5 inches of snow in 14 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 7.5 hours - COOP observer at Medora measured 5.0 inches of snow - COOP observer 1 mile north of Virden measured 4.0 inches of snow	n/a	n/a	n/a
3/12/1980	10:00 a.m.	Heavy Snow	- COOP observer at Medora measured 4.0 inches of snow in 8.5 hours - COOP observer 1 mile north of Virden measured 4.0 inches of snow in 12 hours	n/a	n/a	n/a
4/13/1980 thru 4/14/1980	9:00 p.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 7.0 inches of snow in 23 hours - COOP observer at Medora measured 6.0 inches of snow in 21 hours - COOP observer 1 mile north of Virden measured 6.0 inches of snow in 22 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 14 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/27/1980	12:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 23 hours - COOP observer 1 mile north of Virden measured 6.0 inches of snow in 24 hours - COOP observer at Medora measured 6.0 inches of snow	n/a	n/a	n/a
2/9/1981 thru 2/11/1981	8:00 p.m.	Heavy Snow	- COOP observer at Medora measured 8.0 inches of snow in 27 hours - COOP observer at Carlinville measured 7.7 inches of snow - COOP observer 1 mile east of Mt. Olive measured 7.0 inches of snow in 25 hours - COOP observer 1 mile north of Virden measured 7.0 inches of snow in 26 hours	n/a	n/a	n/a
12/16/1981 thru 12/17/1981	10:30 a.m.	Heavy Snow	- COOP observer 1 mile north of Virden measured 9.0 inches of snow in 10.5 hours - COOP observer at Medora measured 9.0 inches of snow - COOP observer at Carlinville measured 6.1 inches of snow in 19.5 hours	n/a	n/a	n/a
12/22/1981	11:00 a.m.	Heavy Snow	- COOP observer 1 mile north of Virden measured 8.0 inches of snow in 7.5 hours - COOP observer at Carlinville measured 5.0 inches of snow in 12 hours	n/a	n/a	n/a
12/28/1981	12:00 a.m.	Heavy Snow	COOP observer 1 mile north of Virden measured 7.0 inches of snow in 13.5 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 15 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/29/1982 thru 1/31/1982	7:30 a.m.	Heavy Snow	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • snowfall accumulations of up to 24 inches • many highways were closed and about 4,000 persons were stranded on highways for as long as 2 days • sections of the state were without power due to the heavy snow and high winds • some roofs collapsed due to the weight of the snow - COOP observer 1 mile east of Mt. Olive measured 11.0 inches of snow and indicated the presence of ice pellets on the 29th - COOP observer at Medora measured 10.0 inches of snow - COOP observer at Carlinville measured 8.5 inches of snow and indicated the presence of ice pellets on the 28th and 29th - COOP observer 1 mile north of Virden measured 6.0 inches of snow						
2/8/1982 thru 2/9/1982	4:00 p.m.	Heavy Snow	- COOP observer at Medora measured 6.0 inches of snow in 7 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 7 hours - COOP observer 1 mile north of Virden measured 5.0 inches of snow in 12 hours - COOP observer at Carlinville measured 4.8 inches of snow in 7 hours	n/a	n/a	n/a
12/20/1983 thru 12/21/1983	8:00 p.m.	Heavy Snow	- COOP observer at Medora measured 8.0 inches of snow in 22 hours - COOP observer at Carlinville measured 5.5 inches of snow in 18 hours - COOP observer 1 mile north of Virden measured 5.0 inches in 22 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 16 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
2/26/1984 thru 2/28/1984	7:00 p.m.	Blizzard	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • snowfall accumulations of 3 to 15 inches combined with winds gusting to 40 knots caused blizzard conditions • many roads and schools had to be closed due to drifting snow - COOP observer 1 mile north of Virden measured 15.0 inches of snow and noted strong winds and drifting snow - COOP observer at Carlinville measured 10.5 inches of snow and noted blowing and drifting snow - COOP observer at Medora measured 9.0 inches of snow						
3/12/1984	7:30 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 5.5 inches of snow in 16.5 hours - COOP observer 1 mile north of Virden measured 5.0 inches of snow in 10.5 hours	n/a	n/a	n/a
12/19/1985	6:00 a.m.	Heavy Snow	COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 6 hours	n/a	n/a	n/a
2/14/1986	12:00 a.m.	Heavy Snow	COOP observer 1 mile north of Virden measured 9.0 inches of snow in 15 hours	n/a	n/a	n/a
1/9/1987 thru 1/10/1987	5:30 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 9.0 inches of snow in 22 hours - COOP observer at Carlinville measured 8.7 inches of snow in 17 hours - COOP observer at Medora measured 8.5 inches of snow in 20 hours	n/a	n/a	n/a
12/14/1987 thru 12/15/1987	8:00 a.m.	Heavy Snow	- COOP observer 1 mile north of Virden measured 6.0 inches of snow in 21.5 hours and indicated the presence of ice pellets and glaze ice - COOP observer at Carlinville measured 5.7 inches of snow in 21 hours and indicated the presence of ice pellets and glaze ice - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 16 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 17 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
2/10/1988 thru 2/11/1988	9:00 a.m.	Heavy Snow	- COOP observer at Carlinville measured 5.9 inches of snow in 20 hours - COOP observer at Virden measured 5.1 inches of snow in 19 hours - COOP observer at Medora measured 5.0 inches of snow in 21 hours - COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 9 hours	n/a	n/a	n/a
3/3/1988	12:00 a.m.	Heavy Snow	COOP observer at Virden measured 8.0 inches of snow in 19 hours	n/a	n/a	n/a
12/27/1988	9:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 10 hours - COOP observer at Virden measured 5.0 inches of snow in 12.5 hours	n/a	n/a	n/a
2/6/1989 thru 2/7/1989	n/a	Heavy Snow	COOP observer at Virden measured 7.0 inches of snow	n/a	n/a	n/a
3/5/1989 thru 3/6/1989	7:00 a.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Data Publication record for this storm indicated: • snowfall accumulations of 6 to 12 inches - COOP observer at Carlinville measured 10.0 inches of snow, indicated the presence of ice pellets and glaze ice on the 5th and noted considerable blowing and drifting of snow on the 6th - COOP observer at Medora measured 9.5 inches of snow, indicated glaze ice on the 5th and noted winds at 30 mph and drifting on the 6th - COOP observer 1 mile north of Virden measured 6.5 inches of snow and indicated the presence of ice pellets and glaze ice on the 5th - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow and indicated the presence of ice pellets and glaze ice on the 5th						
2/3/1990 thru 2/4/1990	9:30 p.m.	Heavy Snow	COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 9.5 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 18 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
3/23/1990 thru 3/24/1990	9:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 8.5 inches of snow in 17 hours - COOP observer at Medora measured 8.5 inches of snow in 23 hours - COOP observer at Virden measured 6.0 inches of snow in 17 hours - COOP observer at Carlinville measured 5.7 inches of snow in 19 hours	n/a	n/a	n/a
12/21/1990 thru 12/23/1990	5:00 a.m.	Winter Storm	- COOP observer at Carlinville measured 7.2 inches of snow, indicated the presence of ice pellets and glaze ice on the 21st & 22nd and noted freezing rain the morning of the 21st - COOP observer at Virden measured 7.0 inches of snow and indicated the presence of ice pellets and glaze ice on the 21st and 22nd - COOP observer at Medora measured 6.0 inches of snow and noted freezing rain and sleet on the 21st - COOP observer 1 mile east of Mt. Olive measured 5.5 inches of snow	n/a	n/a	n/a
1/5/1991	12:00 a.m.	Winer Storm	- NOAA's Storm Data Publication record for this storm indicated: • a series of snow and ice storms occurred in the first week of January over much of Illinois - COOP observer at Carlinville indicated the presence of ice pellets and glaze ice and noted that the 5th through the 11th about 2 inches of ice covered the ground making walking anywhere hazardous - COOP observer at Medora indicated the presence of glaze ice and noted freezing rain	n/a	n/a	n/a
11/6/1991 thru 1/7/1991	5:00 p.m.	Heavy Snow	- COOP observer at Carlinville measured 4.2 inches of snow in 13 hours - COOP observer at Medora measured 4.0 inches of snow in 9 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 19 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/9/1993 thru 1/10/1993	3:00 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 14 hours - COOP observer at Medora measured 6.0 inches of snow in 22 hours - COOP observer at Carlinville measured 5.9 inches of snow in 23 hours - COOP observer at Virden measured 5.0 inches of snow in 21 hours	n/a	n/a	n/a
2/15/1993 thru 2/16/1993	8:30 a.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 6.5 inches of snow in 16.5 hours - COOP observer at Medora measured 6.5 inches of snow in 23.5 hours - COOP observer at Carlinville measured 6.4 inches of snow in 16.5 hours - COOP observer at Virden measured 5.0 inches of snow	n/a	n/a	n/a
2/24/1993 thru 2/25/1993	9:00 p.m.	Heavy Snow	- COOP observer at Carlinville measured 10.7 inches of snow - COOP observer at Virden measured 10.5 inches of snow - COOP observer at Medora measured 9.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 7.5 inches of snow in 16.5 hours	n/a	n/a	n/a
1/16/1994	9:30 a.m.	Winter Storm	- COOP observer at Virden measured 5.2 inches of snow - COOP observer at Carlinville measured 5.1 inches of snow in 11 hours and indicated the presence of ice pellets - COOP observer at Medora measured 4.0 inches of snow in 14.5 hours and indicated the presence of ice pellets - COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 11.5 hours	n/a	n/a	n/a
1/6/1995	12:00 a.m.	Heavy Snow	COOP observer at Virden measured 5.5 inches of snow in 16 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 20 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
12/18/1995 thru 12/19/1995	2:00 p.m.	Winter Storm	- COOP observer at Medora measured 5.5 inches of snow in 16.5 hours and noted that rain changed to sleet and snow and was very windy with snow drifting - COOP observer at Carlinville measured 5.5 inches of snow in 22.5 hours and indicated the presence of ice pellets and glaze ice - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 17.5 hours	n/a	n/a	n/a
1/2/1996	2:00 a.m.	Heavy Snow	COOP observer at Carlinville measured 5.0 inches of snow in 19 hours	n/a	n/a	n/a
1/5/1996	n/a	Heavy Snow	COOP observer at Virden measured 5.4 inches of snow	n/a	n/a	n/a
2/15/1996 thru 2/16/1996	6:30 p.m.	Heavy Snow	COOP observer at Carlinville measured 4.5 inches of snow in 5.5 hours	n/a	n/a	n/a
1/8/1997 thru 1/9/1997	6:00 p.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts between 5 and 8 inches fell across the area • strong winds and very cold temperatures followed the storm and caused drifting snow and very cold windchills • schools remained closed for several days - COOP observer at Carlinville measured 8.5 inches of snow - COOP observer at Medora measured 8.0 inches of snow - COOP observer at Virden measured 7.0 inches of snow in 18 hours - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 19.5 hours						
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 21 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/15/1997 thru 1/16/1997	11:00 p.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Events Database record for this storm indicated: • freezing rain, sleet and snow with snowfall amounts ranging from 3 to 7 inches • numerous auto accidents occurred along with some power outages • most area schools were closed - COOP observer at Carlinville measured 5.0 inches of snow - COOP observer at Medora measured 4.0 inches of snow and noted that sleet fell during the early morning hours before changing to snow - COOP observer at Virden measured 4.0 inches of snow and indicated the presence of ice pellets - COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow						
12/21/1998 thru 12/22/1998	12:00 a.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated: • light freezing rain, sleet and snow came in with a cold front • roads across much of the area became covered with a thin coating of ice causing numerous auto accidents • temperatures dropped into the single digits between the 21st and 22nd in most areas and only rose into the teens on the 22nd - COOP observer at Virden indicated the presence of glaze ice	n/a	n/a	n/a
1/1/1999 thru 1/2/1999	6:00 p.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Events Database record for this storm indicated: • freezing rain, sleet and snow with freezing rain and sleet accumulations of around 1.0 inch and snowfall amounts ranging from 6 to 14 inches • the freezing rain and sleet fell during the middle of the storm, creating a rock hard layer of ice that was very difficult to move • transportation across the area came to a stop for much of holiday weekend • very cold temperatures after the storm kept conditions icy • most area schools closed through the middle of the week - COOP observer at Virden measured 10.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 9.0 inches of snow - COOP observer at Carlinville measured 5.0 inches of snow						
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 22 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/13/1999	4:30 a.m.	Ice Storm	- NOAA's Storm Events Database record for this storm indicated: • ice accumulations of at least ¼ of an inch • some trees and power lines were downed • ice-covered roads made travel difficult to impossible • area schools were closed through the end of the week	n/a	n/a	n/a
1/29/2000	5:00 a.m.	Heavy Snow	- COOP observer at Carlinville measured 5.0 inches of snow - COOP observer 1 mile east of Mt. Olive measured 4.5 inches of snow in 11 hours	n/a	n/a	n/a
3/11/2000	5:00 a.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated snowfall amounts ranging from 3 to 10 inches - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 5 hours - COOP observer at Virden measured 5.5 inches of snow in 8 hours	n/a	n/a	n/a
12/13/2000	7:00 a.m.	Heavy Snow	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 6 to 10 inches • some schools in rural areas were closed into the next week as temperatures remained very cold and a couple of minor snowfalls kept travel conditions poor - COOP observer 1 mile east of Mt. Olive measured 7.0 inches of snow in 10.5 hours - COOP observer at Virden measured 6.0 inches of snow in 14 hours	n/a	n/a	n/a
1/26/2001	1:00 a.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated: • light rain during the early morning hours resulted in a thin coating of ice on area roads • most schools across the area were closed and numerous traffic accidents were reported - COOP observer at Virden indicated the presence of glaze ice	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 23 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
3/25/2002 thru 3/26/2002	6:00 p.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Events Database record for this storm indicated: • sleet and snow with sleet accumulations of 1 inch and snowfall amounts ranging from 3 to 4 inches • the combination of sleet and snow made for extremely hazardous travel conditions across the area - COOP observer 1 mile east of Mt. Olive noted the presence of ice starting about 8 p.m. - COOP observer at Virden measured 2.5 inches of snow and indicated the presence of glaze ice on the 25th and ice pellets on the 26th - COOP observer at Medora measured 1.5 inches of snow						
12/24/2002	6:00 a.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 4 to 8 inches • travel conditions were difficult on Christmas Day - COOP observer at Medora measured 5.1 inches of snow - COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 11.5 hours - COOP observer at Virden measured 5.0 inches of snow	n/a	n/a	n/a
1/1/2003 thru 1/2/2003	11:00 p.m.	Heavy Snow	COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 18 hours	n/a	n/a	n/a
1/25/2004	6:00 a.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Events Database record for this storm indicated: • freezing rain, sleet and snow with some areas receiving freezing rain accumulations of ¼ to ½ inch, sleet accumulations of 1 to 2 inches and snowfall amounts ranging from 1 to 2 inches • transportation across the region was brought to a halt • many schools were closed into mid-week - COOP observer at Virden measured 4.0 inches of snow in 12 hours - COOP observer at Medora measured 2.1 inches of snow and indicated the presence of ice pellets and glaze ice						
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 24 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/15/2005 thru 1/16/2005	9:00 p.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 5.0 inches of snow in 7 hours - COOP observer at Carlinville measured 4.0 inches of snow	n/a	n/a	n/a
12/8/2005	10:00 a.m.	Heavy Snow	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 2 to 5 inches - COOP observer at Carlinville measured 4.0 inches of snow in 7.5 hours - COOP observer at Virden measured 4.0 inches of snow in 6.5 hours	n/a	n/a	n/a
3/20/2006 thru 3/21/2006	7:30 p.m.	Heavy Snow	- COOP observer at Virden measured 7.2 inches of snow in 16 hours, indicated the presence of ice pellets and noted that beads of sleet fell first prior to the snow - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 17 hours and noted that the snow drifted - COOP observer at Carlinville measured 5.0 inches of snow - COOP observer at Medora measured 4.3 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

<table>
<tr><th colspan="7">Figure 23
(Sheet 25 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017</th></tr>
<tr><th>Date(s)</th><th>Start Time</th><th>Event Type</th><th>Magnitude</th><th>Injuries</th><th>Fatalities</th><th>Property Damages</th></tr>
<tr><td>11/29/2006 thru 12/1/2006</td><td>10:00 p.m.</td><td>Winter Storm</td><td>This event was part of a federally-declared disaster (Declaration #1681)
Event Description Provided Below</td><td>n/a</td><td>n/a</td><td>$500,422</td></tr>
<tr><td colspan="7">- NOAA’s Storm Events Database record for this storm indicated:
• freezing rain, sleet and snow with ice and sleet accumulations up to 1 inch and snowfall amounts ranging up to 12 inches
• Macoupin County EMA officials estimated that at least 40,000 of the 50,000 residents lost power during the storm with the southern quarter of the County especially hard hit (most municipalities from Brighton to Bunker Hill to Staunton lost virtually all power)
• in some areas power was not restored for a week
• many rural schools were closed for several days due to slick roads and power outages
• numerous buildings and automobiles were damaged by falling trees and tree limbs
- COOP observer at Medora measured 4.0 inches of ice and 2.0 inches of snow
- COOP observer at Carlinville measured 1.0 inches of ice and 5.0 inches of snow and noted the rain change to freezing rain and sleet around 9 a.m. on the 30th
- COOP observer at Virden measured 5.0 inches of snow and indicated the presences of glaze ice and damaging winds on the 30th and ice pellets and glaze ice on the 1st
- COOP observer 1 mile east of Mt. Olive measured 1.0 inches of ice and 2.0 inches of snow, indicated the presence of ice pellets, glaze ice and damaging winds on the 1st and note major tree and power line damage with their power going out at 6 p.m. on the 30th
- Macoupin County EMA Coordinator identified $500,422 in damages and emergency protective measures sustained by 47 entities in Macoupin County (See the “Assessing Vulnerability” section for a breakdown by entity)
- Bunker Hill Planning Committee member records indicate that the City lost power and 1.5 inches of ice and 8 to 10 inches of snow covered the City</td></tr>
<tr><td>1/12/2007 thru 1/14/2007</td><td>10:00 p.m.</td><td>Ice Storm</td><td>Event Description Provided Below</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td colspan="7">- NOAA’s Storm Events Database record for this storm indicated:
• three rounds of freezing precipitation with ice accumulations from ¼ to ½ inch and sleet accumulations up to 1 ½ inches
• significant tree and limb damage was reported as a result of this storm
• widespread power outages were reported with more than 100,000 homes and businesses losing power during this storm
- COOP observer 1 mile east of Mt. Olive indicated the presence of glaze ice on the 13th, noted the power went about at 1 a.m. on the 13th, and that there was ½ inch of ice on trees but none on the roads
- COOP observer at Virden indicated the presence of glaze ice on the 12th and 13th</td></tr>
<tr><td colspan="4">Subtotal:</td><td>0</td><td>0</td><td>$500,422</td></tr>
</table>

Figure 23
(Sheet 26 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
1/20/2007 thru 1/21/2007	11:00 p.m.	Heavy Snow	- COOP observer 1 mile east of Mt. Olive measured 4.0 inches of snow in 6 hours - COOP observer at Carlinville measured 4.0 inches of snow	n/a	n/a	n/a
12/8/2007 thru 12/12/2007	11:00 p.m.	Ice Storm	- NOAA's Storm Events Database record for this storm indicated: • freezing rain and sleet with ice accumulations up to ½ inch and sleet accumulations up to 1 inch • numerous trees and power lines were reported down across the area • some businesses had to close due to power loss and most schools were closed for a couple of days - COOP observer 1 mile east of Mt. Olive indicated the presence of glaze ice on the 9th and noted thin ice on the grass but nothing on the road on the 9th and ½ inch ice on trees and clear roads on the 10th	n/a	n/a	n/a
12/14/2007 thru 12/15/2007	4:30 p.m.	Heavy Snow	- COOP observer at Virden measured 6.5 inches of snow in 26 hours - COOP observer at Medora measured 6.5 inches of snow - COOP observer at Carlinville measured 5.5 inches of snow	n/a	n/a	n/a
1/31/2008 thru 2/1/2008	12:00 p.m.	Heavy Snow	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts up to 11 inches - COOP observer at Carlinville measured 9.0 inches of snow - COOP observer at Virden measured 8.5 inches of snow in 21 hours - COOP observer 1 mile east of Mt. Olive measured 8.0 inches of snow - COOP observer at Medora measured 7.7 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 27 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
2/21/2008 thru 2/22/2008	4:00 a.m.	Sleet	- NOAA's Storm Events Database record for this storm indicated: • sleet accumulations of ½ inch to 2 inches • at least 100 vehicle accidents were reported across the region • most area schools were closed both days - COOP observer 1 mile east of Mt. Olive indicated the presence of ice pellets and glaze ice on the 22nd and noted there was a rain/sleet mix	n/a	n/a	n/a
3/3/2008 thru 3/4/2008	8:00 p.m.	Heavy Snow	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 6 to 12 inches - COOP observer at Virden measured 7.0 inches of snow in 26 hours - COOP observer at Medora measured 6.8 inches of snow	n/a	n/a	n/a
12/18/2008 thru 12/19/2008	4:00 p.m.	Ice Storm	- NOAA's Storm Events Database record for this storm indicated: • ice accumulations around ¼ inch across Macoupin County • tree limbs were reported down and there were scattered power outages - COOP observer 1 mile east of Mt. Olive indicated the presence of glaze ice on the 18th but noted that the glazing on the trees was gone on the 19th	n/a	n/a	n/a
1/26/2009 thru 1/28/2009	9:00 p.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 6 to 10 inches, with an average of 6 inches of snow recorded across Macoupin County - COOP observer 1 mile east of Mt. Olive measured 6.5 inches of snow - COOP observer at Medora measured 6.2 inches of snow - COOP observer at Carlinville measured 6.0 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

<table>
<tr><th colspan="7">Figure 23
(Sheet 28 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017</th></tr>
<tr><th>Date(s)</th><th>Start Time</th><th>Event Type</th><th>Magnitude</th><th>Injuries</th><th>Fatalities</th><th>Property Damages</th></tr>
<tr><td>1/31/2011 thru 2/2/2011</td><td>12:00 a.m.</td><td>Winter Storm</td><td>Event Description Provided Below</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td colspan="7">- NOAA’s Storm Events Database record for this storm indicated:
• sleet accumulations ranging from 2 to 3 inches and snowfall amounts ranging from 2 to 6 inches with some areas receiving up to 22 inches of snow and wind gusts of over 40 mph
- COOP observer at Carlinville measured 9.0 inches of sleet/snow
- COOP observer at Virden measured 7.0 inches of sleet/snow, indicated the presence of ice pellets and glaze ice on the 1st and noted that there was ¼ inch of glaze on everything
- COOP observer 1 mile east of Mt. Olive measured 3.0 inches of sleet with 2.0 inches of snow on top, indicated the presence of glaze ice on the 1st and ice pellets and glaze ice on the 2nd and noted ¼ inch of ice in the trees
- COOP observer at Medora measured 4.0 inches of sleet/snow</td></tr>
<tr><td>2/21/2013</td><td>9:00 a.m.</td><td>Winter Storm</td><td>- NOAA’s Storm Events Database record for this storm indicated:
• freezing rain, sleet and snow with snowfall amounts ranging from 6.0 to 8.0 inches
- COOP observer 1 mile east of Mt. Olive measured 5.8 inches of snow in 11 hours
- COOP observer at Carlinville measured 5.0 inches of snow
- COOP observer at Medora measured 5.0 inches of snow</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>3/24/2013</td><td>8:00 a.m.</td><td>Heavy Snow</td><td>Event Description Provided Below</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td colspan="7">- NOAA’s Storm Events Database record for this storm indicated:
• snowfall amounts ranging from 6 to 16 inches
• the heaviest snow fell from parts of Calhoun County, east across Jersey, Macoupin and into Montgomery County
• most schools were closed the next day, however overall impacts were minimal
- COOP observer at Medora measured 12.7 inches of snow
- COOP observer at Carlinville measured 12.0 inches of snow
- COOP observer 1 mile east of Mt. Olive measured 9.9 inches of snow</td></tr>
<tr><td colspan="4">Subtotal:</td><td>0</td><td>0</td><td>$0</td></tr>
</table>

Figure 23
(Sheet 29 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
12/13/2013 thru 12/14/2013	3:00 p.m.	Heavy Snow	- COOP observer at Medora measured 6.1 inches of snow, noted the presence of sleet and indicated that the heavy snow on tree branches caused some breakage - COOP observer 1 mile east of Mt. Olive measured 5.9 inches of snow in 20 hours, noted that precipitation started as rain/freezing rain before turning to sleet and snow and indicated they lost power for 19 hours due downed power lines from ice and snow - COOP observer at Carlinville measured 5.0 inches of snow	n/a	n/a	n/a
1/5/2014	5:00 a.m.	Winter Storm	Event Description Provided Below	n/a	n/a	n/a
- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 9 to 15 inches • strong northerly winds created snow drifts ranging from 2 to 5 feet • all schools and most businesses were closed on the 5th & 6th, with many schools remaining closed for several days due to very cold temperatures and windchills - COOP observer at Carlinville measured 12.0 inches of snow - COOP observer at Medora measured 6.4 inches of snow - COOP observer 1 mile east of Mt. Olive measured 6.0 inches of snow in 11 hours						
2/4/2014 thru 2/5/2014	10:00 a.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 6 to 10 inches • travel was very difficult in rural areas • most schools were closed for a couple of days - COOP observer at Carlinville measured 8.0 inches of snow - COOP observer at Medora measured 6.7 inches of snow - COOP observer 1 mile east of Mt. Olive measured 5.8 inches of snow in 16 hours	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**

Figure 23
(Sheet 30 of 30)
Severe Winter Storm Events Reported in Macoupin County
1950 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
2/15/2015 thru 2/16/2015	6:00 p.m.	Heavy Snow	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts up to 10 inches - COOP observer 1 mile east of Mt. Olive measured .08 inches of snow in 22 hours - COOP observer at Medora measured 6.8 inches of snow	n/a	n/a	n/a
2/20/2015 thru 2/21/2015	8:00 p.m.	Winter Storm	- NOAA's Storm Events Database record for this storm indicated: • freezing rain, sleet and snow with snowfall amounts up to 6 inches - COOP observer 1 mile east of Mt. Olive measured 4.9 inches of snow and indicated the presence of ice pellets - COOP observer at Medora measured 3.1 inches of snow	n/a	n/a	n/a
2/28/2015 thru 3/1/2015	3:00 p.m.	Heavy Snow	- NOAA's Storm Events Database record for this storm indicated: • snowfall amounts ranging from 6 to 8 inches - COOP observer 1 mile east of Mt. Olive measured 6.2 inches of snow - COOP observer at Medora measured 5.8 inches of snow	n/a	n/a	n/a
Subtotal:				**0**	**0**	**$0**
GRAND TOTAL				**0**	**0**	**$1,200,422**

Sources: Macoupin County Multi-Jurisdictional All Hazards Mitigation Planning Committee Member responses to Natural Hazard Events Questionnaire.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Cooperative Observation Forms.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Data.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

Figure 24
Extreme Cold Events Reported in Macoupin County
2000 – 2017

Date(s)	Start Time	Event Type	Magnitude	Injuries	Fatalities	Property Damages
12/16/2000 the 12/17/2000	8:00 p.m.	Extreme Cold/ Windchill	- NOAA's Storm Events Database record for this event indicated: • temperatures dropped into the single digits with windchill values down to -30°F during the evening of the 16th • wind chills remained at -20°F to -40°F through noon on the 17th • A 79-year old man from Springfield, suffering from early stages of dementia, left his home on the 16th and apparently became disoriented and headed south into Macoupin County. He was found dead in an open field on the 20th. - COOP observer at Virden measured a maximum temperature of 17°F and minimum temperature of -1°F on the 17th	0	1	n/a
1/1/2010 thru 1/12/2010	12:00 a.m.	Cold/Windchill	- NOAA's Storm Events Database record for this event indicated: • temperature dropped below zero for the first time in 10 years in many locations - COOP observer at Virden recorded high temperatures ranging from 9°F to 26°F and low temperatures ranging from -8°F to 15°F - COOP observer at Carlinville recorded maximum temperatures ranging from 10°F to 28°F and minimum temperatures ranging from -9°F to 12°F	n/a	n/a	n/a
1/6/2014 thru 1/7/2014	12:00 a.m.	Cold/ Windchill	- NOAA's Storm Events Database record for this event indicated: • low temperatures and wind chills followed a winter storm that brought heavy snow to much of the area • windchill readings the morning of the 7th ranged from -25°F to -39°F - COOP observer at Carlinville measured maximum temperatures of -4°F and 17°F and minimum temperatures of -12°F and -8°F	n/a	n/a	n/a
Subtotal:				**0**	**1**	**$0**
GRAND TOTAL:				**0**	**1**	**$0**

Sources: NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Cooperative Observation Forms.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

3.3 EXCESSIVE HEAT

IDENTIFYING THE HAZARD

What is the definition of excessive heat?

Excessive heat is generally characterized by temperatures that hover 10 degrees or more above the average high temperature of a region for a prolonged period of time (several days to several weeks) and is often accompanied by high humidity. In comparison, a heat wave is generally defined as a period of abnormally and uncomfortably hot and unusually humid weather that typically lasts two or more days.

Excessive heat events are usually a result of both high temperatures and high relative humidity. (Relative humidity refers to the amount of moisture in the air.) The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures.

On hot days the human body relies on the evaporation of perspiration or sweat to cool and regulate the body's internal temperature. Sweating does nothing to cool the body unless the water is removed by evaporation. When the relative humidity is high, then the evaporation process is hindered, robbing the body of its ability to cool itself.

Excessive heat is one of the leading weather-related killers in the United States. On average, hundreds of fatalities and even more heat-related illnesses occur each year.

What is the Heat Index?

In an effort to raise the public's awareness of the hazards of excessive heat, the National Weather Service (NWS) devised the "Heat Index". The Heat Index, sometimes referred to as the "apparent temperature", is a measure of how hot it feels when relative humidity is added to the actual air temperature. **Figure 30** shows the Heat Index as it corresponds to various air temperatures and relative humidity.

As an example, if the air temperature is 96°F and the relative humidity is 65%, then the Heat Index would be 121°F. It should be noted that the Heat Index values were devised for shady, light wind conditions. Exposure to full sunshine can increase Heat Index values by up to 15°F. Also strong winds, particularly with very hot, very dry air, can be extremely hazardous. When the Heat Index reaches 105°F or greater, there is an increased likelihood that continued exposure and/or physical activity will lead to individuals developing severe heat disorders.

What are heat disorders?

Heat disorders are a group of illnesses caused by prolonged exposure to hot temperatures and are characterized by the body's inability to shed excess heat. These disorders develop when the heat gain exceeds the level the body can remove or if the body cannot compensate for fluids and salt lost through perspiration. In either case the body loses its ability to regulate its internal

Figure 30
Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution   Extreme Caution   Danger   Extreme Danger

Source: NOAA, National Weather Service.

temperature. All heat disorders share one common feature: the individual has been overexposed to heat, or over exercised for their age and physical condition on a hot day. The following describes the symptoms associated with the different heat disorders.

- **Sunburn.** Sunburn is characterized by redness and pain of skin exposed too long to the sun without proper protection. In severe cases it can cause swelling, blisters, fever and headaches. It can significantly retard the skin's ability to shed excess heat.
- **Heat Cramps.** Heat cramps are characterized by heavy sweating and painful spasms, usually in the muscles of the legs and possibly the abdomen. The loss of fluid through perspiration leaves the body dehydrated resulting in muscle cramps. This is usually the first sign that the body is experiencing trouble dealing with heat.
- **Heat Exhaustion.** Heat exhaustion is characterized by heavy sweating, weakness, nausea, exhaustion, dizziness and faintness. Breathing may become rapid and shallow and the pulse thready (weak). The skin may appear cool, moist and pale. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a mild form of shock. If not treated, the victim's condition will worsen.
- **Heat Stroke (Sunstroke).** Heat stroke is a life-threatening condition characterized by a high body temperature (106°F or higher). The skin appears to be dry and flushed with very little perspiration present. The individual may become mentally confused and aggressive. The pulse is rapid and strong. There is a possibility that the individual will faint or slip into unconsciousness. If the body is not cooled quickly, then brain damage and death may result.

Studies indicate that, all things being equal, the severity of heat disorders tend to increase with age. Heat cramps in a 17-year-old may be heat exhaustion in someone 40 and heat stroke in a person over 60. Elderly persons, small children, chronic invalids, those on certain medications and persons with weight or alcohol problems are particularly susceptible to heat reactions.

Figure 31 below indicates the heat index at which individuals, particularly those in higher risk groups, might experience heat-related disorders. Generally, when the heat index is expected to exceed 105°F, the NWS will initiate excessive heat alert procedures.

Figure 31
Relationship between Heat Index and Heat Disorders

Heat Index (°F)	Heat Disorders
80°F – 90°F	Fatigue is possible with prolonged exposure and/or physical activity
90°F – 105°F	Heat cramps, heat exhaustion and heat stroke possible with prolonged exposure and/or physical activity
105°F – 130°F	Heat cramps, heat exhaustion and heat stroke likely; heat stroke possible with prolonged exposure and/or physical activity
130°F or Higher	Heat stroke highly likely with continued exposure

Source: NOAA, Heat Wave: A Major Summer Killer.

What is an excessive heat alert?

An excessive heat alert is an advisory or warning issued by the NWS when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines the type of alert issued. There are four types of alerts that can be issued for an extreme heat event. The following provides a brief description of each type of alert based on the ***excessive heat advisory/warning criteria*** established by NWS Weather Forecast Office in St. Louis, Missouri. The St. Louis Office is responsible for issuing alerts for Macoupin County.

- **Outlook.** An excessive heat outlook is issued when the potential exists for an excessive heat event to develop over the next three (3) to seven (7) days.
- **Watch.** An excessive heat watch is issued when conditions are favorable for an excessive heat event to occur within the next 24 to 72 hours.
- **Advisory.** An excessive heat advisory is issued when the heat index is expected to be around 105°F, <u>or</u> when the heat index will range from 100°F to 104°F for at least four (4) consecutive days.
- **Warning.** An excessive heat warning is issued when the heat index is expected to be around 110°F, <u>or</u> when the heat index is expected to reach 105°F for four (4) consecutive days.

PROFILING THE HAZARD

When have excessive heat events occurred previously? What is the extent of these events?

Excessive Heat Fast Facts – Occurrences

Number of Excessive Heat Events Reported (1995 – 2017): ***39***

Hottest Temperature Recorded in the County: ***114°F (July 14, 1954 at Virden)***

Most Likely Month for Excessive Heat Events to Occur: ***July***

Figure 32, located at the end of this section, summarizes the previous occurrences as well as the extent or magnitude of excessive heat events recorded in Macoupin County. NOAA's Storm Events Database has documented 39 occurrences of excessive heat in Macoupin County between 1995 and 2017. Since 1995, at least one *recorded* excessive heat event has occurred each year in Macoupin County with the exception of 1996, 1997, 1998, 2000 and 2008. A review of the NWS's COOP data records suggests that excessive heat events have occurred with similar frequency between 1950 and 1995.

Figure 33 charts the reported occurrences of excessive heat by month. Of the 39 events, 26 (67%) took place in July making this the peak month for excessive heat events in Macoupin County. There were seven events that spanned two month; however, for illustration purposes only the month the event started in is graphed.

Figure _33
Excessive Heat Events by Month
1995 – 2017

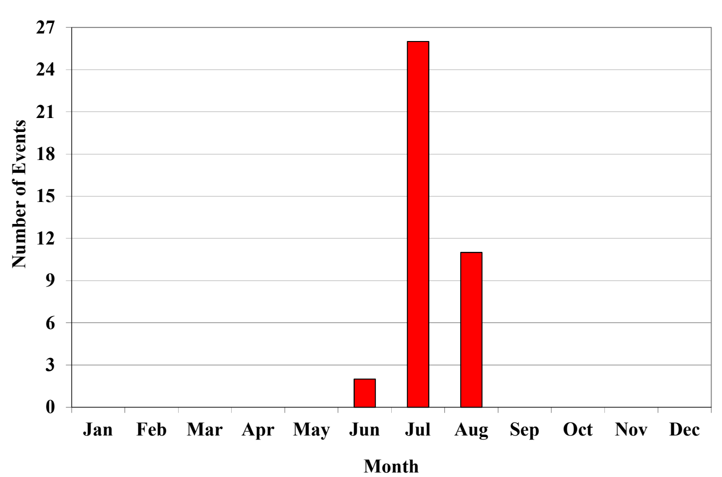


Figure 34 charts the reported occurrences of excessive heat by hour. Of the 39 occurrences, 64% began during the p.m. hours, with 22 of the events (88%) beginning at 12:00 p.m.

According to the Midwestern Regional Climate Center, temperature records for Macoupin County were kept from 1893 through 2014 for Carlinville and from 1948 through 2011 for Virden. During these periods, the hottest temperature recorded in Macoupin County was 114°F at Virden on July 14, 1954. **Figures 35** and **36** list the hottest days recorded in Carlinville and Virden.

Figure 34
Excessive Heat Events by Hour
1997 – 2017

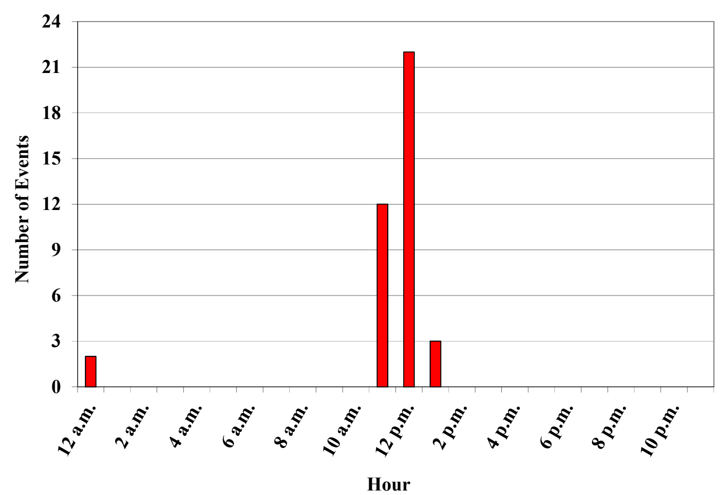


Figure 35
Hottest Days Recorded in Carlinville

	Date	Temperature		Date	Temperature
1	07/24/1934	113°F	6	07/14/1936	112°F
2	07/15/1936	113°F	7	07/14/1954	112°F
3	07/08/1954	113°F	8	07/22/1901	111°F
4	07/20/1934	112°F	9	07/28/1930	111°F
5	07/23/1934	112°F	10	07/21/1934	111°F

Source: Midwest Regional Climate Center cli-MATE

Figure 36
Hottest Days Recorded in Virden

	Date	Temperature		Date	Temperature
1	07/14/1954	114°F	7	07/13/1954	104°F
2	07/12/1954	110°F	8	07/19/1954	104°F
3	07/18/1954	110°F	9	07/20/1954	104°F
4	06/26/1954	107°F	10	07/10/1966	104°F
5	07/15/1954	107°F	11	07/12/1966	104°F
6	08/20/1983	105°F	12	07/13/1966	104°F

Source: Midwest Regional Climate Center cli-MATE

What locations are affected by excessive heat?

Excessive heat affect the entire County. All communities in Macoupin County have been affected by excessive heat. Excessive heat events generally extend across an entire region and affect multiple counties. The *2013 Illinois Natural Hazard Mitigation Plan* classifies Macoupin County's hazard rating for excessive heat as "high."

Do any of the participating municipalities have designated cooling centers?

Yes. Seven of the eleven participating municipalities have designated cooling centers. A "designated" cooling center is identified as any facility that has been *formally* identified by the municipality (through emergency planning, resolution, Memorandum of Agreement, etc.) as a location available for use by residents of the jurisdiction during excessive heat events. **Figure 37** identifies the location of each cooling center by jurisdiction. At this time Benld, Carlinville, Royal Lakes and Virden do not have any cooling centers designated within their municipalities.

Figure 37
Designated Cooling Centers by Participating Municipality

Name/Address	Name/Address
Brighton	*Mount Olive*
Municipal Building, 206 S. Main St.	Immanuel Lutheran Church, 111 E. Main St.
St. Paul UMC Cartwright Building, 101 Green St.	City Hall, 215 E. Main St.
Bunker Hill	*Staunton*
Police Department, 801 S. Franklin St.	Knights of Columbus, 20631 Staunton Rd.
Gillespie	VFW, 120 E. Henry St.
Civic Center, 115 N. Macoupin St.	*Wilsonville*
Girard	Village Hall, 99 Wilson Ave.
City Hall, 1st St. & Madison St.	

In addition to those designated cooling centers identified by the participating municipalities, the Macoupin County Public Health Department's Maple Street Clinic and the Macoupin County Transportation Building also serve as cooling centers.

What is the probability of future excessive heat events occurring?

Macoupin County has experienced 39 verified occurrences of excessive heat between 1995 and 2017. With 39 occurrences over the past 23 years, Macoupin County should expect to experience at least one excessive heat event a year. There were nine years over the past 23 years where two or more excessive heat events occurred. This indicates that the probability that more than one excessive heat event may occur during any given year within the County is 39%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to excessive heat?

Yes. All of Macoupin County, including the participating municipalities, is vulnerable to the dangers presented by excessive heat. Since 2008, Macoupin County has experienced 20 excessive heat events.

What impacts resulted from the recorded excessive heat events?

The data provided by NOAA's Storm Events Database indicates that between 1995 and 2017, three of the 39 excessive heat events caused $55,000 in property damage and $410,000 in crop damage. Both the property and crop damage totals represent losses sustained in 21 counties (including Macoupin County). A breakdown by county was unavailable. Property damage information was either unavailable or none was recorded for the remaining 36 reported occurrences.

NOAA's Storm Events Database documented a total of 222 heat-related injuries as a result of three excessive heat events. The heat-related injury totals represent losses sustained over a 21-county area (including Macoupin County). A breakdown by county was unavailable.

In comparison, Illinois averages 74 deaths per year as a result of excessive heat. Excessive heat has triggered more deaths than any other natural hazard in Illinois. More deaths are attributed to excessive heat than the combined number of deaths attributed to floods, tornadoes, lightning and extreme cold.

Excessive Heat Fast Facts – Impacts/Risk

Excessive Heat Events
- ❖ Total Property Damage: ***$55,000^***
- ❖ Infrastructure/Critical Facilities Damage: ***n/a***
- ❖ Total Crop Damage: ***$410,000****
- ❖ Fatalities: ***n/a***
- ❖ Injuries: 222*

Excessive Heat Risk/Vulnerability to:
- ❖ Public Health & Safety – General Population: ***Low/Medium***
- ❖ Public Health & Safety – Sensitive Populations: ***Medium/High***
- ❖ Buildings/Infrastructure/Critical Facilities: ***Low***

^ The property damage totals represent losses sustained during two separate events over a 21-county area (including Macoupin County). A detailed breakdown by county was not available.

* The injury and crop damage totals represent losses sustained during three separate events over a 21-county area (including Macoupin County). A detailed breakdown by county was unavailable.

No other injuries or deaths were reported as a result of excessive heat in Macoupin County. This does not mean however that none occurred; it simply means that excessive heat was not identified as the primary cause. This is especially true for deaths. Usually heat is not listed as the primary cause of death, but rather an underlying cause. The heat indices were sufficiently high for all the excessive heat events to produce heat cramps or heat exhaustion with the possibility of heat stroke in cases of prolonged exposure or physical activity.

The level of risk or vulnerability posed by excessive heat to the public health and safety of the *general population* is considered to be low to medium. This assessment is based on the absence of designated cooling centers in some of the participating municipalities tempered by the fact that Macoupin County does not have large urban areas where living conditions (such as older, poorly-ventilated high rise buildings and low-income neighborhoods) tend to contribute to heat-related injuries and fatalities.

The level of risk or vulnerability posed by excessive heat to the public health and safety of *sensitive populations* is considered to medium to high. Sensitive populations such as the elderly, small children, individuals with chronic conditions, those on certain medication and persons with weight or alcohol problems are more susceptible to heat-related reactions and therefore their risk is elevated.

What other impacts can result from excessive heat events?

Other impacts of excessive heat include road buckling, power outages, stress on livestock, early school dismissals and school closings. In addition, excessive heat events can also lead to an increase in water usage and may result in municipalities imposing water use restrictions. In Macoupin County, excessive heat has the ability to impact the drinking water supplies of all the participating municipalities. Each relies solely on surface water sources for their drinking water supplies.

Are existing buildings, infrastructure and critical facilities vulnerable to excessive heat?

No. In general, existing buildings, infrastructure and critical facilities located in the County and the participating municipalities are not vulnerable to excessive heat. The primary concern is for the health and safety of those living in the County (including all of the municipalities).

While buildings do not typically sustain damage from excessive heat, in rare cases infrastructure and critical facilities may be directly or indirectly damaged. While uncommon, excessive heat has been known to contribute to damage caused to roadways within Macoupin County. The combination of excessive heat and vehicle loads has caused pavement cracking and buckling.

Excessive heat has also been known to indirectly contribute to disruptions in the electrical grid. When the temperatures rise, the demand for energy also rises in order to operate air conditioners, fans and other devices. This increase in demand places stress on the electrical grid components, increasing the likelihood of power outages. While not common in Macoupin County, there is the potential for this to occur. The potential may increase over the next two decades if new power plants are not built to replace the state's aging nuclear power facilities that are expected to be decommissioned.

In general, the risk or vulnerability to buildings, infrastructure and critical facilities from excessive heat is considered low, even taking into consideration the potential for damage to roadways and disruptions to the electrical grid.

Are future buildings, infrastructure and critical facilities vulnerable to excessive heat?

No. Future buildings, infrastructure and critical facilities within the County and participating municipalities are no more vulnerable to excessive heat events than the existing building, infrastructure and critical facilities. As discussed above, buildings do not typically sustain damage from excessive heat. Infrastructure and critical facilities may, in rare cases, be damaged by excessive heat, but very little can be done to prevent this.

What are the potential dollar losses to vulnerable structures from excessive heat?

Unlike other natural hazards there are no standard loss estimation models or methodologies for excessive heat. With only three of the 39 recorded events listing property damage numbers, there is no way to accurately estimate future potential dollar losses from excessive heat. Since excessive heat typically does not cause structure damage, it is unlikely that future dollar losses will be extreme. The primary concern associated with excessive heat is the health and safety of those living in the County and municipalities, especially sensitive populations such as the elderly, infants, young children and those with medical conditions.

Figure 32
(Sheet 1 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/11/1995 thru 7/17/1995	12:00 p.m.	95^	0	$50,000^	$200,000^	A very hot and humid air mass settled over the region for nearly a week, producing high temperatures close to 100°F and heat indices approaching 120°F at times - many roads throughout the region experienced buckling - crops withered with the dry weather - there was no widespread loss of livestock although dairy cows produced less milk and cattle/swine/chickens put on less weight - 95 heat-related injuries, $50,000 in property damage and $200,000 in crop damage was recorded over a 21 county area (including Macoupin County); however a detailed breakdown by County was not available COOP observers recorded the following temperature ranges from the 11th through the 17th: - at Carlinville high temperatures ranged from 89°F to 99°F and low temperatures ranged from 66°F to 78°F (high 99°F / low 78°F on the 13th) - at Virden high temperatures ranged from 85°F to 98°F and low temperatures ranged from 62°F to 79°F (high 98°F / low 77°F on the 13th)
Subtotal:		**95^**	**0**	**$50,000^**	**$200,000^**	

^ The 95 heat-related injuries, $50,000 in property damages and $200,000 in crop damages resulting from the July 11-17, 1995 excessive heat event represent losses sustained over a 21-county area (including Macoupin County). A detailed breakdown by county was not available.

Figure 32
(Sheet 2 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/28/1995 thru 7/31/1995	12:00 p.m.	30†	0	$5,000†	$10,000†	Another heat wave moved through the area at the end for July with heat indices at 110°F for several days - several people were treated in area hospitals for heat related illnesses, mainly across metropolitan areas just east of St. Louis COOP observers recorded the following temperature ranges from the 28th through the 31st: - at Carlinville high temperatures ranged from 90°F to 92°F and low temperatures ranged from 67°F to 74°F - at Virden high temperatures ranged from 87°F to 91°F and low temperatures ranged from 69°F to 78°F
8/9/1995 thru 8/24/1995	1:00 p.m.	97§	0	n/a	$200,000§	A heat wave developed during most of the middle of August with high temperatures near the 100°F mark and heat indices over 110°F - area crops suffered greatly from the hot and dry weather COOP observers recorded the following temperature ranges from the 9th through the 20th: - at Carlinville high temperatures ranged from 90°F to 94°F and low temperatures ranged from 73°F to 76°F - at Virden high temperatures ranged from 85°F to 95°F and low temperatures ranged from 71°F to 75°F
Subtotal:		**127†§**	**0**	**$5,000†**	**$210,000†§**	

† The 30 heat-related injuries, $5,000 in property damages and $10,000 in crop damages resulting from the July 28-31, 1995 excessive heat event represent losses sustained over a 21-county area (including Macoupin County). A detailed breakdown by county was not available.

§ The 97 heat-related injuries and $200,000 in crop damages resulting from the August 9-24, 1995 excessive heat event represent losses sustained over a 21-county area (including Macoupin County). A detailed breakdown by county was not available.

Figure 32 (Sheet 3 of 12) Excessive Heat Events Reported in Macoupin County 1995 – 2017						
Date(s)	**Start Time**	**Injuries**	**Fatalities**	**Property Damages**	**Crop Damages**	**Magnitude/Description**
7/18/1999 thru 7/31/1999	12:00 p.m.	n/a	n/a	n/a	n/a	A heat wave gripped the region the last 2 weeks of July – temperatures remained in the middle to upper 90s with a few days topping 100°F and the heat indices ranged from 105°F to near 115°F - 8 heat-related deaths and 119 heat-related injuries were recorded over a 17 county area – most the deaths and injuries occurred in the Metro East area, primarily in Madison and St. Clair Counties COOP observers recorded the following temperature ranges from the 18th through the 31st: - at Carlinville high temperatures ranged from 86°F to 100°F and low temperatures ranged from 68°F to 78°F (highs of 99°F and 100°F and lows of 76°F and 789°F on the 29th and 30th) - at Virden high temperatures ranged from 91°F to 100°F and low temperatures ranged from 68°F to 79°F (highs of 100°F and lows of 75°F and 79°F on the 29th and 30th)
7/7/2001 thru 7/10/2001	11:00 a.m.	n/a	n/a	n/a	n/a	The first heat wave of the summer gripped the region with temperatures peaking in the middle to upper 90s and heat indices ranging from 105°F to 110°F COOP observer at Virden recorded high temperatures ranging from 90°F to 94°F and low temperatures ranging from 67°F to 79°F
7/17/2001	11:00 a.m.	n/a	n/a	n/a	n/a	A one-day heat wave hit as temperatures climbed into the lower to middle 90s and very humid conditions pushed the heat indices into the 110°F to 115°F range COOP observer at Virden recorded a high temperature of 93°F and a low temperature of 70°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32 (Sheet 4 of 12) Excessive Heat Events Reported in Macoupin County 1995 – 2017						
Date(s)	**Start Time**	**Injuries**	**Fatalities**	**Property Damages**	**Crop Damages**	**Magnitude/Description**
7/29/2001 thru 8/2/2001	11:00 a.m.	n/a	n/a	n/a	n/a	The 3rd heat wave of the month hit the region with high temperatures in the lower to middle 90s and the humidity pushing the heat indices to between 105°F and 110°F COOP observer at Virden recorded high temperatures ranging from 90°F to 95°F and low temperatures ranging from 71°F to 74°F
8/7/2001 thru 8/9/2001	12:00 a.m.	n/a	n/a	n/a	n/a	A second heat wave hit the area with high temperatures in the lower to upper 90s and the heat indices ranging from 102°F to 110°F COOP observer at Virden recorded high temperatures ranging from 91°F to 96°F and low temperatures ranging from 71°F to 75°F
8/21/2001 thru 8/22/2001	12:00 a.m.	n/a	n/a	n/a	n/a	The last heat wave of the summer hit the area with temperatures reaching the hottest of the summer with highs in the middle 90s to around 100°F and heat indices ranging from 105°F to 110°F COOP observer at Virden recorded a high temperature of 97°F and a low temperature of 72°F on the 22nd
7/8/2002 thru 7/9/2002	11:00 a.m.	n/a	n/a	n/a	n/a	A two day heat wave hit the area with high temperatures in the middle to upper 90s and heat indices ranging from 105°F to 110°F COOP observer at Virden recorded high temperatures ranging from 93°F to 94°F and low temperatures ranging from 74°F to 76°F
7/20/2002 thru 7/22/2002	11:00 a.m.	n/a	n/a	n/a	n/a	Another heat wave enveloped the area with high temperatures in the middle to upper 90s and heat indices ranging from 105°F to 115°F COOP observer at Virden recorded high temperatures ranging from 93°F to 96°F and low temperatures ranging from 74°F to 76°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 5 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/26/2002 thru 8/6/2002	11:00 a.m.	n/a	n/a	n/a	n/a	A heat wave blanketed the region with high temperatures in the middle to upper 90s and heat indices ranging from 105°F to near 115°F - there was a one day break in the heat as a weak cold front dropped temperatures back into the 80s on July 29; however temperatures quickly rebounded and remained high into August COOP observer at Virden recorded high temperatures ranging from 86°F to 94°F and low temperatures ranging from 68°F to 76°F
8/15/2003 thru 8/21/2003	12:00 p.m.	n/a	n/a	n/a	n/a	A late summer heat wave hit the area with high temperatures in the middle to upper 90s and heat indices ranging from 105°F to 110°F - the heat wave hit as most schools were opening, resulting in many schools reducing their schedule to a half day while a few closed altogether COOP observer at Virden recorded high temperatures ranging from 89°F to 98°F and low temperatures ranging from 65°F to 75°F
8/24/2003 thru 8/28/2003	12:00 p.m.	n/a	n/a	n/a	n/a	After a brief cool down the heat returned to the area with high temperatures pushing into the middle 90s to around 100°F and heat indices ranging from 105°F to 110°F COOP observer at Virden recorded high temperatures ranging from 88°F to 96°F and low temperatures ranging from 67°F to 75°F
7/20/2004 thru 7/22/2004	12:00 p.m.	n/a	n/a	n/a	n/a	A second heat wave hit the region with temperatures in the lower to middle 90s and the heat indices ranging from 105°F to 110°F COOP observers recorded the following temperature ranges from the 20th through the 22nd: - at Carlinville high temperatures ranged from 87°F to 93°F and low temperatures ranged from 70°F to 76°F - at Virden high temperatures ranged from 85°F to 93°F and low temperatures ranged from 70°F to 76°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 6 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/20/2005 thru 7/26/2005	12:00 p.m.	n/a	n/a	n/a	n/a	The first significant heat wave in several years hit the region with temperatures hitting around 100°F and heat indices as high as 121°F COOP observers recorded the following temperature ranges from the 20th through the 26th: - at Carlinville high temperatures ranged from 92°F to 98°F and low temperatures ranged from 70°F to 78°F (high of 98°F / low of 78°F on the 25th) - at Virden high temperatures ranged from 92°F to 99°F and low temperatures ranged from 72°F to 78°F (high of 99°F / low of 77°F on the 24th)
7/17/2006 thru 7/21/2006	12:00 p.m.	n/a	n/a	n/a	n/a	A heat wave hit the region with temperatures ranging from the middle 90s to around 100°F and heat indices ranging from 100°F to close to 110°F COOP observers recorded the following temperature ranges from the 17th through the 21st: - at Carlinville high temperatures ranged from 90°F to 95°F and low temperatures ranged from 66°F to 74°F - at Virden high temperatures ranged from 86°F to 94°F and low temperatures ranged from 69°F to 75°F
7/30/2006 thru 8/2/2006	12:00 p.m.	n/a	n/a	n/a	n/a	Excessive heat returned to the area in late July with high temperatures in the upper 90s to around 100°F and heat indices ranging from 105°F to 110°F COOP observers recorded the following temperature ranges from July 30th through August 2nd: - at Carlinville high temperatures ranged from 96°F to 99°F and low temperatures ranged from 71°F to 77°F (highs of 99°F and lows of 76°F and 77°F on the 31st and 1st) - at Virden high temperatures ranged from 97°F to 98°F and low temperatures ranged from 72°F to 77°F (highs of 98°F and lows of 77°F on the 31st and 2nd)
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 7 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
8/5/2007 thru 8/16/2007	12:00 p.m.	n/a	n/a	n/a	n/a	The first and only real heat wave of the summer enveloped the area with temperatures in the middle 90s to around 100°F and heat indices ranging from 105°F to 110°F - many schools across the area went to an early dismissal schedule in order to combat the heat COOP observer at Carlinville recorded high temperatures ranging from 92°F to 102°F and low temperatures ranging from 63°F to 78°F for the 5th through 16th (high of 101°F / low of 68°F on the 13th and highs of 99°F and 102°F and lows of 71°F and 72°F on the 15th and 16th)
6/21/2009 thru 6/27/2009	11:00 a.m.	n/a	n/a	n/a	n/a	The first heat wave of the season produced high temperatures in the middle to upper 90s and heat indices averaging around 105°F COOP observers recorded the following temperature ranges from the 21st through the 27th: - at Carlinville high temperatures ranged from 91°F to 94°F and low temperatures ranged from 67°F to 75°F - at Virden high temperatures ranged from 90°F to 92°F and low temperatures ranged from 69°F to 76°F
7/14/2010	12:00 p.m.	n/a	n/a	n/a	n/a	A one-day heat wave hit the area with temperatures in the middle 90s and heat indices ranging from 105°F to 110°F COOP observers recorded the following temperatures on the 14th: - at Carlinville the high temperature was 92°F and low temperature was 77°F - at Virden high temperature was 93°F and low temperature was 74°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 8 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/17/2010	12:00 p.m.	n/a	n/a	n/a	n/a	Another one-day heat wave hit the area with temperatures in the middle 90s and heat indices averaging around 105°F COOP observers recorded the following temperatures on the 17th: - at Carlinville the high temperature was 93°F and low temperature was 75°F - at Virden high temperature was 91°F and low temperature was 73°F
7/22/2010 thru 7/24/2010	12:00 p.m.	n/a	n/a	n/a	n/a	A three-day heat wave hit the area with temperatures in the middle to upper 90s and heat indices ranging from 105°F to 110°F COOP observers recorded the following temperature ranges from the 22nd through the 24th: - at Carlinville high temperatures ranged from 93°F to 94°F and low temperatures ranged from 70°F to 76°F - at Virden high temperatures ranged from 91°F to 93°F and low temperatures ranged from 73°F to 78°F
8/2/2010 thru 8/4/2010	1:00 p.m.	n/a	n/a	n/a	n/a	A short but intense heat wave hit the area with high temperatures on the 3rd and 4th near 100°F and heat indices around 110°F COOP observers recorded the following temperature ranges from the 2nd through the 4th: - at Carlinville high temperatures ranged from 86°F to 98°F and low temperatures ranged from 64°F to 75°F - at Virden high temperatures ranged from 86°F to 96°F and low temperatures ranged from 69°F to 76°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 9 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
8/8/2010 thru 8/14/2010	1:00 p.m.	n/a	n/a	n/a	n/a	A significant heat wave gripped the area with high temperatures in the upper 90s to around 100°F and heat indices in the 110°F to 115°F range due to high moisture levels COOP observers recorded the following temperature ranges from the 8th through the 14th: - at Carlinville high temperatures ranged from 91°F to 96°F and low temperatures ranged from 69°F to 76°F - at Virden high temperatures ranged from 91°F to 97°F and low temperatures ranged from 68°F to 76°F
7/1/2011 thru 7/3/2011	12:00 p.m.	n/a	n/a	n/a	n/a	A hot and humid air mass settled over the area the first three days of July with high temperatures in the lower to upper 90s and heat indices around 105°F COOP observers recorded the following temperature ranges from the 1st through the 3rd: - at Carlinville high temperatures ranged from 88°F to 95°F and low temperatures ranged from 68°F to 73°F - at Virden high temperatures ranged from 88°F to 94°F and low temperatures ranged from 72°F to 75°F
7/10/2011 thru 7/12/2011	12:00 p.m.	n/a	n/a	n/a	n/a	A short but intense heat wave hit the area with high temperatures in the upper 90s to around 100°F and hear indices ranging from 110°F to 115°F COOP observers recorded the following temperature ranges from the 10th through the 12th: - at Carlinville high temperatures ranged from 92°F to 95°F and low temperatures ranged from 67°F to 77°F - at Virden high temperatures ranged from 91°F to 95°F and low temperatures ranged from 71°F to 80°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 10 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/17/2011 thru 8/3/2011	12:00 p.m.	n/a	n/a	n/a	n/a	A major heat wave hit the area lasting from mid-July into the beginning of August with high temperatures ranging from the lower 90s to around 100°F, night time temperatures hovering around 80°F and heat indices ranging from around 105°F to 115°F COOP observers recorded the following temperature ranges from July 17th through the August 3rd: - at Carlinville high temperatures ranged from 87°F to 98°F and low temperatures ranged from 65°F to 78°F - at Virden high temperatures ranged from 87°F to 97°F and low temperatures ranged from 70°F to 79°F
8/31/2011 thru 9/3/2011	12:00 p.m.	n/a	n/a	n/a	n/a	The last heat wave of the summer hit the region with high temperatures topping 100°F in many locations on the 31st and heat indices ranging around 105°F COOP observer at Carlinville recorded high temperatures ranging from 98°F to 100°F and low temperatures ranged from 68°F to 72°F for August 31st through September 3rd (high of 100°F / low of 71°F on the 2nd)
6/27/2012 thru 7/8/2012	12:00 p.m.	n/a	n/a	n/a	n/a	Some of the hottest temperatures in many years occurred the last 4 days of June and continued into July - nearly all reporting stations were over 100°F the last 3 to 4 days of June with most sites around 105°F - while the temperatures were high, the dry was very dry leading to heat indices that were not much different than the air temperature COOP observer at Carlinville recorded high temperatures ranging from 92°F to 104°F and low temperatures ranged from 66°F to 74°F for June 27th through July 8th (highs of 102°F to 104°F and lows of 72°F to 74°F on the 5th through the 7th)
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 11 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/16/2012 through 7/19/2012	12:00 p.m.	n/a	n/a	n/a	n/a	Excessive heat returned to the area with high temperatures between 100°F and 106°F and heat indices only a few degrees higher COOP observer at Carlinville recorded high temperatures ranging from 95°F to 102°F and low temperatures ranged from 70°F to 79°F for the 16th through the 19th (high of 102°F / low of 79°F on the 18th)
7/22/2012 thru 7/27/2012	12:00 p.m.	n/a	n/a	n/a	n/a	After a brief break, excessive heat returned to the region once again with high temperatures ranging from 100°F to 108°F and heat indices only a few degrees higher due to the relatively dry air COOP observer at Carlinville recorded high temperatures ranging from 90°F to 103°F and low temperatures ranged from 63°F to 79°F for the 22nd through the 27th (highs of 103°F and lows of 76°F to 79°F on the 23rd through the 25th)
8/30/2013 thru 9/1/2013	11:00 a.m.	n/a	n/a	n/a	n/a	The first and only heat wave of the summer hit the area with high temperatures peaking around 100°F and heat indices ranging from 105°F to 110°F COOP observer at Carlinville recorded high temperatures ranging from 93°F to 98°F and low temperatures ranged from 68°F to 72°F for August 30th through September 1st
8/20/2014 thru 8/27/2014	12:00 p.m.	n/a	n/a	n/a	n/a	The first extended heat wave of the summer hit the region with high temperatures in the mid to upper 90s and the heat indices ranging from 105°F to 110°F
7/12/2015 thru 7/13/2015	11:00 a.m.	n/a	n/a	n/a	n/a	Excessive heat hit parts of central Illinois with high temperatures in the mid to upper 90s and heat indices around 110°F
Subtotal:		**0**	**0**	**$0**	**$0**	

Figure 32
(Sheet 12 of 12)
Excessive Heat Events Reported in Macoupin County
1995 – 2017

Date(s)	Start Time	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/17/2015 thru 7/19/2015	11:00 a.m.	n/a	n/a	n/a	n/a	After a brief break, excessive heat returned to the region with high temperatures in the lower to middle 90s and heat indices ranging from 105°F to 110°F
7/27/2015 thru 7/29/2015	11:00 a.m.	n/a	n/a	n/a	n/a	The last heat wave of the summer hit the region with high temperatures in the middle 90s and heat indices ranging from 105°F to 110°F
7/18/2016 thru 7/24/2016	11:00 a.m.	n/a	n/a	n/a	n/a	Excessive heat gripped the region with high temperatures in the mid to upper 90s and heat indices up to 110°F
7/19/2017 thru 7/23/2017	12:00 p.m.	n/a	n/a	n/a	n/a	Excessive heat hit west-central Illinois with high temperatures in the upper 90s to 105°F and heat indices ranging from 105°F to 110°F
Subtotal:		**0**	**0**	**$0**	**$0**	
GRAND TOTAL:		**222‡**	**0**	**$55,000‡**	**$410,000‡**	

‡ There were three (3) events where 222 heat-related injuries, $55,000 in property damage and $410,000 in crop damage were recorded and represent losses sustained by multiple counties (including Macoupin County). A detailed breakdown by county was not available.

Sources: NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Cooperative Observation Forms.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

3.4 TORNADOES

IDENTIFYING THE HAZARD

What is the definition of a tornado?

A tornado is a violently rotating column of air, usually characterized by a twisting, funnel-shaped cloud, which extends from the cloud formation of a thunderstorm to the ground. The strongest tornadoes have rotating wind speeds of more than 200 miles per hour and can create damage paths in excess of one mile wide and 50 miles long.

Not all tornadoes have a visible funnel cloud. Some may appear nearly transparent until dust and debris are picked up or a cloud forms within the funnel. Generally, tornadoes move from southwest to northeast, but they have been known to travel in any direction, even backtracking. The average forward speed of a tornado is 30 mile per hour, but this may vary from nearly stationary to 70 miles per hour.

About 1,200 tornadoes hit the United States yearly. On average, 49 tornadoes occur each year in Illinois. The destruction caused by a tornado may range from light to catastrophic depending on the intensity, size and duration of the storm. Tornadoes cause crop and property damage, power outages, environmental degradation, injuries and fatalities. Tornadoes are known to blow off roofs, move cars and tractor trailers and demolish homes. Typically tornadoes cause the greatest damage to structures of light construction, such as residential homes. On average, tornadoes cause 60 to 65 facilities and 1,500 injuries in the United States annually.

How are tornadoes rated?

Originally tornadoes were rated using the Fujita Scale (F-Scale), which related the degree of damage caused by a tornado to the intensity of the tornado's wind speed. The Scale identified six categories of damage, F0 through F5. **Figure 38** gives a brief description of each category.

Use of the original Fujita Scale was discontinued on February 1, 2007 in favor of the Enhanced Fujita Scale. The original scale had several flaws including basing a tornado's intensity and damages on wind speeds that were never scientifically tested and proven. It also did not take into consideration that a multitude of factors (i.e. structure construction, wind direction and duration, flying debris, etc.) affect the damage caused by a tornado. In addition, the process of rating the damage itself was based on the judgment of the damage assessor. In many cases, meteorologists and engineers highly experienced in damage survey techniques often came up with different F-scale ratings for the same damage.

The Enhanced Fujita Scale (EF-Scale) was created to remedy the flaws in the original scale. It continues to use the F0 through F5 categories, but it classifies the level of damage (one through eight) as calibrated by engineers and meteorologists to 28 different types of damage indicators (mainly various building types, towers/poles and trees.) The wind speeds assigned to each category are estimates, not measurements, based on the damage assessment. **Figure 38** identifies the Enhanced Fujita Scale.

Figure 38
Fujita & Enhanced Fujita Tornado Measurement Scales

F-Scale		EF-Scale		Description
Category	**Wind Speed (mph)**	**Category**	**Wind Speed (mph)**	
F0	40 – 72	EF0	65 – 85	Light damage – some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; damage to sign boards
F1	73 – 112	EF1	86 – 110	Moderate damage – peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads
F2	113 – 157	EF2	111 – 135	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	158 – 207	EF3	136 – 165	Severe damage – roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown
F4	208 – 260	EF4	166 – 200	Devastating damage – well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated
F5	261 – 318	EF5	Over 200	Incredible damage – strong frame houses lifted off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur

Source: National Oceanic and Atmospheric Administration, Storm Prediction Center.

The idea behind the EF-Scale is that a tornado scale needs to take into account the typical strengths and weaknesses of different types of construction, instead of applying a "one size fits all" approach. This is due to the fact that the same wind speed can cause different degrees of damage to different kinds of structures. In a real life application, the degree of damage to each of the 28 indicators can be mapped together to create a comprehensive damage analysis. As with the original scale, the EF-Scale rates the tornado as a whole based on the most intense damage within the tornado's path.

While the EF-Scale is currently in use, ***the historical data presented in this report is based on the original F-Scale***. None of the tornadoes rated before February 1, 2007 will be re-evaluated using the EF-Scale.

Are alerts issued for tornadoes?

Yes. The National Weather Service Weather Forecast Office in St. Louis, Missouri is responsible for issuing ***tornado watches*** and ***warnings*** for Macoupin County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watch.** A tornado watch is issued when conditions are favorable for severe thunderstorms and possible tornado development. It does not mean that a tornado is imminent, just that individuals need to be alert and prepared.
- **Warning.** A tornado warning is issued when a tornado has been sighted or indicated by radar. Warnings indicate imminent danger to life and property for those who are in the path of the tornado. Individuals should see shelter immediately.

PROFILING THE HAZARD

When have tornadoes occurred previously? What is the extent of these previous tornadoes?

Figure 39, located at the end of this section, summarizes the previous occurrences as well as the extent or magnitude of tornado events recorded in Macoupin County. NOAA's Storm Events Database and the NWS Weather Forecast Office in St. Louis have documented 38 occurrences of tornadoes in Macoupin County between 1950 and 2017. In comparison, there have been 2,199 tornadoes statewide between 1950 and 2012 according to the most recent Illinois Natural Hazard Mitigation Plan.

Tornado Fast Facts – Occurrences

Number of Tornadoes Reported (1950 – 2017): ***38***
Highest F-Scale Rating Recorded: ***EF3 (April 19, 2011)***
Most Likely Month for Tornadoes to Occur: ***May***
Most Likely Time for Tornadoes to Occur: ***Late Afternoon***
Average Length of a Tornado: ***3.9 miles***
Average Width of a Tornado: ***80 yards***
Average Damage Pathway of a Tornado: ***0.18 sq. mi.***
Longest Tornado Path in the County: ***27.9 miles (May 12, 1978)***
Widest Tornado Path in the County: ***700 yards (May 12, 1978)***

Figure 40 charts the reported occurrences of tornadoes by magnitude. Of the 38 reported occurrences there was: one – EF3, seven – F2s, two – EF2s, eight – F1s, three – EF1s, thirteen – F0s, and four – EF0s.

Figure 40
Tornadoes by Magnitude
1950 – 2017

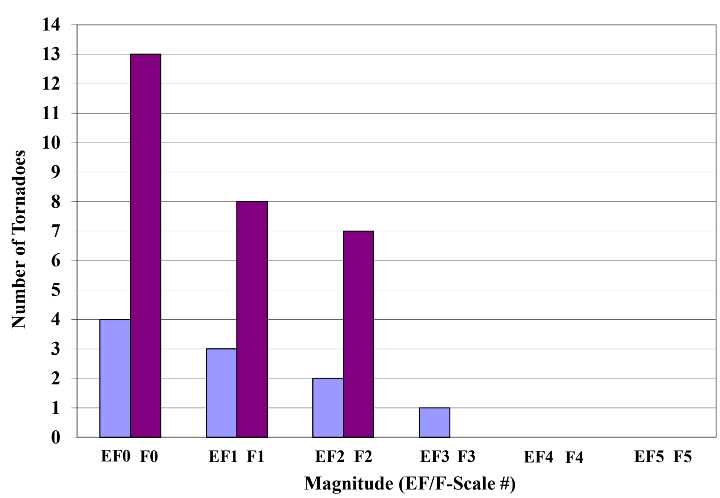


Figure 41 charts the reported tornadoes by month. Of the 38 events, 25 (66%) took place in April, May and June making this the peak period for tornadoes in Macoupin County. Of those 25 events, 13 (52%) occurred during May making this the peak month for tornadoes. In comparison, 1,457 of the 2,199 tornadoes (66%) recorded in Illinois since 1950 took place in April, May and June.

Figure 41
Tornadoes by Month
1950 – 2017

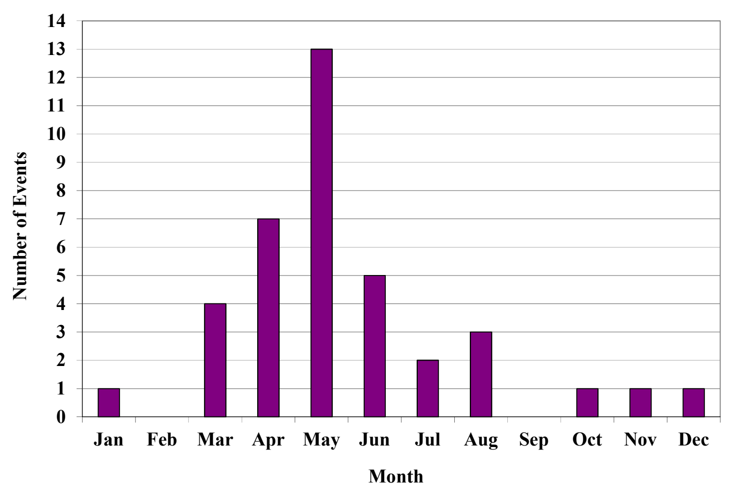
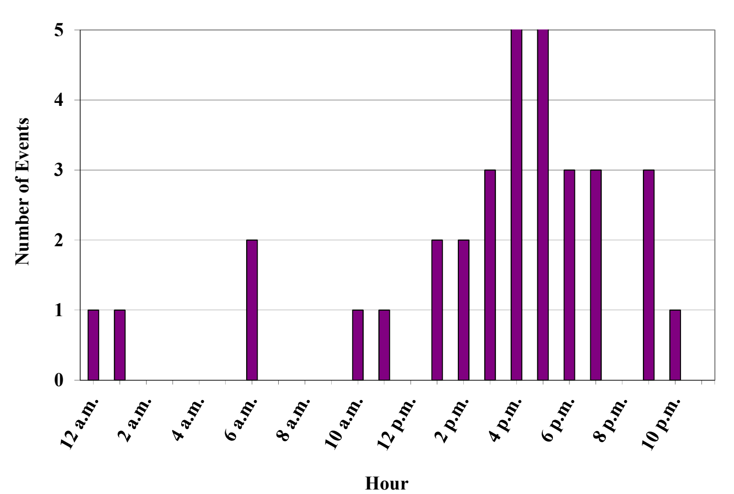


Figure 42 charts the reported tornadoes by hour. Approximately 84% of all tornadoes occurred during the p.m. hours, with 24 of the p.m. events (75%) taking place between 3 p.m. and 8 p.m. In comparison, more than half of all Illinois tornadoes occur between 3 p.m. and 7 p.m.

Figure 42
Tornadoes by Hour
1950 – 2017



The tornadoes that have impacted Macoupin County have varied from 0.1 miles to 27.9 miles in length and from 20 yards to 700 yards in width. The average length of a tornado in Macoupin County is 3.9 miles and the average width is 80 yards (0.045 miles).

Figures 43 shows the pathway of each reported tornado. The numbers by each tornado correspond with the tornado description in **Figure 39**. Records indicate that most of these tornadoes generally moved from southwest to northeast across the County. Unlike other natural hazards (i.e., severe winter storms, drought and excessive heat), tornadoes impact a relatively small area. Typically the area impacted by a tornado is less than four square miles. In Macoupin County, the average damage pathway or area impacted by a tornado is 0.18 square miles.

An EF1 tornado caused damage to several outbuildings in Sawyerville on March 7, 2017.

Photo courtesy of the National Weather Service

The longest and widest tornado recorded in Macoupin County occurred on May 12, 1978. This F2 tornado, measuring 34.1 miles in length and 700 yards in width, touched down in Shipman and traveled northeast passing just north of the center of Carlinville before lifting off northeast of Farmersville in Montgomery County. The tornado was on the ground in Macoupin County for approximately 27.9 miles. The damage pathway of this tornado covered 13.6 square miles, with approximately 11.1 square miles occurring in Macoupin County.

What locations are affected by tornadoes?

Tornadoes have the potential to affect the entire County. All of the participating municipalities, with the exception of Benld, Brighton, Royal Lakes and Staunton, have had reported occurrences of tornadoes within their corporate limits. The *2013 Illinois Natural Hazard Mitigation Plan* prepared by IEMA classifies Macoupin County's hazard rating for tornadoes as "severe."

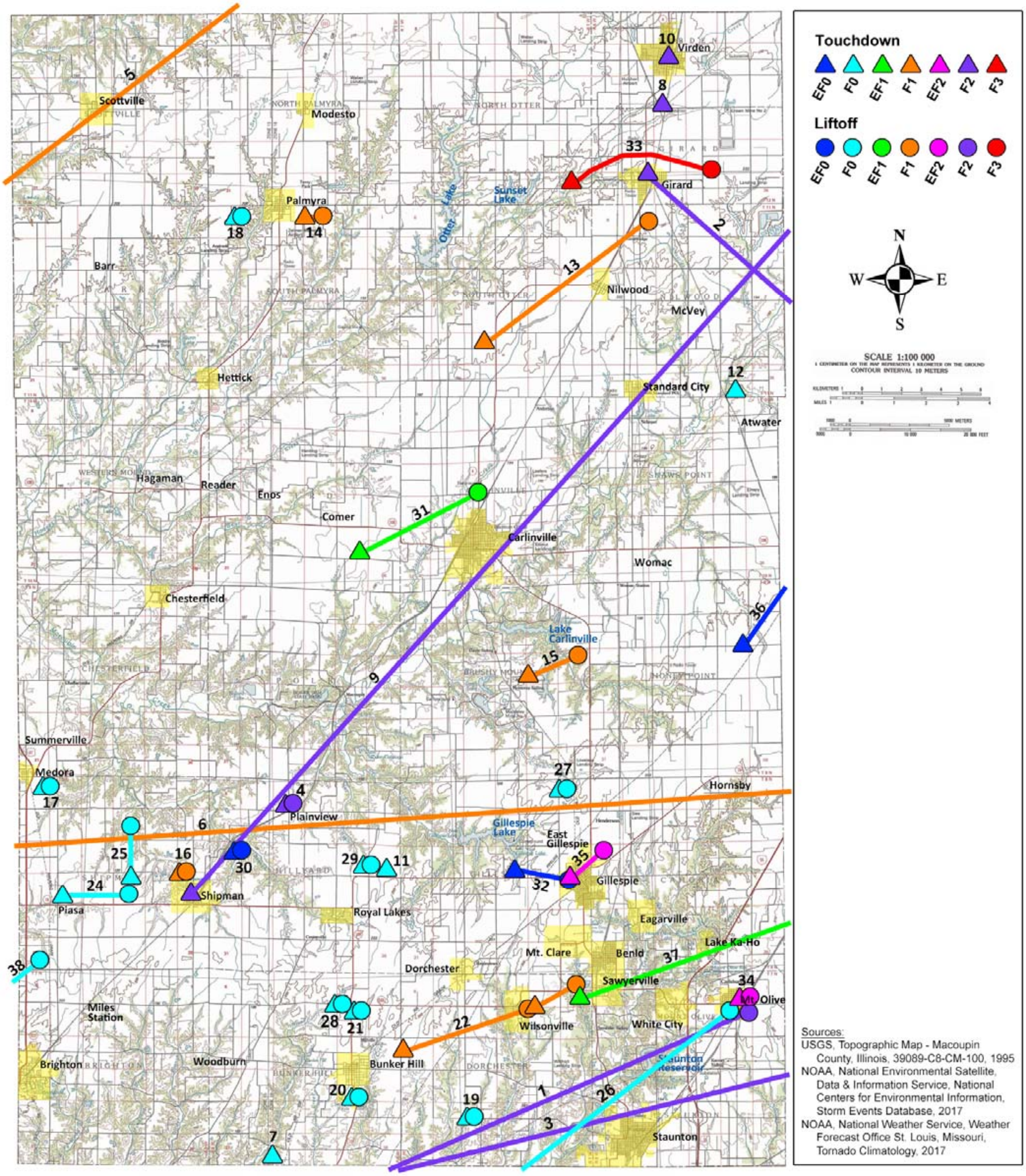
What is the probability of future tornadoes occurring?

Macoupin County has had 38 verified occurrences of tornadoes between 1950 and 2017. With 38 tornadoes over the past 68 years, the probability or likelihood that a tornado will touchdown somewhere in the County in any given year is 56%. There were ten years over the last 68 years where more than one tornado occurred. This indicates that the probability that more than one tornado may occur during any given year within the County is 15%.

The second story of a brick building was blown off by an EF2 tornado that ripped through Mt. Olive on May 20, 2013.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

Figure 43
Tornado Pathways in Macoupin County



ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to tornadoes?

Yes. All of Macoupin County is vulnerable to the dangers presented by tornadoes. According to NOAA's Storm Events Database and the NWS Weather Forecast Office in St. Louis, a majority of the tornadoes have touched down or passed through the central and southern portions of the County. Since 2008, eight tornadoes have been recorded in Macoupin County.

All of the participating municipalities, with the exception of Benld, Brighton and Royal Lakes have had a tornado touch down or pass through their municipal boundaries. **Figure 44** lists the verified tornadoes that have touched down in or near or passed through each participating municipality. In terms of unincorporated areas vulnerable to tornadoes, Piasa and Plainview have each had three tornadoes touch down in or near their vicinity while Atwater and Womac have each had one tornado touch down in their vicinity.

Figure 44
Verified Tornadoes In or Near Participating Municipalities

Participating Municipality	Number of Verified Tornadoes	Year	
		Touched Down/Passed Through Municipality	Touched Down/Passed Near Municipality
Benld	0	---	---
Brighton	0	---	---
Bunker Hill	6	2005	1966, 2003, 2005, 2005, 2006
Carlinville	3	1978	1999, 2009
Gillespie	3	2009, 2013	1961
Girard	3	1959	1996, 2011
Mt. Olive	3	1950, 2006, 2013	---
Royal Lakes	2	---	1990, 2007
Staunton	2	---	1959, 2006
Virden	2	1967	1990
Wilsonville	2	2005, 2005	---

What impacts resulted from the recorded tornadoes?

Data obtained from NOAA's Storm Events Database, NWS Weather Forecast Office in St. Louis and committee member records indicates that between 1950 and 2017, 15 of the 38 tornadoes caused $5,072,750 in property damage. Included in the property damage total is $550,000 in damages sustained as a result of four separate tornado events (December 2, 1950, August 4, 1959, October 10, 1959 and May 6, 1960) and represents losses incurred in two or more counties (including Macoupin County.) A breakdown by county was unavailable.

Eight of the 15 tornadoes have property damage totals of at least $200,000. Property damage information was either unavailable or none was recorded for the remaining 23 reported occurrences.

NOAA's Storm Events Database and committee member records documented three fatalities and nine injuries as a result of five tornado events. Detailed information on the injuries sustained was only available for two of the events. The following provides a brief description of each.

Tornado Fast Facts – Impacts/Risk

Tornado Impacts
- Total Property Damage: ***$5,072,750***^
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Total Crop Damage: ***n/a***
- Injuries: ***9***
- Fatalities: ***3***

Tornado Risk/Vulnerability to:
- Public Health & Safety – Rural Areas: ***Low to Medium***
- Public Health & Safety – Municipalities: ***High***
- Buildings/Infrastructure/Critical Facilities – Rural Areas: ***Low***
- Buildings/Infrastructure/Critical Facilities – Municipalities/Populated Unincorp. Areas: ***High***

^ Included in the property damage total is $550,000 in damages sustained as the result of four separate tornado event and represents losses incurred in two or more counties (including Macoupin County). A breakdown by county was not available.

* Infrastructure/Critical Facilities Damage totals are included in the Total Property Damage amounts.

- A man sustained cuts on his hands when the windows of the vehicle he had taken shelter in were shattered during an F2 tornado on May 12, 1978.
- During the April 19, 2011 EF3 tornado, two individuals sustained minor cuts and bruises while trying to seek shelter in a basement.

In comparison, Illinois averages roughly four tornado fatalities annually; however, this number varies widely from year to year.

Appendix K contains select photographs provided by Macoupin County EMA Coordinator James Pitchford that illustrate the extent of the property damage sustained during the EF3 tornado that passed near Girard on April 19, 2011.

What impacts resulted from the historic tornadoes?

The most destructive tornado in terms of impacts ever recorded in Macoupin County occurred on March 19, 1948. This F4 tornado was 28 miles long and 400 yards wide. It developed near Alton in Madison County and moved northeast through Fosterburg before entering Macoupin County and decimating Bunker Hill and ravaging Gillespie.

A total of 33 fatalities, 449 injuries and $3.6 million in property damages was recorded for this tornado. Based on the Bureau of Labor Statistics (BLS) Consumer Price Index (CPI) Inflation Calculator, the property damages sustained equal over $38.3 million in 2018. The following provides a breakdown of the damages by jurisdiction.

An F4 tornado destroyed approximately 80% of Bunker Hill on March 19, 1948.

Courtesy of James Pitchford, Macoupin County EMA Coordinator

Bunker Hill
- 80% of the City was destroyed (2,000 buildings including 250 homes)
- 19 fatalities and approximately 165 injuries were recorded
- Property damages were estimated at $1.5 million (approximately $15.9 million in 2018 according to the BLS CPI Inflation Calculator)

Gillespie
- 150 homes were destroyed
- 5 fatalities were recorded

This tornado is the 6th deadliest tornado in Illinois since 1880, according to the National Weather Service. **Appendix J** contains historic news articles and photograph detailing the extent of the damages experienced as a result of this tornado.

What other impacts can result from tornadoes?

In addition to causing damage to buildings and properties, tornadoes can damage infrastructure and critical facilities such as roads, bridges, railroad tracks, drinking water treatment facilities, water towers, communication towers, antennae, power substations, transformers and poles. Depending on the damage done to the infrastructure and critical facilities, indirect impacts on individuals could range from inconvenient (i.e., adverse travel) to life-altering (i.e., loss of utilities for extended periods of time).

What is the level of risk/vulnerability to public health and safety from tornadoes?

Macoupin County ranks in the top 25 counties in Illinois in terms of tornado frequency. This fact alone suggests that the overall risk posed by tornadoes to public health and safety is relatively high. While frequency is important, other factors must be examined when assessing vulnerability including population distribution and density, the ratings and pathways of previously recorded tornadoes, the presence of high risk living accommodations (such as high rise buildings, mobile homes, etc.) and adequate access to health care for those injured following a tornado.

An EF3 tornado caused significant damage to numerous outbuildings and several farms just north of Girard on April 19, 2011.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

Macoupin County

For Macoupin County the level of risk or vulnerability posed by tornadoes to public health and safety is considered to be low to medium. This assessment is based on the fact that despite their relative frequently, a large majority of the tornadoes that have impacted the County have touched down in rural areas away from concentrated populations. This has contributed to a low number of injuries and fatalities. In addition, the County is not densely populated and there is not a large number of high risk living accommodations present.

In terms of adequate access to health care, Carlinville Area Hospital in Carlinville is equipped to provide continuous care to persons injured by a tornado assuming that it is not directly impacted. In addition, there are hospitals in Carrollton (Greene County), Jerseyville (Jersey County), Litchfield and Hillsboro (Montgomery County) and Jacksonville (Morgan County) as well as regional centers in Springfield (Sangamon County) and the Metro East St. Louis area (Madison

County) which are equipped to provide care and have sufficient capacity for the influx of additional patients from one or more counties.

Participating Municipalities

In general if a tornado were to touchdown or pass through any of the participating municipalities the risk to the public health and safety would be considered high. This is based on the fact that a majority of the participating jurisdictions are small in size (less than 1 ½ square miles) and have relatively dense and evenly distributed populations within their municipal boundaries. As a result, if a tornado were to touch down anywhere within the corporate limits of these municipalities it will have a greater likelihood of causing injuries or even fatalities.

Are existing buildings, infrastructure and critical facilities vulnerable to tornadoes?

Yes. All existing buildings, infrastructure and critical facilities located within the County and the participating municipalities are vulnerable to damage from tornadoes. Buildings, infrastructure and critical facilities located in the path of a tornado usually suffer extensive damage, if not complete destruction.

While some buildings adjacent to a tornado's path may remain standing with little or no damage, all are vulnerable to damage from flying debris. It is common for flying debris to cause damage to roofs, siding and windows. In addition, mobile homes, homes on crawlspaces and buildings with large spans (i.e., schools, barns, airport hangers, factories, etc.) are more likely to suffer damage. Most workplaces and many residential units do not provide sufficient protection from tornadoes.

A piece of metal was driven into a tree during the EF3 tornado that passed just north of Gillespie on April 19, 2011.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

The damages sustained by infrastructure and critical facilities during a tornado are similar to those experienced during a severe storm. There is a high probability that power, communication and transportation will be disrupted in and around the affected area.

Assessing the Vulnerability of Existing Residential Structures

One way to assess the vulnerability of existing residential structures is to estimate the number of housing units that may be potentially damaged if a tornado were to touchdown or pass through any of the participating municipalities or the County. In order to accomplish this, a set of decisions/assumptions must be made regarding:

- the size (area impacted) by the tornado;
- the method used to estimate the area impacted by the tornado within each jurisdiction; and
- the method used to estimate the number of potentially-damaged housing units.

The following provides a brief discussion of each decision/assumption.

Assumption #1

The area impacted by an average tornado in Macoupin County = 0.18 sq. miles

Size of Tornado: To calculate the number of existing residential structures vulnerable to a tornado, the size (area impacted) by the tornado must first be determined. There are several scenarios that can be used to calculate the size, including the worst case and the average. For this analysis the area impacted by an average-sized tornado in Macoupin County will be used since it has a higher probability of recurring. In Macoupin County the area impacted by an average-sized tornado is 0.18 square miles. This average is based on over 60 years of data.

Assumption #2

The entire area impacted by the average-sized tornado falls within the limits of each participating jurisdiction.

Method for Estimating the Area Impacted: Next, a method for determining the area within each jurisdiction impacted by the average-sized tornado needs to be chosen. There are several methods that can be used including creating an outline of the area impacted by the average-sized tornado and overlaying it on a map of each jurisdiction (most notably the municipalities) to see if any portion of the area falls outside of the corporate limits (which would require additional calculations) or just assume that the entire area of the average-sized tornado falls within the limits of each jurisdiction. For this discussion, it is assumed that the entire area of the average-sized tornado will fall within the limits of the participating jurisdictions.

This method is quicker, easier and more likely to produce consistent results when the Plan is updated. There is, however, a greater likelihood that the number of potentially-damaged housing units will be overestimated for those municipalities that have irregular shaped boundaries or occupy less than one square mile.

Assumption #3

The average housing unit density for each municipality will be used to determine the number of potentially-damaged housing units.

Method for Estimating Potentially-Damaged Housing Units: With the size of the tornado calculated and a method for estimating the area impacted chosen, a decision must be made on an approach for estimating the number of potentially-damaged housing units. There are several methods that can be used including overlaying the average-sized tornado on a map of each jurisdiction and counting the impacted housing units or calculating the average housing unit density to estimate the number of potentially-damaged housing units.

For this analysis, the average housing unit density will be used since it provides a realistic perspective on potential residential damages without conducting extensive counts. Using the average housing unit density also allows future updates to the Plan to be easily recalculated and provides an exact comparison to previous estimates.

The average housing unit density can be calculated by taking the number of housing units in a jurisdiction and dividing that by the land area within the jurisdiction. **Figure 45** provides a sample calculation.

Figure 45
Calculation of Average Housing Unit Density

Total Housing Units in the Jurisdiction ÷ Land Area within the Jurisdiction = Average Housing Unit Density
(Rounded Up to the Nearest Whole Number)

Macoupin County: 21,584 housing units ÷ 862.906 sq. miles = 26 housing units/sq. mile

Figure 46 provides a breakdown of housing unit densities by participating municipality as well as for the unincorporated areas of the County and the County as a whole.

Figure 46
Average Housing Unit Density by Participating Municipality

Jurisdiction	Total Housing Units (2010)	Mobile Homes (2000)*	Land Area (Sq. Miles) (2010)	Average Housing Unit Density (Units/Sq. Mile) (Raw)
Benld	750	25	1.060	707.54717
Brighton	920	31	1.874	490.92850
Bunker Hill	745	56	1.261	590.80095
Carlinville	2,615	176	2.995	873.12187
Gillespie	1,519	42	1.455	1043.98625
Girard	941	150	0.935	---
Mount Olive	984	25	1.153	853.42585
Royal Lakes	108	42	0.466	---
Staunton	2,343	128	3.062	765.18615
Virden	1,599	181	1.827	875.20525
Wilsonville	264	24	0.956	---
Unincorp. County	6,771	1,142	833.677	8.12185
County	21,584	2,341	862.906	25.01315

Source: U. S. Census Bureau.

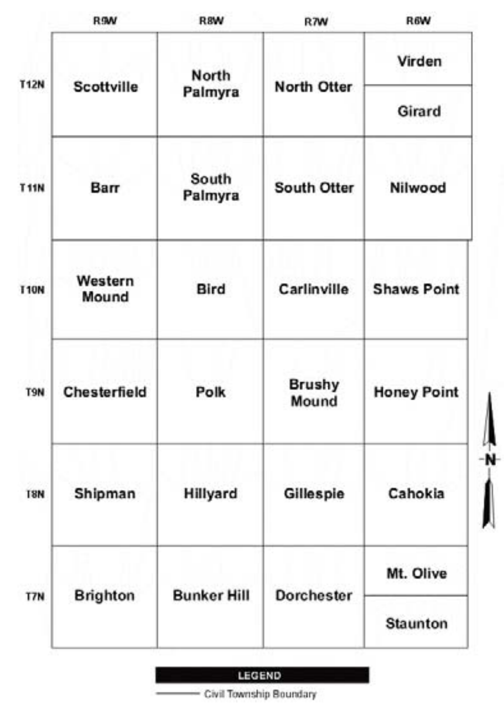
* Information on additional housing characteristics, such as mobile homes, was not covered by the 2010 Census. Instead the U.S. Census Bureau has chosen to use estimates generated from the American Community Survey. Based on a review of the data, it was decided that the 2000 Census data would be used instead of the estimates for mobile homes, in part because the number housing units has remained stable and the estimates vary greatly from the 2000 actual counts for some municipalities.

While the average housing unit density provides an adequate assessment of the number of housing units in areas where the housing density is fairly constant, such as municipalities, it does not provide a realistic assessment for those counties with large, sparsely populated rural areas such as Macoupin County.

In Macoupin County, as well as many other west-central Illinois counties, there are pronounced differences in housing unit densities within the County. Approximately 76% of all housing units and 69% of all mobile homes are located in nine of the County's 26 townships (Brighton, Bunker

Hill, Cahokia, Carlinville, Gillespie, Girard, Mount Olive, Staunton and Virden). **Figure 47** identifies the township boundaries. Tornado damage to buildings (especially mobile homes), infrastructure and critical facilities in these more densely populated townships is likely to be greater than in the rest of the County.

Figure 47
Macoupin County Township Boundaries



Source: Illinois Secretary of State

This substantial difference in density skews the average _county_ housing unit density in Macoupin County and is readily apparent when compared to the average housing unit densities for each of the townships within the County. **Figure 48** provides a breakdown of housing unit densities by township and illustrates the differences between the various townships and the County as a whole.

For 17 of the 26 townships, the average _county_ housing unit density is greater (in some cases considerably greater) than the average _township_ housing unit densities. However, the average _county_ housing unit density is considerably less than the housing unit densities for eight of the nine most populated townships.

Estimating the Number of Potentially-Damaged Housing Units

With the average housing unit densities calculated it is relatively simple to provide an estimate of the number of existing potentially-damaged housing units. This can be done by multiplying the average housing unit density by the area impacted by the average-sized tornado. **Figure 49** provides a sample calculation.

Figure 49
Calculation of Potentially-Damaged Existing Housing Units

Average Housing Unit Density x Area Impacted by the Average-Sized Macoupin County Tornado = Potentially-Damaged Housing Units (Rounded Up to the Nearest Whole Number)

Macoupin County: 26 housing units/sq. mile x 0.18 sq. miles = 4.68 housing units
(5 housing units)

Figure 48
Average Housing Unit Density by Township

Township	Total Housing Units (2010)	Mobile Homes (2000)*	Land Area (Sq. Miles) (2010)	Average Housing Unit Density (Units/Sq. Mile) (Raw)
Barr	155	38	36.628	4.23174
Bird	135	0	36.158	3.73361
Brighton	1,646	223	36.089	45.60947
Brushy Mound	357	53	35.231	10.13312
Bunker Hill	1,387	177	36.194	38.32127
Cahokia	1,594	158	36.592	43.56143
Carlinville	2,947	197	35.368	83.32391
Chesterfield	380	45	35.673	10.65231
Dorchester	652	63	35.976	18.12319
Gillespie	1,831	195	35.655	51.35325
Girard	1,102	157	18.112	60.84364
Hillyard	330	78	36.111	9.13849
Honey Point	87	19	37.020	2.35008
Mount Olive	1,536	141	18.016	85.25755
Nilwood	293	58	36.470	8.03400
North Otter	449	16	35.674	12.58620
North Palmyra	388	76	36.172	10.72653
Polk	287	18	36.171	7.93453
Scottville	166	27	36.712	4.52168
Shaws Point	233	15	34.074	6.83806
Shipman	593	112	35.808	16.56055
South Otter	204	23	35.771	5.70294
South Palmyra	380	60	36.138	10.51525
Staunton	2,611	177	18.130	144.01544
Virden	1,711	198	17.965	95.24075
Western Mound	130	17	34.998	3.71450
County	21,584	2,341	862.906	25.01315
Townships – 9 most populated	16,365	1,623	252.121	64.90931
Townships – 17 least populated	5,219	718	610.785	8.54474

Source: U. S. Census Bureau.

* Information on additional housing characteristics, such as mobile homes, was not covered by the 2010 Census. Instead the U.S. Census Bureau has chosen to use estimates generated from the American Community Survey. Based on a review of the data, it was decided that the 2000 Census data would be used instead of the estimates for mobile homes in Macoupin County, in part because the number housing units has remained stable and the estimates vary greatly from the 2000 actual counts for some townships.

For those municipalities that cover less than one square mile, the average housing unit density cannot be used to calculate the number of potentially-damaged housing units. The average housing unit density assumes that the land area within the municipality is at least one square mile and as a result distorts the number of potentially-damaged housing units for very small municipalities.

To calculate the number of potentially-damaged housing units for these municipalities, take the area impacted by the average-sized Macoupin County tornado and divide that by the land area within the municipality to get the impacted land area. The impacted land area is then multiplied by the total number of housing units within the municipality to get the number of potentially-damaged housing units. **Figure 50** provides a sample calculation.

Figure 50
Calculation of Potentially-Damaged Housing Units for Municipalities Covering Less Than One Square Mile

Area Impacted by the Average-Sized Macoupin County Tornado ÷ Land Area within the Jurisdiction = Impacted Land Area

Royal Lakes: 0.18 sq. mile ÷ 0.466 sq. miles = 0.386266094

Impacted Land Area x Total Housing Units in the Jurisdiction = Potentially-Damaged Housing Units
(Rounded Up to the Nearest Whole Number)

Royal Lakes: 0.386266094 x 108 housing units = 42 housing units

Occasionally villages and cities will annex large tracts of undeveloped land into their corporate limits. In many cases these large tracts of land are often sparsely populated. Consequently, including these tracts of land in the calculations to determine the number of potentially-damaged housing units skews the results, especially for very small municipalities. Therefore, to provide a more realistic assessment of the number of potentially-damaged housing units, these undeveloped areas need to be subtracted from the land area figures obtained from the U.S. Census Bureau.

On May 31, 2013 an EF2 tornado touched down in Gillespie damaging multiple structures in the City.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

In Macoupin County there is one municipality, Wilsonville, which has several large, sparsely populated wooded and open areas within its municipal boundaries. These areas account for over two-thirds of the land area in the Village. If these undeveloped areas are subtracted from the land area figure obtained from the U.S. Census Bureau, then the remaining land area accounts for 0.266 square miles. This area, located in the central portion of the Village, is where a majority of the housing units are situated and has a fairly consistent housing unit density. Therefore, the refined land area figure will be used to calculate the potentially-damages housing units.

Figures 51 and **52** provide a breakdown of the number of potentially-damaged housing units by participating municipality as well as by township and for the unincorporated areas of the County and the County as a whole. It is important to note that for the nine most densely populated townships, the estimated number of potentially-damaged housing units would only be reached if a tornado's pathway included the major municipality within the township. If the tornado remained in the rural portion of the township, then the number of potentially-damaged housing units would be considerably lower.

Figure 51
Estimated Number of Housing Units by Municipality Potentially Damaged by a Tornado

Participating Municipality	Total Housing Units (2010)	Land Area (Sq. Miles) (2010)	Average Housing Unit Density (Units/Sq. Mi.) (Raw)	Potentially-Damaged Housing Units (Units/0.18 Sq. Mi.) (Raw)	Potentially-Damaged Housing Units (Units/ Sq. Mi.) (Rounded Up)
Benld	750	1.060	707.54717	127.35849	128
Brighton	920	1.874	490.92850	88.36713	89
Bunker Hill	745	1.261	590.80095	106.34417	107
Carlinville	2,615	2.995	873.12187	157.16194	158
Gillespie	1,519	1.455	1043.98625	187.91753	188
Girard	941	0.935	---	181.15508	182
Mount Olive	984	1.153	853.42585	153.61665	154
Royal Lakes	108	0.466	---	41.71674	42
Staunton	2,343	3.062	765.18615	137.73351	138
Virden	1,599	1.827	875.20525	157.53695	158
Wilsonville*	264	0.266	---	178.64662	179
Unincorp. County	6,771	833.677	8.12185	1.46193	2
County	21,584	862.906	25.01315	4.50237	5

* Wilsonville contains several large, sparsely populated wooded and open areas within its municipal boundaries. These areas account for ⅔ of the land area in the Village and skew the potentially-damaged housing unit calculations. In order to provide a more realistic assessment of potentially-damage housing units, these undeveloped areas were subtracted from the land area figure obtained from the U.S. Census Bureau and the refined land area figure is used to calculate potentially-damaged housing units.

What is the level of risk/vulnerability to existing buildings, infrastructure and critical facilities vulnerable from tornadoes?

There are several factors that must be examined when assessing the vulnerability of existing buildings, infrastructure and critical facilities to tornadoes. These factors include tornado frequency, population distribution and density, the ratings and pathways of previously recorded tornadoes, and the presence of high risk living accommodations (such as high rise buildings, mobile homes, etc.)

Macoupin County

For Macoupin County the level of risk or vulnerability posed by tornadoes to existing buildings, infrastructure and critical facilities is consider to be low to medium. This assessment is based on the frequency with which tornadoes have occurred in the County and the amount of damage that has been sustained tempered by the low population density throughout most the County and the relative absence of high risk living accommodations. While previously recorded tornadoes have followed largely rural pathways they have caused significant damage on several occasions.

Figure 52
Estimated Number of Housing Units by Township
Potentially Damaged by a Tornado

Township	Total Housing Units (2010)	Land Area (Sq. Miles) (2010)	Average Housing Unit Density (Units/Sq. Mi.) (Raw)	Potentially-Damaged Housing Units (Units/0.18 Sq. Mi.) (Raw)	Potentially-Damaged Housing Units (Units/ Sq. Mi.) (Rounded Up)
Barr	155	36.628	4.23174	0.76171	1
Bird	135	36.158	3.73361	0.67205	1
Brighton	1,646	36.089	45.60947	8.20970	9
Brushy Mound	357	35.231	10.13312	1.82396	2
Bunker Hill	1,387	36.194	38.32127	6.89783	7
Cahokia	1,594	36.592	43.56143	7.84106	8
Carlinville	2,947	35.368	83.32391	14.99830	15
Chesterfield	380	35.673	10.65231	1.91742	2
Dorchester	652	35.976	18.12319	3.26217	4
Gillespie	1,831	35.655	51.35325	9.24359	10
Girard	1,102	18.112	60.84364	10.95186	11
Hillyard	330	36.111	9.13849	1.64493	2
Honey Point	87	37.020	2.35008	0.42301	1
Mount Olive	1,536	18.016	85.25755	15.34636	16
Nilwood	293	36.470	8.03400	1.44612	2
North Otter	449	35.674	12.58620	2.26552	3
North Palmyra	388	36.172	10.72653	1.93078	2
Polk	287	36.171	7.93453	1.42822	2
Scottville	166	36.712	4.52168	0.81390	1
Shaws Point	233	34.074	6.83806	1.23085	2
Shipman	593	35.808	16.56055	2.98090	3
South Otter	204	35.771	5.70294	1.02653	2
South Palmyra	380	36.138	10.51525	1.89275	2
Staunton	2,611	18.130	144.01544	25.92278	26
Virden	1,711	17.965	95.24075	17.14334	18
Western Mound	130	34.998	3.71450	0.66861	1
County	21,584	862.906	25.01315	4.50237	5
Townships – 9 most populated	16,365	252.121	64.90931	11.68368	12
Townships – 17 least populated	5,219	610.785	8.54474	1.53805	2

Participating Municipalities

In general if a tornado were to touchdown or pass through any of the participating municipalities the risk to existing buildings, infrastructure and critical facilities would be considered high. This assessment is based on the population and housing unit distribution within the municipalities where wide expanses of open spaces do not generally exist. As a result, if a tornado were to touch down within any of the municipalities it will have a greater likelihood of causing substantial property damage.

Are future buildings, infrastructure and critical facilities vulnerable to tornadoes?

Yes and No. While four of the participating jurisdictions have building codes in place that will likely lessen the vulnerability of new buildings and critical facilities to damage from tornadoes, the County and seven other municipalities do not. However, even new buildings and critical facilities built to code are vulnerable to the risks posed by a high rated tornado.

An EF1 tornado on March 7, 2017 downed power poles in Sawyerville.

Photo provided by Tiffany Boehler, Macoupin County Public Health Dept.

Infrastructure such as new communication and power lines will continue to be vulnerable to tornadoes as long as they are located above ground. Flying debris can disrupt power and communication lines even if they are not directly in the path of the tornado. Steps to bury all new lines would eliminate the vulnerability, but this action would be cost prohibitive in most areas.

What are the potential dollar losses to vulnerable structures from tornadoes?

Unlike other hazards, such as flooding, there are no standard loss estimation models or methodologies for tornadoes. However, a rough estimate of potential dollar losses to the *potentially-damaged housing units* determined previously can be calculated if several additional decisions/assumptions are made regarding:

- the value of the potentially-damaged housing units; and
- the percent damage sustained by the potentially-damaged housing units (i.e., damage scenario).

These assumptions represent a ***probable scenario*** based on the reported historical occurrences of tornadoes in Macoupin County. The purpose of providing a rough estimate is to help residents and municipal/county officials make informed decisions to better protect themselves and their communities. These estimates are meant to provide a ***general idea*** of the magnitude of the potential damage that could occur. The following provides a brief discussion of each decision/assumption.

Assumption #4

The average market value for residential structures in each participating jurisdiction will be used to determine the value of potentially-damaged housing units.

Value of Potentially-Damaged Housing Units: In order to determine the potential dollar losses to the potentially-damaged housing units, the monetary value of the units must first be calculated. Typically when damage estimates are prepared after a natural disaster such as a tornado, they are based on the market value of the structure. Since it would be impractical to determine the individual market value of each potentially-damaged housing unit, the average market value of residential structures in each municipality will be used.

To determine the average market value, the average assessed value must first be calculated. The average assessed value is determined by taking the total assessed value of residential buildings within a jurisdiction and dividing that number by the total number of housing units within the jurisdiction. The average market value is then determined by taking the average assessed value and multiplying that number by three (the assessed value of a structure in Macoupin County is approximately one-third of the market value). **Figure 53** provides a sample calculation. The total assessed value is based on 2016 tax assessment information provided by the Macoupin County Clerk.

Figure 53
Calculation of Average Assessed Value & Average Market Value

Average Assessed Value

Total Assessed Value of Residential Buildings in the Jurisdiction÷ Total Housing Units in the Jurisdiction = Average Assessed Value
(Rounded to the Nearest Dollar)

Benld: $6,854,981 ÷ 750 housing units = $9,140

Average Market Value

Average Assessed Value x 3 = Average Market Value

Benld: $9,140 x 3 = $27,420

Figures 54 and **55** provides the average assessed value and average market value for each participating municipality as well as by township and for the unincorporated areas of the County and the County as a whole.

Figure 54
Average Market Value of Housing Units by Municipality

Participating Jurisdiction	Total Assessed Value of Residential Buildings (2016)	Total Housing Units (2010)	Average Assessed Value (Raw)	Average Market Value (Raw)	Average Market Value (Rounded)
Benld	$6,854,981	750	$9,139.97467	$27,419.92401	$27,420
Brighton	$20,287,777	920	$22,051.93152	$66,155.79456	$66,156
Bunker Hill	$14,609,440	745	$19,609.98658	$58,829.95974	$58,830
Carlinville	$42,997,637	2,615	$16,442.69101	$49,328.07303	$49,328
Gillespie	$20,462,096	1,519	$13,470.76761	$40,412.30283	$40,412
Girard	$13,417,628	941	$14,258.90329	$42,776.70987	$42,777
Mount Olive	$13,184,308	984	$13,398.68699	$40,196.06097	$40,196
Royal Lakes	$678,864	108	$6,285.77778	$18,857.33334	$18,857
Staunton	$44,835,564	2,343	$19,135.96415	$57,407.89245	$57,408
Virden	$21,305,655	1,599	$13,324.36210	$39,973.08630	$39,973
Wilsonville	$2,426,704	264	$9,192.06061	$27,576.18183	$27,576
Unincorp. County	$123,784,264	6,771	$18,281.53360	$54,844.60080	$54,845
County	$349,265,025	21,584	$16,181.66350	$48,544.99050	$48,545

Source: Pete Duncan, Macoupin County Clerk.

Assumption #5

The tornado would completely destroy the potentially-damaged housing units.

Structural Damage = 100%
Content Damage = 100%

Damage Scenario: Finally, a decision must be made regarding the percent damage sustained by the potentially-damaged housing units and their contents. For this scenario, the expected percent damage sustained by the structure and its contents is 100%; in other words, all of the potentially-damaged housing units would be completely destroyed. While it is highly unlikely that each and every housing unit would sustain the maximum percent damage, identifying and calculating different degrees of damage within the average area impacted gets complex and provides an additional complication when updating the Plan.

Figure 55
Average Market Value of Housing Units by Township

Participating Jurisdiction	Total Assessed Value of Residential Buildings (2016)	Total Housing Units (2010)	Average Assessed Value (Raw)	Average Market Value (Raw)	Average Market Value (Rounded)
Barr	$1,284,066	155	$8,284.29677	$24,852.89031	$24,853
Bird	$1,618,415	135	$11,988.25926	$35,964.77778	$35,965
Brighton	$39,572,835	1,646	$24,041.81956	$72,125.45868	$72,125
Brushy Mound	$8,343,563	357	$23,371.32493	$70,113.97479	$70,114
Bunker Hill	$28,753,436	1,387	$20,730.66763	$62,192.00289	$62,192
Cahokia	$16,877,616	1,594	$10,588.21581	$31,764.64743	$31,765
Carlinville	$53,251,249	2,947	$18,069.64676	$54,208.94028	$54,209
Chesterfield	$3,286,816	380	$8,649.51579	$25,948.54737	$25,949
Dorchester	$11,187,280	652	$17,158.40491	$51,475.21473	$51,475
Gillespie	$24,640,314	1,831	$13,457.29874	$40,371.89622	$40,372
Girard	$15,533,583	1,102	$14,095.81034	$42,287.43102	$42,287
Hillyard	$2,380,049	330	$7,212.26970	$21,636.80910	$21,637
Honey Point	$625,011	87	$7,184.03448	$21,552.10344	$21,552
Mount Olive	$21,702,140	1,536	$14,128.99740	$42,386.99220	$42,387
Nilwood	$2,336,732	293	$7,975.19454	$23,925.58362	$23,926
North Otter	$12,400,102	449	$27,617.15367	$82,851.46101	$82,851
North Palmyra	$4,596,726	388	$11,847.23196	$35,541.69588	$35,542
Polk	$6,191,838	287	$21,574.34843	$64,723.04529	$64,723
Scottville	$1,156,125	166	$6,964.60843	$20,893.82529	$20,894
Shaws Point	$4,638,191	233	$19,906.39914	$59,719.19742	$59,719
Shipman	$8,127,275	593	$13,705.35413	$41,116.06239	$41,116
South Otter	$2,862,821	204	$14,033.43627	$42,100.30881	$42,100
South Palmyra	$2,970,204	380	$7,816.32632	$23,448.97896	$23,449
Staunton	$51,071,442	2,611	$19,560.10800	$58,680.32400	$58,680
Virden	$23,403,105	1,711	$13,678.02747	$41,034.08241	$41,034
Western Mound	$454,091	130	$3,493.00769	$10,479.02307	$10,479
Townships – 9 most populated	$274,805,720	16,365	$16,792.28353	$50,376.85059	$50,377
Townships – 17 least populated	$74,459,305	5,219	$14,266.96781	$42,800.90343	$42,801

Source: Pete Duncan, Macoupin County Clerk.

<u>*Potential Dollar Losses*</u>

Now that all of the decisions/assumptions have been made, the potential dollar losses can be calculated. First, the potential dollar losses to the ***structure*** of the potentially-damaged housing units must be determined. This is done by taking the average market value for a residential structure and multiplying it by the percent damage (100%) to get the average structural damage per unit. Next the average structural damage per unit is multiplied by the number of potentially-damaged housing units. **Figure 56** provides a sample calculation.

Figure 56
***Structure* – Potential Dollar Loss Calculations**

Average Market Value of a Housing Unit with the Jurisdiction x Percent Damage = Average Structural Damage per Housing Unit

Benld: $27,420 x 100% = $27,420 per housing unit

Average Structural Damage per Housing Unit x Number of Potentially-Damaged Housing Units within the Jurisdiction = *Structure* Potential Dollar Losses (Rounded to the Nearest Dollar)

Benld: $27,420 per housing unit x 128 housing units = $3,509,760

Next, the potential dollar losses to the ***content*** of the potentially-damaged housing units must be determined. Based on FEMA guidance, the value of a residential housing unit's content is approximately 50% of its market value. Therefore, start by taking one-half the average market value for a residential structure and multiply by the percent damage (100%) to get the average content damage per unit. Next the average content damage per unit is multiplied by the number of potentially-damaged housing units. **Figure 57** provides a sample calculation.

Figure 57
***Content* – Potential Dollar Loss Calculations**

½ (Average Market Value of a Housing Unit) with the Jurisdiction x Percent Damage = Average Content Damage per Housing Unit

Benld: ½ ($27,420) x 100% = $13,710 per housing unit

Average Content Damage per Housing Unit x Number of Potentially-Damaged Housing Units within the Jurisdiction = *Content* Potential Dollar Losses (Rounded to the Nearest Dollar)

Benld: $13,710 per housing unit x 128 housing units = $1,754,880

Finally the ***total potential dollar losses*** may be calculated by adding together the potential dollar losses to the structure and content. **Figures 58** and **59** gives a breakdown of the total potential dollar losses by municipality and township.

Figure 58
Estimated Potential Dollar Losses to Potentially-Damaged Housing Units from a Tornado by Municipality

Participating Jurisdiction	Average Market Value (2016)	Potentially-Damaged Housing Units (Rounded Up)	Potential Dollar Losses		Total Potential Dollar Losses
			Structure	Content	
Benld	$27,420	128	$3,509,760	$1,754,880	$5,264,640
Brighton	$66,156	89	$5,887,884	$2,943,942	$8,831,826
Bunker Hill	$58,830	107	$6,294,810	$3,147,405	$9,442,215
Carlinville	$49,328	158	$7,793,824	$3,896,912	$11,690,736
Gillespie	$40,412	188	$7,597,456	$3,798,728	$11,396,184
Girard	$42,777	182	$7,785,414	$3,892,707	$11,678,121
Mount Olive	$40,196	154	$6,190,184	$3,095,092	$9,285,276
Royal Lakes	$18,857	42	$791,994	$395,997	$1,187,991
Staunton	$57,408	138	$7,922,304	$3,961,152	$11,883,456
Virden	$39,973	158	$6,315,734	$3,157,867	$9,473,601
Wilsonville	$27,576	179	$4,936,104	$2,468,052	$7,404,156
Unincorp. County	$54,845	2	$109,690	$54,845	$164,535
County	$48,545	5	$242,725	$121,363	$364,088

For comparison, an estimate of potential dollar losses was also calculated for the entire County, the unincorporated portions of the County, and for the nine most populated and the 17 least populated townships. As discussed previously, the estimate for the County is skewed because it does not take into consideration the differences in the housing density within the County.

This assessment illustrates why potential residential dollar losses should be considered when jurisdictions are deciding which mitigation projects to pursue. Potential dollar losses caused by an average tornado in Macoupin County would be expected to ***exceed at least $5.2 million*** in any of the participating municipalities, with exception Royal Lakes.

Figure 59
Estimated Potential Dollar Losses to Potentially-Damaged Housing Units from a Tornado by Township

Township	Average Market Value (2016)	Potentially-Damaged Housing Units (Rounded Up)	Potential Dollar Losses		Total Potential Dollar Losses
			Structure	Content	
Barr	$24,853	1	$24,853	$12,427	$37,280
Bird	$35,965	1	$35,965	$17,983	$53,948
Brighton	$72,125	9	$649,125	$324,563	$973,688
Brushy Mound	$70,114	2	$140,228	$70,114	$210,342
Bunker Hill	$62,192	7	$435,344	$217,672	$653,016
Cahokia	$31,765	8	$254,120	$127,060	$381,180
Carlinville	$54,209	15	$813,135	$406,568	$1,219,703
Chesterfield	$25,949	2	$51,898	$25,949	$77,847
Dorchester	$51,475	4	$205,900	$102,950	$308,850
Gillespie	$40,372	10	$403,720	$201,860	$605,580
Girard	$42,287	11	$465,157	$232,579	$697,736
Hillyard	$21,637	2	$43,274	$21,637	$64,911
Honey Point	$21,552	1	$21,552	$10,776	$32,328
Mount Olive	$42,387	16	$678,192	$339,096	$1,017,288
Nilwood	$23,926	2	$47,852	$23,926	$71,778
North Otter	$82,851	3	$248,553	$124,277	$372,830
North Palmyra	$35,542	2	$71,084	$35,542	$106,626
Polk	$64,723	2	$129,446	$64,723	$194,169
Scottville	$20,894	1	$20,894	$10,447	$31,341
Shaws Point	$59,719	2	$119,438	$59,719	$179,157
Shipman	$41,116	3	$123,348	$61,674	$185,022
South Otter	$42,100	2	$84,200	$42,100	$126,300
South Palmyra	$23,449	2	$46,898	$23,449	$70,347
Staunton	$58,680	26	$1,525,680	$762,840	$2,288,520
Virden	$41,034	18	$738,612	$369,306	$1,107,918
Western Mound	$10,479	1	$10,479	$5,240	$15,719
Townships – 9 Most Populated	$50,377	12	$604,524	$302,262	$906,786
Townships – 17 Least Populated	$42,801	2	$85,602	$42,801	$128,403

Figure 39 (Sheet 1 of 14) Tornadoes Reported in Macoupin County 1950 – 2017											
Map No.	**Date(s)**	**Start Time**	**Location(s)**	**Magnitude (Fujita Scale)**	**Length[1] (Miles)**	**Width (Yards)**	**Injuries**	**Fatalities**	**Property Damage**	**Crop Damage**	**Description**
1	12/2/1950	3:15 p.m.	White City[^] Mt. Olive	F2	11.5	50	1	3	$25,000[§]	n/a	*Touchdown/Liftoff – Two Counties* touched down in Madison County near Fosterburg and traveled northeast lifting off near Mt. Olive – total length: 18.8 miles - One person was killed and three more were injured when a car was carried 200 yards near Mt. Olive
2	8/4/1959	6:15 a.m.	Girard	F2	5.7	33	n/a	n/a	$25,000[†]	n/a	*Touchdown/Liftoff – Two Counties* touched down in Girard and followed an intermittent path to the southeast before lifting off at Irving in Montgomery County– total length: 26.7 miles
Subtotal:							**1**	**3**	**$50,000[§†]**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

[^] Tornado touchdown verified in the vicinity of this location(s).

[§] The $25,000 in property damages sustained as a result of the December 2, 1950 tornado represent losses sustained in two counties. A detailed breakdown by county was not available.

[†] The $25,000 in property damages sustained as a result of the August 4, 1959 tornado represent losses sustained in two counties. A detailed breakdown by county was not available.

Figure 39
(Sheet 2 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
3	10/10/1959	5:15 p.m.	Staunton	F2	10.8	33	n/a	n/a	$250,000[‡]	n/a	*Touchdown/Liftoff – Multiple Counties* touched down in Madison County near Godfrey and traveled northeast, moving along the Madison/Macoupin County Line before entering Montgomery County and lifting off at Filmore – total length: 48.7 miles
4	3/29/1960	9:35 p.m.	Plainview	F2	0.1	33	n/a	n/a	$2,500	n/a	an auto service station and two churches were damaged
5	5/6/1960	1:05 p.m.	Scottville	F1	8.2	50	n/a	n/a	$250,000[£]	n/a	*Touchdown/Liftoff – Multiple Counties* touched down in Greene County just east of Carrollton and traveled northeast crossing the northwest corner of Macoupin County and the southeast corner of Morgan County before lifting off southwest of Springfield in Sangamon County – total length: 43.5 miles
Subtotal:							**0**	**0**	**$502,500[‡£]**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

‡ The $250,000 in property damages sustained as a result of the October 10, 1959 tornado represent losses sustained in three counties. A detailed breakdown by county was not available; however narrative descriptions indicated that a majority of the damages occurred in Madison and Montgomery Counties.

£ The $250,000 in property damages sustained as a result of the May 6, 1960 tornado represent losses sustained in four counties. A detailed breakdown by county was not available.

Figure 39
(Sheet 3 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
6	3/6/1961	1:30 p.m.	Medora^ Shipman^ Plainview^ Gillespie^	F1	24.0	77	0	0	n/a	n/a	*Touchdown/Liftoff – Multiple Counties* touched down in Jersey County just north of Jerseyville and traveled east-northeast through Macoupin County into Montgomery County where it changed courses tracking east-southeast through Shelby County and into Cumberland County before lifting off approx. 5 miles southeast of Greenup – total length: 117.9 miles - farmsteads near Medora were damaged
7	8/9/1966	9:50 p.m.	Bunker Hill^	F0	0.3	100	n/a	n/a	$250	n/a	hog houses and trees were damaged near the Macoupin/Madison County Line
Subtotal:							**0**	**0**	**$250**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 4 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
8	1/24/1967	6:50 p.m.	Virden Virden^	F2	2.5	100	0	0	$250,000	n/a	- tornado damaged approx. 100 houses across the southeast part of the city - damage was mostly to roofs or from falling trees or limbs - several mobile homes were badly damaged - one house was left upside down on its roof - two grain bins were lifted over an adjacent building & deposited 200 yards to ¼ mile away - A City Alderman identified $200,000 in damages and indicated that several homes were destroyed but no injuries were sustained
9	5/12/1978	3:50 p.m.	Shipman Plainview^ Carlinville Standard City	F2	27.9	700	1	0	$245,000	n/a	*Touchdown/Liftoff – Two Counties* touched down in Shipman and traveled northeast, passing just north of the center of Carlinville before lifting off northeast of Farmersville in Montgomery County – total length: 34.1 miles - A man was cut on the hands when the windows of the car that he took shelter in were broken by the tornado
Subtotal:							**1**	**0**	**$495,000**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 5 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
10	5/9/1990	7:30 p.m.	Virden	F2	0.2	50	n/a	n/a	$250,000	n/a	- a mobile home was destroyed - power lines and other structures suffered minor damage
11	5/16/1990	1:56 a.m.	Royal Lakes^	F0	0.1	50	n/a	n/a	n/a	n/a	
12	8/19/1993	5:15 p.m.	Atwater^	F0	0.1	35	n/a	n/a	n/a	n/a	tornado touched down in a cornfield causing extensive crop damage
13	5/25/1996	6:25 p.m.	Nilwood^ Girard^	F1	8.0	100	n/a	n/a	$250,000	n/a	- 6 farms were damaged by the tornado - a couple of barns were destroyed as were several machine sheds and other outbuildings - a garage was destroyed at one home - trees and power lines were downed
14	5/12/1998	7:16 p.m.	Palmyra^	F1	1.0	200	n/a	n/a	$50,000	n/a	- a couple of farms were damaged by the tornado - 3 barns and a grain bin were destroyed - a truck was overturned
15	6/1/1999	6:55 p.m.	Carlinville^	F1	1.7	50	n/a	n/a	n/a	n/a	- 4 railcars were blown off the tracks at a coal facility - half a dozen trees were downed in the area
16	4/20/2000	6:59 a.m.	Shipman^	F1	1.0	30	n/a	n/a	$25,000	n/a	- 2 farm buildings were destroyed - some trees and power lines were downed
Subtotal:							**0**	**0**	**$575,000**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 6 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
17	7/18/2000	5:50 p.m.	Medora^	F0	0.1	40	n/a	n/a	n/a	n/a	
18	5/1/2002	2:00 p.m.	Palmyra^	F0	0.5	75	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #1416)*** - some trees and power lines were downed
19	5/8/2003	2:00 p.m.	Bunker Hill^	F0	0.2	50	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #1416)*** - tornado briefly touched down in a field between Bunker Hill & Staunton
20	6/13/2005	5:00 p.m.	Bunker Hill	F0	1.5	40	n/a	n/a	n/a	n/a	- several large trees were topped - some minor structural damage occurred to some buildings - a few vehicles were also damaged by fallen trees
21	6/13/2005	5:05 p.m.	Bunker Hill^	F0	1.0	50	n/a	n/a	n/a	n/a	- a large machine shed was damaged with debris tossed up to 300 yards northeast of IL Rte. 159 over an open farm field
Subtotal:							**0**	**0**	**$0**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 7 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
22	6/13/2005	5:05 p.m.	Bunker Hill^ Wilsonville	F1	3.0	70	n/a	n/a	$100,000	n/a	Event Description Provided Below
Unincorporated Macoupin County - a large machine shed was completely destroyed near Mansholt Road with debris tossed over 450 yards away - several grain silos and a machine shed on a farm on South Dorchester Road sustained minor damage *Wilsonville* - the roof of a church was damaged - tree and power pole damage was also sustained - Macoupin County EMA Coordinator identified $100,000 in damages and indicated that damage was sustained by trees, power lines and a roof											
23	6/13/2005	5:10 p.m.	Wilsonville Sawyerville^	F1	2.5	60	n/a	n/a	n/a	n/a	- a machine shed was destroyed and another damaged off of Wilhoit Airport Road with debris from both tossed up to 300 yards away and some of the debris was wrapped around tree trunks - a machine shed just south of IL Rte. 138 on Wilhoit Airport Road was also damaged with debris tossed up to 400 yards away - tree damage was observed just east of Wilhoit Airport Road
Subtotal:							**0**	**0**	**$100,000**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 8 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
24	4/2/2006	4:15 p.m.	Piasa Shipman^	F0	2.0	30	n/a	n/a	n/a	n/a	<u>*Piasa*</u> - numerous homes sustained roof and siding damage - several trees and wooden power poles were snapped - large branches were knocked out of trees <u>*Unincorporated Macoupin County*</u> - destroyed a barn near Beacon Road - collapsed a parking canopy at Shipman Elevator Company - a woman driving on IL Rte. 16 reported being pushed off the road by the tornado
25	4/2/2006	4:15 p.m.	Piasa^	F0	0.5	30	n/a	n/a	n/a	n/a	- farm buildings and a grain bin were damaged along Little Flock Road - a mobile home was destroyed after being lifted and carried for approx. 20 yards
Subtotal:							**0**	**0**	**$0**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 9 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
26	4/2/2006	4:26 p.m.	Staunton^ Mt. Olive	F0	11.0	50	n/a	n/a	n/a	n/a	*Touchdown/Liftoff – Two Counties* touched down in Madison County south of Dorsey and traveled northeast lifting off at Mt. Olive – total length: 16.0 miles *Unincorporated Macoupin County* - damaged trees and downed power lines - blew shingles off of roofs near Staunton *Mt. Olive* - blew shingles off of roofs
27	4/2/2006	4:35 p.m.	East Gillespie^	F0	0.1	20	n/a	n/a	n/a	n/a	destroyed a mobile home on IL Rte. 4 at Quarry Road
28	7/19/2006	5:50 p.m.	Bunker Hill^	F0	0.2	20	n/a	n/a	n/a	n/a	- tornado touched down briefly in an open field near the intersection of IL Rte. 138 & IL Rte. 159 - Macoupin County EMA Coordinator indicated that shelter was provided at the Macoupin County Fairgrounds
29	5/4/2007	4:04 p.m.	Royal Lakes^	EF0	0.1	40	n/a	n/a	n/a	n/a	
Subtotal:							**0**	**0**	**$0**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 10 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
30	5/4/2007	5:05 p.m.	Shipman^	EF0	0.1	40	n/a	n/a	n/a	n/a	
31	3/8/2009	10:30 a.m.	Carlinville^	EF1	4.2	75	n/a	n/a	n/a	n/a	- destroyed a lumber shed, an outbuilding and a small shed - seriously damaged 2 grain bins and knocked over another 2 grain bins - caused minor damage to a home - damaged trees
32	5/13/2009	10:38 p.m.	Gillespie	EF0	1.7	40	n/a	n/a	n/a	n/a	- a building on the high school campus lost its roof - several homes and outbuildings were damaged - a power pole sustained damage
Subtotal:							**0**	**0**	**$0**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 11 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
33	4/19/2011	4:58 p.m.	Girard^	EF3	5.1	200	3	0	$3,000,000	n/a	Event Description Provided Below ***Appendix K*** contains select photographs

- Several farms sustained damage along the path of the tornado with many homes sustaining major roof damage
- Numerous outbuildings were either destroyed or sustained major damage along the tornado's path
- Two individuals seeking shelter in a basement sustained minor cuts and bruises
- The Girard Emergency Manager identified $3 million in damages and indicated that 3 individuals sustained injuries, 3 homes were destroyed, 6 homes were heavily damaged and numerous outbuildings were damaged or destroyed
- The path of the tornado was curved. A breakdown of damages by location is provided below.

Emerson Airline Road (2.5 miles west of Girard)
- several houses sustained extensive damage in this location

Henry Road (north of the intersection with Emerson Airline Road)
- 3 farmsteads sustained damage
- one home was destroyed
- one home sustained moderate damage, trapping the residents in the basement until they could be rescued
- several barns were destroyed

Neff Road
- several farmsteads were destroyed or damaged in this area
- one home was destroyed
- numerous outbuildings were destroyed

Pleasant Hill Road (1.2 miles northwest of Girard)
a brick home sustained major damage and all of the outbuildings were destroyed

Illinois Route 4 (1 mile north of Girard)
- a farm was destroyed
- several cows were killed
- approx. 20 power poles were blown down

Prose Road (1/2 mile south of intersection with Substation Road)
- a brick home sustained extensive damage with most of the exterior walls destroyed but with the interior wall structure intact

Kimes Road (near intersection with Adams Road)
- a house sustained moderate roof damage

Adams Road
- a farmstead sustained minor damage

	Injuries	Fatalities	Property Damage	Crop Damage
Subtotal:	**3**	**0**	**$3,000,000**	**$0**

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 12 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
34	5/20/2013	9:14 p.m.	Mt. Olive	EF2	0.2	75	3	0	n/a	n/a	- tornado damage path was 4 blocks long and ranged from 50 to 75 yards wide - the second story of a brick building was blown off - large sections of several roofs were blown 2 blocks to the north - a historic two-story home had the roof blown off - several homes and businesses had windows blown out
35	5/31/2013	7:49 p.m.	Gillespie	EF2	1.5	150	n/a	n/a	n/a	n/a	- Event Description Provided Below
- blew the windows out of an apartment building at the intersection of Broadway St. & LJ Ave. - north end of the Gillespie High School gymnasium sustained major damage - blew the roof off a house northeast of the high school and snapped off a large pine tree at its base - destroyed a garage at the corner of Henry St. & Fulton St. - caused extensive damage to trees and roofs along its entire path - The Mayor confirmed that damage was sustained to the high school gymnasium and complex, residences, trees and power lines											
Subtotal:							**3**	**0**	**$0**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 13 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
36	11/17/2013	11:30 a.m.	Womac[^]	EF0	4.0	20	n/a	n/a	n/a	n/a	*Touchdown/Liftoff – Two Counties* touched down southeast of Womac and traveled northeast before lifting off near northeast of Barnett in Montgomery County – total length: 4.0 miles - caused minor tree damage
37	3/7/2017	12:50 a.m.	Sawyerville Lake Ka-Ho	EF1	6.7	100	1	0	$350,000	n/a	Event Description Provided Below
Touchdown/Liftoff – Two Counties touched down southwest of Sawyerville and traveled northeast, through the village, crossed Interstate 55 and Historic Route 66 before lifting off southeast of Litchfield in Montgomery County – total length: 12.9 miles - The Macoupin County Health Department's Emergency Preparedness Coordinator identified $350,000 in damages and one injury and confirmed the types of damages sustained *Sawyerville* - destroyed a garage, damaging two cars inside - several outbuildings sustained minor to moderate damage in the southern portions of the Village including a greenhouse - most of the damage was to trees and from the loss of roof coverings on homes and outbuildings - several power poles were downed *Lake Ka-Ho area* - tornado caused damage similar to that experienced in Sawyerville											
Subtotal:							**1**	**0**	**$0**	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

[^] Tornado touchdown verified in the vicinity of this location(s).

Figure 39
(Sheet 14 of 14)
Tornadoes Reported in Macoupin County
1950 – 2017

Map No.	Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length[1] (Miles)	Width (Yards)	Injuries	Fatalities	Property Damage	Crop Damage	Description
38	4/29/2017	3:04 p.m.	Piasa^	EF1	0.7	50	n/a	n/a	n/a	n/a	*Touchdown/Liftoff – Two Counties* touched down northwest of Brighton in Jersey County and traveled northeast before lifting off south of Piasa – total length: 2.4 miles caused minor tree damage
Subtotal:							**0**	**0**	**$0**	**$0**	
GRAND TOTAL							**9**	**3**	**$5,072,750***	**$0**	

[1] The length provided is only for the portion(s) of the tornado that occurred in Macoupin County.

^ Tornado touchdown verified in the vicinity of this location(s).

* There were 4 events that occurred on December 2, 1950, August 4, 1959, October 10, 1959 and May 6, 1960 where $550,000 in property damages was sustained as result of these tornadoes and present losses sustained in two or more counties (including Macoupin County). A detailed description and breakdown by county was not available.

Sources: Chris Miller, Warning Coordination Meteorologist, National Weather Service, Weather Forecast Office Lincoln, Illinois.
Macoupin County Multi-Jurisdictional All Hazard Mitigation Planning Committee Member responses to the Natural Hazard Events Questionnaire.
NOAA, National Weather Service, Weather Forecast Office St. Louis, Missouri, Tornado Climatology, Macoupin County.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

3.5 FLOODS

IDENTIFYING THE HAZARD

What is the definition of a flood?

The Federal Emergency Management Agency (FEMA) defines a “flood” as a general or temporary condition where two or more acres of normally dry land or two or more properties are inundated by:

- overflow of inland or tidal waters;
- unusual and rapid accumulation or runoff of surface waters from any source;
- mudflows; or
- a sudden collapse or subsidence of shoreline land.

The severity of a flooding event is determined by a combination of topography and physiography, ground cover, precipitation and weather patterns and recent soil moisture conditions. On average, flooding causes more than $5 billion in damages each year in the United States. Floods cause utility damage and outages, infrastructure damage (both to transportation and communication systems), structural damage to buildings, crop loss, decreased land values and impede travel.

What types of flooding occur in Macoupin County?

There are two main types of flooding that affect Macoupin County: general flooding and flash flooding. General flooding can be broken down into two categories: riverine flooding and shallow flooding. The following provides a brief description of each type.

General Flooding – Riverine Flooding

Riverine flooding occurs when the water in a river or stream gradually rises and overflows its banks. This type of flooding affects low lying areas near rivers, streams, lakes and reservoirs and generally occurs when:

- persistent storm systems enter the area and remain for extended periods of time,
- winter and spring rains combine with melting snow to fill river basins with more water than the river or stream can handle,
- ice jams create natural dams which block normal water flow, and
- torrential rains from tropical systems make landfall.

General Flooding – Shallow Flooding

Shallow flooding occurs in flat areas where there are no clearly defined channels (i.e., rivers and streams) and water cannot easily drain away. There two main types of shallow flooding: sheet flow and ponding. If the surface runoff cannot find a channel, it may flow out over a large area at a somewhat uniform depth in what’s called sheet flow. In other cases the runoff may collect in depressions and low-lying areas where it cannot drain out, creating a ponding effect. Ponding floodwaters do not move or flow away, they remain in the temporary ponds until the water can infiltrate the soil, evaporate or are pumped out.

Flash Floods

Flash flooding occurs when there is a rapid rise of water along a stream or low-lying area. This type of flooding generally occurs within six hours of a significant rain event and is usually produced when heavy localized precipitation falls over an area in a short amount of time. Considered the most dangerous type of flood event, flash floods happen quickly with little or no warning. Typically, there is no time for the excess water to soak into the ground nor are the storm sewers able to handle the sheer volume of water. As a result, streams overflow their banks and low-lying (such as underpasses, basements etc.) areas can rapidly fill with water.

Flash floods are very strong and can tear out trees, destroy buildings and bridges and scour out new channels. Flash flood-producing rains can also weaken soil and trigger debris flows that damage homes, roads and property. A vehicle caught in swiftly moving water can be swept away in a matter of seconds. Twelve inches of water can float a car or small SUV and 18 inches of water can carry away large vehicles.

What is a base flood?

A base flood refers to any flood having a 1% chance of occurring in any given year. It is also known as the 100-year flood or the one percent annual chance flood. The base flood is the national standard used by the National Flood Insurance Program (NFIP) and the State of Illinois for the purposes of requiring the purchase of flood insurance and regulating new development.

Many individuals misinterpret the term "100-year flood". This term is used to describe the risk of future flooding; it does not mean that it will occur once every 100 years. Statistically speaking, a 100-year flood has a 1/100 (1%) chance of occurring in any given year. In reality, a 100-year flood could occur two times in the same year or two years in a row, especially if there are other contributing factors such as unusual changes in weather conditions, stream channelization or changes in land use (i.e., open space land developed for housing or paved parking lots). It is also possible not to have a 100-year flood event over the course of 100 years.

While the base flood is the standard most commonly used for floodplain management and regulatory purposes in the United States, the 500-year flood is the national standard for protecting critical facilities, such as hospitals and power plants. A 500-year flood has a 1/500 (0.2%) chance of occurring in any given year.

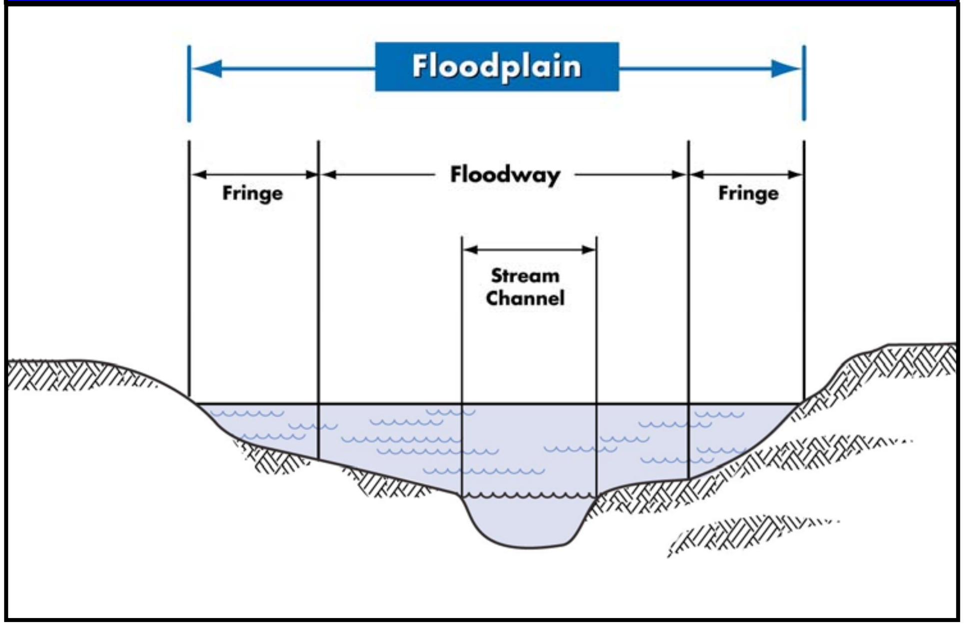
What is a floodplain?

The general definition of a floodplain is any land area susceptible to being inundated or flooded by water from any source (i.e., river, stream, lake, estuary, etc.). This general definition differs slightly from the regulatory definition of a floodplain.

A regulatory or base floodplain is defined as the land area that is covered by the floodwaters of the base flood. This land area is subject to a 1% chance of flooding in any given year. The base floodplain is also known as the 100-year floodplain or a Special Flood Hazard Area (SFHA). It is this second definition that is generally most familiar to people and the one that is used by the NFIP and the State of Illinois.

A base floodplain is divided into two parts: the floodway and the flood fringe. **Figure 60** illustrates the various components of a base floodplain.

Figure 60
Floodplain Illustration



Source: Illinois Department of Natural Resources, Quick Guide to Floodplain Management.

The floodway is the channel of a river or stream and the adjacent floodplain that is required to store and convey the base flood without increasing the water surface elevation. Typically the floodway is the most hazardous portion of the floodplain because it carries the bulk of the base flood downstream and is usually the area where water is deepest and is moving the fastest. Floodplain regulations prohibit construction within the floodway that results in an increase in the floodwater's depth and velocity.

The flood fringe is the remaining area of the base floodplain, outside of the floodway, that is subject to shallow inundation and low velocity flows. In general, the flood fringe plays a relatively insignificant role in storing and discharging floodwaters. The flood fringe can be quite wide on large streams and quite small or nonexistent on small streams. Development within the flood fringe is typically allowed via permit if it will not significantly increase the floodwater's depth or velocity and the development is elevated above or otherwise protected to the base flood elevation.

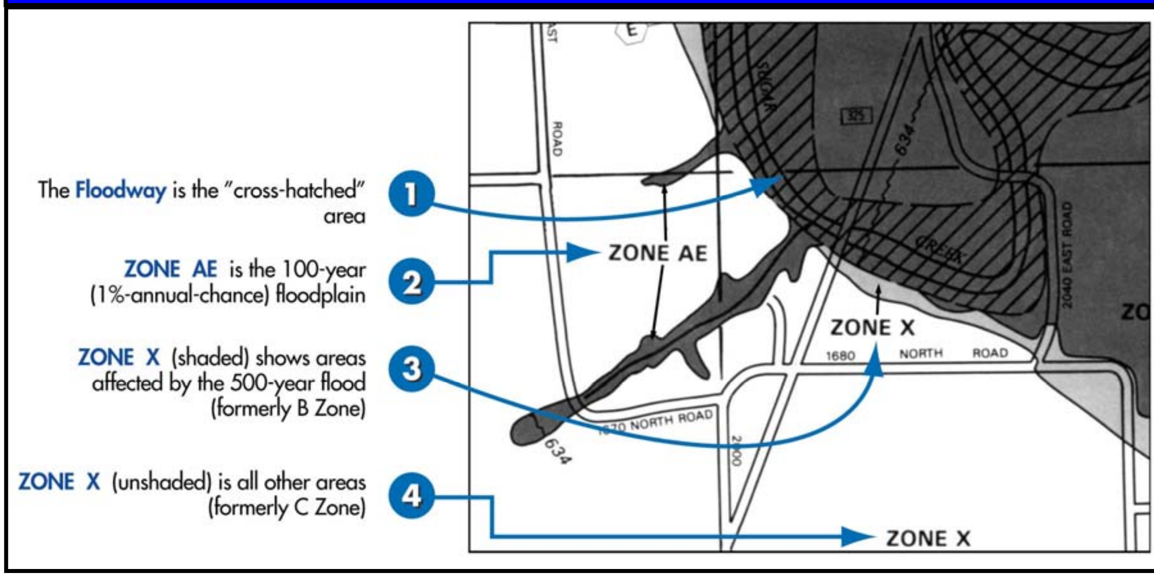
What is a Special Flood Hazard Area?

A Special Flood Hazard Area (SFHA) is the base floodplain. As discussed previously, this is the land area that is covered by the floodwaters of the base flood and has a 1% chance of flooding in any given year. The term SFHA is most commonly used when referring to the based floodplain on the Flood Insurance Rate Maps (FIRM) produced by FEMA. The SFHA is the area where floodplain regulations must be enforced by a community as a condition of participation in the NFIP and the area where mandatory flood insurance purchase requirements apply. SFHA are delineated on the FIRMs and may be designated as Zones A, AE, A1-30, AO, AH, AR, and A99 depending on the amount of flood data available, the severity of the flood hazard or the age of the flood map.

What are Flood Insurance Rate Maps?

Flood Insurance Rate Maps (FIRMs) are maps that identify both the SFHA and the risk premium zones applicable to a community. These maps are produced by FEMA in association with the NFIP for floodplain management and insurance purposes. Digital versions of these maps are referred to as DFIRMs. **Figure 61** shows an example of a FIRM.

Figure 61
Example of a Flood Insurance Rate Map (FIRM)



Source: Illinois Department of Natural Resources, Quick Guide to Floodplain Management.

A FIRM will generally shows a community's base flood elevations, flood zones and floodplain boundaries. The information presented on a FIRM is based on historic, meteorological, hydrologic and hydraulic data as well as open-space conditions, flood-control projects and development. ***These maps only define flooding that occurs when a creek or river becomes overwhelmed. They do not define overland flooding that occurs when an area receives extraordinarily intense rainfall and storm sewers and roadside ditches are unable to handle the surface runoff.***

What are flood zones?

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. These zones are depicted on a community's FIRM. The following provides a brief description of each flood zone.

- **Zone A.** Zone A, also known as the Special Flood Hazard Area (SFHA) or base floodplain, is defined as the floodplain area that has a 1% chance of flooding in any given year. There are multiple Zone A designations, including Zones A, AO, AH, A1-30, AE, AR or A99. Land areas located within Zone A are at a high risk for flooding.

During a 30 year period, the length of many mortgages, there is at least a 1 in 4 chance that a base flood will occur in a SFHA. All home and business owners in SFHAs with mortgages from federally regulated or insured lenders are required to purchase flood insurance.

- **Zone X (shaded).** Zone X (shaded), formerly known as Zone B, is defined as the floodplain area between the limits of the base flood (Zone A) and the 500-year flood. Land areas located within Zone X (shaded) are affected by the 500-year flood and are considered at a moderate risk for flooding.

  Zone X (shaded) is also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile. While flood insurance is not federally required in Zone X (shaded), it is recommended for all property owners and renters.
- **Zone X (unshaded).** Zone X (unshaded), formerly known as Zone C, is defined as all other land areas outside of Zone A and Zone X (shaded). Land areas located in Zone X (unshaded) are considered to have a low or minimal risk of flooding. While flood insurance is not federally required in Zone X (unshaded), it is recommended for all property owners and renters.

What is a Repetitive Loss Structure or Property?

FEMA defines a "repetitive loss structure" as a National Flood Insurance Program-insured structure that has received two or more flood insurance claim payments of more than $1,000 each within any 10-year period since 1978. These structures/properties account for approximately one-fourth of all National Flood Insurance Program (NFIP) insurance claim payments since 1978.

Currently, repetitive loss properties make up 1.3% of all policies, but are expected to account for 15% to 20% of future losses. These structures not only increase the NFIP's annual losses, they drain funds needed to prepare for catastrophic events. As a result, FEMA and the NFIP are working with states and local governments to mitigate these properties.

What is floodplain management?

Floodplain management is the administration of an overall community program of corrective and preventative measures to reduce flood damage. These measures take a variety of forms and generally include zoning, subdivision or building requirements, special-purpose floodplain ordinances, flood control projects, education and planning. Where floodplain development is permitted, floodplain management provides a framework that minimizes the risk to life and property from floods by maintaining a floodplain's natural function. Floodplain management is a key component of the National Flood Insurance Program.

What is the National Flood Insurance Program?

The National Flood Insurance Program (NFIP) is a federal program, administered by FEMA, that:

- mitigates future flood losses nationwide through community-enforced building and zoning ordinances; and

- provides access to affordable, federally-backed insurance protection against losses from flooding to property owners in participating communities.

It is designed to provide an insurance alternative to disaster assistance to meet escalating costs of repairing damage to buildings and their contents due to flooding. The U.S. Congress established the NFIP on August 1, 1968 with the passage of the National Flood Insurance Act of 1968. This Program has been broadened and modified several times over the years, most recently with the passage of the Flood Insurance Reform Act of 2004.

Prior to the creation of the NFIP, the national response to flood disasters was generally limited to constructing flood-control projects such as dams, levees, sea-walls, etc. and providing disaster relief to flood victims. While flood-control projects were able to initially reduce losses, their gains were offset by unwise and uncontrolled development practices within floodplains. In light of the continued increase in flood losses and the escalating costs of disaster relief to taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for protection.

Participation in the NFIP is voluntary and based on an agreement between local communities and the federal government. If a community agrees to adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in a SFHA (base floodplain), then the government will make flood insurance available within the community as a financial protection against flood losses.

If a community chooses not to participate in the NFIP or a participating community decides not to adopt new floodplain management regulations or amend its existing regulations to reference new flood hazard data provided by FEMA, then the following sanctions will apply.

- Property owners will not be able to purchase NFIP flood insurance policies and existing policies will not be renewed.
- Federal disaster assistance will not be provided to repair or reconstruct insurable buildings located in identified flood hazard areas for presidentially-declared disasters that occur as a result of flooding.
- Federal mortgage insurance and loan guarantees, such as those written by the Federal Housing Administration and the Department of Veteran Affairs, will not be provided for acquisition or construction purposes within an identified flood hazard area. Federally-insured or regulated lending institutions, such as banks and credit unions, are allowed to make conventional loans for insurable buildings in identified flood hazard areas of non-participating communities. However, the lender must notify applicants that the property is in an identified flood hazard area and that it is not eligible for federal disaster assistance.
- Federal grants or loans for development will not be available in identified flood hazard areas under programs administered by federal agencies such as the Environmental Protection Agency, Small Business Administration and the Department of Housing and Urban Development.

What is the NFIP's Community Rating System?

The NFIP's Community Rating System (CRS) is a voluntary program developed by FEMA to provide incentives (in the form of flood insurance premium discounts) for NFIP participating communities that have gone beyond the minimum NFIP floodplain management requirements to develop extra measures to provide protection from flooding. CRS discounts on flood insurance premiums range from 5% up to 45%. Those discounts provide an incentive for new flood protection activities that can help save lives and property in the event of a flood.

Are alerts issued for flooding?

Yes. The National Weather Service Weather Forecast Office in St. Louis, Missouri is responsible for issuing ***flood watches*** and ***warnings*** for Macoupin County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watches.** A flood watch is issued when flooding or flash flooding is possible. It does not mean that flooding is imminent just that individuals need to be alert and prepared, especially when driving at night.
- **Warnings.** Warnings indicate imminent danger to life and property for those who are in the area of the flooding.
  - **Flood Warning**. A flood warning is issued when flooding is occurring or will occur soon and is expected to last for several days or weeks.
  - **Flash Flood Warning.** A flash flood warning is issued when flash flooding is occurring or is imminent.

PROFILING THE HAZARD

When has flooding occurred previously? What is the extent of these previous floods?

Figures 62 and **63**, located at the end of this section, summarize the previous occurrences as well as the extent or magnitude of flood events recorded in Macoupin County. The flood events are separated into two categories: general floods (riverine and shallow/overland) and flash floods.

Flood Fast Facts – Occurrences

Number of General Floods Reported (1982 – 2017): ***6***

Number of Flash Floods Reported (1998 – 2017): ***25***

Most Likely Month for Flash Floods to Occur: ***May***

Most Likely Time for Flash Floods to Occur: ***Evening***

Number of Federally-Declared Disasters Related to General/Flash Flooding: ***4***

General Floods

While flooding occurs on a fairly regular basis, NOAA's Storm Events Database only had three *recorded* occurrences of general flood events in Macoupin County between 1998 and 2017. An additional three reported occurrences of general flooding in Macoupin County were identified using NOAA's Storm Data Publications, Illinois State Water Survey and U.S. Geological Survey reports based on Committee Member records and FEMA's list of federally-declared disasters. Two of the six general flood events contributed to two separate federally-declared disasters in Macoupin County.

Flash Floods

NOAA's Storm Events Database documented 25 reported occurrences of flash flooding in Macoupin County between 1999 and 2017. Included in the 25 flash flood events are four events that contributed to two separate federally-declared disasters in the County.

Figure 64 charts the reported occurrences of flooding by month. Each of the general flood events took place in different months, with the exception of two events that began or took place in April. Two of the six events spanned two or more months; however, for illustration purposes only the month the event started in is graphed.

In comparison, 14 of the 25 flash flood events (56%) took place in May and June making this the peak period for flash floods. Of the 14 events, eight (57%) occurred in May, making this the peak month for flash flooding.

Figure 64
Flood Events by Month

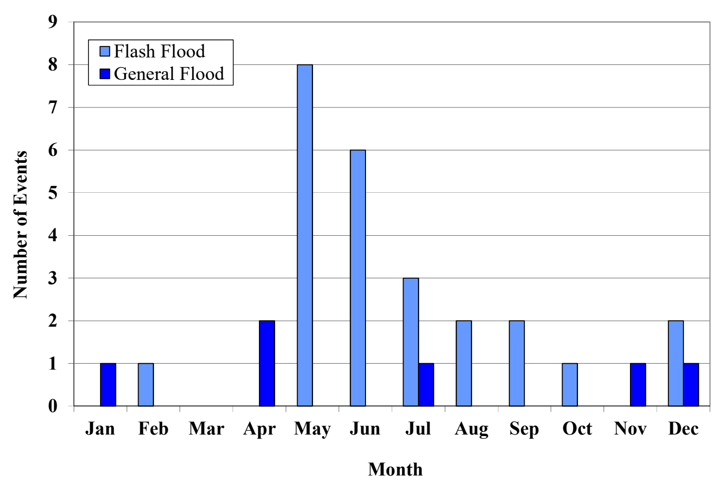
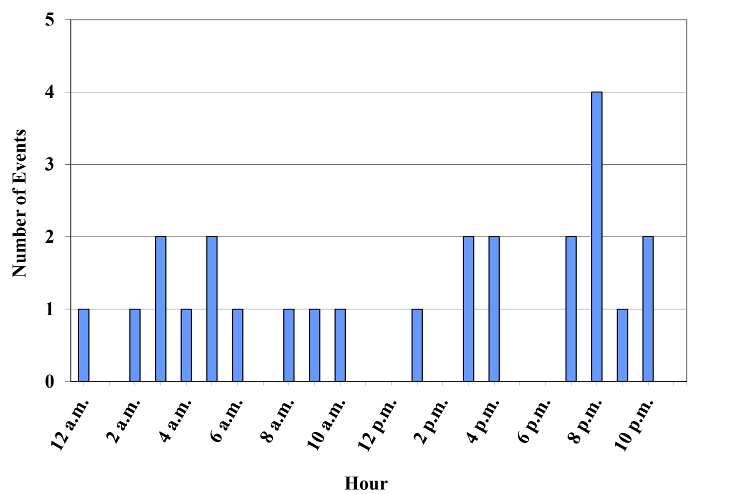


Figure 65 charts the reported occurrences of flash flood events by hour. Approximately 56% of the 25 flash flood events began during the p.m. hours, with nine of the events (64%) taking place between 7:00 p.m. and 11:00 p.m. In comparison, 67% of the general flood events with recorded times began during the a.m. hours.

What locations are affected by floods?

While specific locations are affected by general flooding, most areas of the County can be impacted by overland and flash flooding because of the topography and seasonally high water table of the area. Only 2.4% of the area in Macoupin County is designated as being within the base floodplain and susceptible to riverine floods. This is the smallest percentage of acres located in the floodplain of any county is Illinois. The *2013 Illinois Natural Hazard Mitigation Plan* classifies Macoupin County's hazard rating for floods as "elevated."

Figure 65
Flash Flood Events by Hour



FIRMs have only been developed for three of the participating jurisdictions within Macoupin County: Carlinville, Gillespie and Staunton. These maps were developed between 1981 and 1987 and are the current effective maps. Copies of the FIRMs are located in **Appendix L**. Digital FIRMs have been developed for the portions of Brighton and Virden that are located outside of Macoupin County. These maps were developed between 2007 and 2009 and are also located in **Appendix L**.

While FIRMs have not been developed for the County, Flood Hazard Boundary Maps (FHBMs) were developed in 1977 and became effective on January 6, 1978. Copies of the County FHBMs are located in **Appendix L**.

No other FIRMs or FHBMs have been developed for any of the municipalities in Macoupin County and none are anticipated to be completed or updated in the near future according to the Illinois State Water Survey's Countywide Digital FIRM Status Map.

Figure 66 identifies the bodies of water within or immediately adjacent to participating jurisdictions that are known to cause flooding or have the potential to flood. Water bodies with Special Flood Hazard Areas located within a participating jurisdiction (as identified on the DFIRMs) are identified in bold.

Municipal and County officials have reported overland flood issues outside of the base floodplain in most of the participating municipalities and many unincorporated portions of the County. This overland flooding is known to impair travel.

What jurisdictions within the County take part in the NFIP?

Macoupin County, Brighton, Carlinville, Gillespie, Staunton and Virden all participate in the NFIP. **Figure 67** provides information about each jurisdiction's participation in the NFIP, including the date each participant joined and the year of the most recently adopted floodplain zoning ordinance. The remaining 21 incorporated municipalities in Macoupin County have no identified flood hazard boundaries within their corporate limits and are not required to participate.

Figure 66
Bodies of Water Subject to Flooding

Participating Jurisdiction	Water Bodies
Benld	unnamed tributary Cahokia Creek
Brighton	Briarwood Lak, unnamed tributary Little Piasa Creek
Bunker Hill	Paddock Creek, unnamed tributary Indian Creek
Carlinville	**Briar Creek**
Gillespie	**Bear Creek**
Girard	unnamed tributary East Fork Otter Creek
Mt. Olive	unnamed tributary Old Mt. Olive Reservoir/Sugar Creek
Royal Lakes	Coop Branch, Meshach Lake, Shad Lake, Shadrach Lake
Staunton	**unnamed tributary Ginseng Creek**
Virden	---
Wilsonville	West Fork Cahokia Creek
Unincorporated Macoupin County	**Adams Branch**, **Apple Creek**, Anderson Creek, **Baitter Branch**, Beam Branch, Bear Creek, Bear Creek, Beaver Dam Lake, **Big Branch Creek**, **Briar Creek**, Briarwood Lake, Brush Creek, **Bullard Lake**, Bunker Hill Old Lake, Bunker Hill Reservoir, Bunn Lake, **Cahokia Creek**, Carlinville Lake, Cone Branch, **Coop Branch**, Cottonwood Creek, Crooked Creek, Deer Run Lake, **Dry Fork**, East Creek, **East Fork Otter Creek**, **East Fork Wood River**, Elm Creek, Evergreen Lake, Fox Branch, **Ginseng Creek**, Girder Branch, Goose Creek, Hicks Creek, Hodges Creek, Honey Creek, Honeycut Branch, Horse Creek, Hurricane Creek, I Beam Branch, Indian Creek, Jacobie Lake, **Joes Creek**, Kent Branch, **Kent Creek**, Lake Catatoga, Lake Edward, Lake Ka-Ho, Lake Rinaker, Lake Williamson, Lands Branch, **Left Fork Apple Creek**, **Lick Branch**, **Lick Creek**, Little Negro Lick, Little Piasa Creek, Lynn Grove Branch, **Macoupin Creek**, Matodd Branch, **May Branch**, Miller Branch, Mowens Lake, Mt. Olive Lake, **Nassa Creek**, New Gillespie Lake, Old Gillespie Lake, Old Mt. Olive Reservoir, **Otter Creek**, Otter Lake, Paddock Creek, Palymra-Modesto City Lake, **Panther Creek**, Panther Creek, Piasa Creek, Prairie Branch, Richardson Branch, **Rock Branch**, Shaw Point Branch, Shearles Branch, **Sherry Creek**, Shipman Reservoir, **Silver Creek**, Smith Lake, **Solomon Creek**, **Spanish Needle Creek**, Spring Creek, Staunton Reservoir, Steer Creek, Steidley Branch, Sugar Camp Creek, **Sugar Creek**, Sugar Creek, Sugar Creek, Sunset Lake, Taylor Creek, Timber Creek, Turner Creek, **West Fork Cahokia Creek**, West Fork Otter Creek, West Fork Wood River, Whites Pond, Wolf Branch

Source: FEMA FIRMs & FHBMs.

What is the probability of future flood events occurring?

Flash Floods

There have been 25 verified flash flood events between 1999 and 2017. With 25 occurrences over the past 19 years, Macoupin County should expect at least one flash flood event each year. There were five years over the past 19 years where two or more flash flood events occurred. This indicates that the probability that more than one flash flood event may occur during any given year within the County is 26.3%.

Figure 67 NFIP Participants				
Participating Jurisdictions	**Participation Date**	**Current Effective FIRM/FHBM Date**	**CRS Participation**	**Most Recently Adopted Floodplain Zoning Ordinance**
Macoupin County	09/18/1996	01/06/1978	No	1996
Brighton	05/13/2009	NSFHA	No	2009
Carlinville	09/04/1986	09/04/1986	No	2007
Gillespie	08/04/1987	08/04/1987	No	2003
Staunton	07/17/1981	07/17/1981	No	2003
Virden	05/25/1978	NSFHA	No	2012

Sources: FEMA, Community Status Book.

ASSESSING VULNERABILITY

Several factors including topography, precipitation and an abundance of rivers and streams make Illinois especially vulnerable to flooding. According to the Illinois State Water Survey's Climate Atlas of Illinois, since the 1940s Illinois climate records have shown an increase in heavy precipitation which has led to increased flood peaks on Illinois Rivers.

Are the participating jurisdictions vulnerable to flooding?

Yes. Macoupin County and the participating municipalities are vulnerable to the dangers presented by flooding. Precipitation levels and topography are factors that cumulatively make virtually the entire County susceptible to some form of flooding. Flooding occurs along the floodplains of all the streams within the County as well as outside of the floodplains in low-lying areas where drainage problems occur.

Figure 68 details the number of *recorded* flash flood events by participating jurisdiction. Five of the six general flood events impacted the entire County or a large portion of it and were not location specific. The remaining general flood event took place in Brighton. Since 2008, there have been 15 flash floods recorded in Macoupin County.

Vulnerability to flooding can change depending on several factors, including land use. As land used primarily for agricultural and open space purposes is converted for residential and commercial/industrial uses, the number of buildings and impervious surfaces (i.e., parking lots, roads, sidewalks, etc.) increases. As the number of buildings and impervious surfaces increases, so too does the potential for flash flooding. Rather than infiltrating the ground slowly, rain and snowmelt that falls on impervious surfaces runs off and fills ditches and storm drains quickly creating drainage problems and flooding.

As described in Section 1.3 Land Use and Development Trends, substantial changes in land use (from forested, open and agricultural land to residential, commercial and industrial) are not anticipated within the County in the immediate future. No substantial increases in residential or commercial/industrial developments are expected within the next five years.

Figure 68
Verified Flash Flood Events by Participating Jurisdiction

Participating Municipality	Number	Year
Benld	---	
Brighton	1	2008
Bunker Hill	1	2009
Carlinville	---	
Gillespie	---	
Girard	---	
Mt. Olive	---	
Royal Lakes	---	
Staunton	2	2007, 2009
Virden	---	
Wilsonville	---	
countywide	8	2002, 2002, 2002, 2004, 2008, 2008, 2013, 2015
northern portion of the County	5	2001, 2003, 2010, 2011, 2014
southern portion of the County	5	1999, 2000, 2006, 2008, 2009
central portion of the County	1	2014
southeastern portion of the County	1	2011
southwestern portion of the County	1	2016

* Flash flood verified within the municipality.

What impacts resulted from the recorded floods?

Floods as a whole have caused a minimum of $5,000 in property damage and $5,000 in crop damage. The following provides a breakdown by category.

In comparison, the State of Illinois averages four fatalities per year and an estimated $257 million annually in property damage losses, making flooding the single most financially damaging natural hazard in Illinois.

While both general and flash floods occur on a fairly regular basis within the County, the number of recorded injuries and fatalities is very low. In terms of the risk or vulnerability to public health and safety from *general floods*, the risk is seen as low. However, almost all of the recorded flood events were the result of flash flooding. Since there is very little warning associated with flash flooding the risk to public health and safety from *flash floods* is elevated to medium.

Flood Fast Facts – Impacts/Risk

General Flood Impacts
- Total Property Damage: ***n/a***
- Infrastructure/Critical Facilities Damage*: n/a
- Total Crop Damage: ***n/a***
- Injuries: ***n/a***
- Fatalities: ***n/a***

Flash Flood Impacts
- Total Property Damage: ***$5,000***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Total Crop Damage: ***$5,000***
- Injuries: ***n/a***
- Fatalities: ***n/a***

Flood Risk/Vulnerability to:
- Public Health & Safety – General Flooding: ***Low***
- Public Health & Safety – Flash Flooding: ***Medium***
- Buildings/Infrastructure/Critical Facilities: ***Medium/High***

* Infrastructure/Critical Facilities Damage totals are included in the Total Property Damage amounts.

<u>*General Floods*</u>

Damage information was either unavailable or none was reported for any of the general flood events. No injuries or fatalities were reported as a result of any of the recorded events.

<u>*Flash Floods*</u>

Data obtained from NOAA's Storm Events Database indicates that between 1999 and 2017, one of the 25 flash flood events caused approximately $5,000 million in property damage ad $5,000 in crop damage. Damage information was either unavailable or none was recorded for the remaining 24 reported occurrences.

Approximately 7 inches of rain fell in a short amount of time on October 2, 2014 resulting in flash flooding.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

No injuries or fatalities were reported as a result of any of the recorded events.

What other impacts can result from flooding?

One of the primary threats from flooding is drowning. Nearly half of all flash flood fatalities occur in vehicles as they are swept downstream. Most of these fatalities take place when people drive into flooded roadway dips and low drainage areas. It only takes two feet of water to carry away most vehicles.

Floodwaters also pose biological and chemical risks to public health. Flooding can force untreated sewage to mix with floodwaters. The polluted floodwaters then transport the biological contaminants into buildings and basements and onto streets and public areas. If left untreated, the floodwaters can serve as breeding grounds for bacteria and other disease-causing agents. Even if floodwaters are not contaminated with biological material, basements and buildings that are not properly cleaned can grow mold and mildew, which can pose a health hazard, especially for small children, the elderly and those with specific allergies.

Flooding can also cause chemical contaminants such as gasoline and oil to enter the floodwaters if underground storage tanks or pipelines crack and begin leaking during a flood event. Depending on the time of year, floodwaters also may carry away agricultural chemicals that have been applied to farm fields.

Structural damage, such as cracks forming in a foundation, can also result from flooding. In most cases, however, the structural damage sustained during a flood occurs to the flooring, drywall and wood framing. In addition to structural damage, a flood can also cause serious damage to a building's content.

Infrastructure and critical facilities are also vulnerable to flooding. Roadways, culverts and bridges can be weakened by floodwaters and have been known to collapse under the weight of a vehicle. Buried power and communication lines are also vulnerable to flooding. Water can infiltrate lines and cause disruptions in power and communication.

Are there any repetitive loss structures/properties within Macoupin County?

No. According to information obtained from IEMA, there are no repetitive loss properties located in Macoupin County.

Are existing buildings, infrastructure and critical facilities vulnerable to flooding?

Yes. **Figure 69** identifies the *estimated number* of existing residential structures by participating jurisdiction located within a base floodplain. These counts were prepared by the Consultant and are based on a review of the limited number of current FIRMS and discussions with the Macoupin County Floodplain Manager. Aside from key roads and bridges and buried power and communication lines, no specific infrastructure/critical facilities are located within or adjacent to a floodplain.

Figure 69
Existing Residential Structures Located within a Base Floodplain

Participating Jurisdiction	Number of Residential Structures	Participating Jurisdiction	Number of Residential Structures
Benld	0	Girard	0
Brighton	0	Royal Lakes	0
Bunker Hill	0	Staunton	4
Carlinville	1	Virden	0
Gillespie	0	Wilsonville	0

Only three of the jurisdictions within Macoupin County have current FIRMs: Carlinville, Gillespie and Staunton. These FIRMs were prepared between 1981 and 1987. None of the other municipalities have been mapped. While Flood Hazard Boundary Maps (FHBMs) were completed in 1977 for the unincorporated portions of Macoupin County, FIRMs have yet to be developed. As a result, estimates of existing residential structures in unincorporated Macoupin County are not included.

Macoupin County has the smallest percentage of acres located in the floodplain of any county in Illinois. This fact, coupled with the lack of mapping is the primary reason that there are so few residential structures located in the floodplain. While a very small area is susceptible to riverine flooding, 2.4%, almost the entire County is vulnerable to flash flooding. As a result, a majority of the buildings, infrastructure and critical facilities that may be impacted by flooding are located outside of the base floodplain and are not easily identifiable.

The risk or vulnerability of existing buildings, infrastructure and critical facilities to all forms of flooding is considered to be medium based on: (a) the frequency and severity of recorded flood events within the County; (b) the fact that most of the County is vulnerable to flash flooding; and (c) a majority of the buildings, infrastructure and critical facilities that may be impacted are located outside of the base floodplain.

Are future buildings, infrastructure and critical facilities vulnerable to flooding?

The answer to this question depends on the type of flooding being discussed.

Riverine Flooding

In terms of riverine flooding, the vulnerability of future buildings, infrastructure and critical facilities located within NFIP-participating jurisdictions is low as long as the existing floodplain ordinances are enforced. Enforcement of the floodplain ordinance is the mechanism that ensures that new structures either are not built in flood-prone areas or are elevated or protected to the base flood elevation.

Flash Flooding

In terms of flash flooding, all future buildings, infrastructure and critical facilities are still vulnerable depending on the amount of precipitation that is received, the topography and any land use changes undertaken within the participating jurisdictions.

What are the potential dollar losses to vulnerable structures from flooding?

An estimate of the potential dollar losses to vulnerable *residential structures* located within the *participating municipalities* can be calculated if several assumptions are made. These assumptions represent a probable scenario based on the reported occurrences of flooding in Macoupin County.

The purpose of providing an estimate is to help residents and municipal officials make informed decisions about how they can better protect themselves and their communities. These estimates are meant to provide a ***general idea*** of the magnitude of the potential damage that could occur from a flood event in each of the municipalities.

Assumptions

To calculate the overall potential dollar losses to vulnerable residential structures from a flood, a set of decisions/assumptions must be made regarding:

- type of flood event;
- scope of the flood event;
- number of potentially-damaged housing units;
- value of the potentially-damaged housing units; and
- percent damage sustained by the potentially-damaged housing units (i.e., damage scenario.)

The following provides a detailed discussion of each decision/assumption.

Assumption #1

A riverine flood event will impact vulnerable residential structures within each municipality.

Type of Flood Event. The first step towards calculating the potential dollar losses to vulnerable residential structures is to determine the type of flood event that will be used for this scenario. While flash flooding accounts for over three-quarters of all the recorded flood events identifying residential structures vulnerable to flash flooding is problematic because most are located outside of the base floodplain and the number of structures impacted can change with each event depending on the amount of precipitation received, the topography and the land use of the area.

Therefore, a riverine flood event will be used since it is (a) relatively easy to identify vulnerable residential structures within each municipality (i.e., those structures located within the base floodplain or Special Flood Hazard Areas of any river, stream or creek); and (b) the number of structures impacted is generally the same from event to event.

Assumption #2

All base floodplains within a municipality will flood and experience the same degree of flooding.

Scope of the Flood Event. To establish the number of vulnerable residential structures or potentially-damaged housing units, the scope of the riverine flood event within each municipality must first be determined. In this scenario, the scope refers to the number of rivers, streams and creeks that overflow their banks and the degree of flooding experienced along base floodplains for each river, stream and creek.

Generally speaking, a riverine flood event only affects one or two streams or creeks at a time depending on the cause of the event (i.e., precipitation, snow melt, ice jam, etc.) and usually does not produce the same degree of flooding along the entire length of the river, stream or creek. However, for this scenario, it was decided that:

- ❖ all rivers, streams and creeks with base floodplains would overflow their banks, and
- ❖ the base floodplains of each river, stream and/or creek located within the corporate limits of each municipality would experience the same degree of flooding.

This assumption results in the following conditions for each municipality:

- ➢ Benld, Brighton, Bunker Hill, Girard, Royal Lakes, Virden and Wilsonville would not experience any residential flooding since there are no river, stream or creek base floodplains located within their municipal limits;
- ➢ Carlinville: Briar Creek and its tributaries would overflow their banks and flood a small portion along the south and eastern edges of the City;
- ➢ Gillespie: Bear Creek and its tributaries would overflow their banks and flood a small portion of the central part of the City; and
- ➢ Staunton*:* an unnamed tributary of Ginseng Creek would overflow its banks and flood a small portion of the central part of the City.

Assumption #3

The number of existing residential structures located within the base floodplain(s) in each municipality will be used to determine the number of potentially-damaged housing units.

Number of Potentially-Damaged Housing Units. Since this scenario assumes that all the base floodplains within a municipality will experience the same degree of flooding, the number of existing residential structures located within the base floodplain(s) of each municipality can be used to determine the number of potentially-damaged housing units. **Figure 69** identifies the total number of existing residential structures located within the base floodplains(s) of each municipality. These counts were prepared by the Consultant in consultation with Macoupin County Floodplain Manager.

While base floodplains are present within Gillespie, there are no residential structures located within their limits.

> **Assumption #4**
>
> The average market value for a residential structure in each municipality will be used to determine the value of potentially-damaged housing units.

Value of Potentially-Damaged Housing Units. Now that the number of potentially-damaged housing units has been determined, the monetary value of the units must be calculated. Typically when damage estimates are prepared after a natural disaster such as a flood, they are based on the market value of the structure. Since it would be impractical to determine the individual market value of each potentially-damaged housing unit, the average market value for a residential structure in each municipality will be used to calculate the potential dollar losses.

To determine the average market value, the average assessed value must first be calculated. The average assessed value is determined by taking the total assessed value of residential buildings within a jurisdiction and dividing that number by the total number of housing units in the jurisdiction. **Figure 70** provides a sample calculation. The total assessed value is based on 2016 tax assessment information provided by the Macoupin County Clerk.

To determine the average market value, the average assessed value is multiplied by three (the assessed value of a structure in Macoupin County is approximately one-third of the market value). **Figure 70** provides a sample calculation. **Figure 71** provides the average assessed value and average market value for each participating municipality.

Figure 70
Calculation of Average Assessed Value & Average Market Value

Average Assessed Value
Total Assessed Value of Residential Buildings in the Jurisdiction÷ Total Housing Units in the Jurisdiction = Average Assessed Value
(Rounded to the Nearest Dollar)

Carlinville: $42,997,637 ÷ 2,615 housing units = $16,443

Average Market Value
Average Assessed Value x 3 = Average Market Value

Carlinville: $16,443 x 3 = $49,329

> **Assumption #5**
>
> The potentially-damaged housing units are one or two story homes with basements and the flood depth is two feet.
>
> Structural Damage = 20%
> Content Damage = 30%

Damage Scenario. The final decision that must be made to calculate potential dollar losses is to determine the percent damage sustained by the structure and the structure's contents during the flood event. In order to determine the percent damage using FEMA's flood loss estimation tables, assumptions must be made regarding (a) the type of residential structure flooded (i.e., manufactured home, one story home without a basement, one or two story home with a basement, etc.) and (b) the flood depth.

Figure 71
Average Market Value of Housing Units by Municipality

Participating Jurisdiction	Total Assessed Value of Residential Buildings (2016)	Total Housing Units (2010)	Average Assessed Value (Raw)	Average Market Value (Raw)	Average Market Value (Rounded)
Benld	$6,854,981	750	$9,139.97467	$27,419.92401	$27,420
Brighton	$20,287,777	920	$22,051.93152	$66,155.79456	$66,156
Bunker Hill	$14,609,440	745	$19,609.98658	$58,829.95974	$58,830
Carlinville	$42,997,637	2,615	$16,442.69101	$49,328.07303	$49,328
Gillespie	$20,462,096	1,519	$13,470.76761	$40,412.30283	$40,412
Girard	$13,417,628	941	$14,258.90329	$42,776.70987	$42,777
Mount Olive	$13,184,308	984	$13,398.68699	$40,196.06097	$40,196
Royal Lakes	$678,864	108	$6,285.77778	$18,857.33334	$18,857
Staunton	$44,835,564	2,343	$19,135.96415	$57,407.89245	$57,408
Virden	$21,305,655	1,599	$13,324.36210	$39,973.08630	$39,973
Wilsonville	$2,426,704	264	$9,192.06061	$27,576.18183	$27,576

Source: Pete Duncan, Macoupin County Clerk.

For this scenario it is assumed that the potentially-damaged housing units are one or two story homes with basements and the flood depth is two feet. With these assumptions the expected percent damage sustained by the ***structure*** is estimated to be 20% and the expected percent damage sustained by the structure's ***contents*** is estimated to be 30%.

Potential Dollar Losses

Now that all of the decisions/assumptions have been made, the potential dollar losses can be calculated. First the potential dollar losses to the ***structure*** of the potentially-damaged housing units must be determined. This is done by taking the average market value for a residential structure and multiplying that by the percent damage (20%) to get the average structural damage per unit. Next the average structural damage per unit is multiplied by the number of potentially-damaged housing units. **Figure 72** provides a sample calculation.

Figure 72
Structure **– Potential Dollar Loss Calculations**

Average Market Value of a Housing Unit with the Jurisdiction x Percent Damage = Average Structural Damage per Housing Unit

Carlinville: $49,328 x 20% = $9,865.60 per housing unit

Average Structural Damage x Number of Potentially-Damaged Housing Units within the Jurisdiction = *Structure* Potential Dollar Losses (Rounded to the Nearest Dollar)

Carlinville: $9,865.60 per housing unit x 1 housing unit = $9,866

Next the potential dollar losses to the ***content*** of the potentially-damaged housing units must be determined. Based on FEMA guidance, the value of a residential housing unit's content is approximately 50% of its market value. Therefore, start by taking one-half the average market value for a residential structure and multiply that by the percent damage (30%) to get the average content damage per unit. Then take the average content damage per unit and multiply that by the number of potentially-damaged housing units. **Figure 73** provides a sample calculation.

Figure 73
Content **– Potential Dollar Loss Calculations**

½ (Average Market Value of a Housing Unit with the Jurisdiction) x Percent Damage = Average Content Damage per Housing Unit

Carlinville: ½ ($49,328) x 30% = $7,399.20 per housing unit

Average Content Damage per Housing Unit x Number of Potentially-Damaged Housing Units within the Jurisdiction = *Content* Potential Dollar Losses
(Rounded to the Nearest Dollar)

Carlinville: $7,399.20 per housing unit x 1 housing unit = $7,399

Finally the ***total potential dollar losses*** may be calculated by adding together the potential dollar losses to the structure and the content. **Figure 74** provides a breakdown of the total potential dollar losses by municipality.

Figure 74
Estimated Potential Dollar Losses to Potentially-Damaged Housing Units from a Riverine Flood Event

Participating Jurisdiction	Average Market Value (2016)	Potentially-Damaged Housing Units	Potential Dollar Losses		Total Potential Dollar Losses (Rounded to the Nearest Dollar)
			Structure	Content	
Benld	$27,420	0	$ 0	$ 0	$ 0
Brighton	$66,156	0	$ 0	$ 0	$ 0
Bunker Hill	$58,830	0	$ 0	$ 0	$ 0
Carlinville	$49,328	1	$9,866	$7,399	$17,265
Gillespie	$40,412	0	$ 0	$ 0	$ 0
Girard	$42,777	0	$ 0	$ 0	$ 0
Mount Olive	$40,196	0	$ 0	$ 0	$ 0
Royal Lakes	$18,857	0	$ 0	$ 0	$ 0
Staunton	$57,408	4	$45,926	$34,445	$80,371
Virden	$39,973	0	$ 0	$ 0	$ 0
Wilsonville	$27,576	0	$ 0	$ 0	$ 0

This assessment illustrates the potential residential dollar losses that should be considered when municipalities are deciding which mitigation projects to pursue. Potential dollar losses caused by riverine flooding to vulnerable residences within the participating municipalities would be expected to range from $17,265 to $80,371. There are nine participating municipalities in this scenario who do not have any residences considered vulnerable to riverine flooding.

Vulnerability of Infrastructure/Critical Facilities

The calculations presented above are meant to provide the reader with a sense of the scope or magnitude of a large riverine flood event in dollars. These calculations do not include the physical damages sustained by businesses or other infrastructure and critical facilities.

In terms of businesses, the impacts from a flood event can be physical and/or monetary. Monetary impacts can include loss of sales revenue either through temporary closure or loss of critical services (i.e., power, drinking water and sewer). Depending on the magnitude of the flood event, the damage sustained by infrastructure and critical facilities can be extensive in nature and expensive to repair. As a result, the cumulative monetary impacts to businesses and infrastructure can exceed the cumulative monetary impacts to residences. While average dollar amounts cannot be supplied for these items at this time, they should be taken into account when discussing the overall impacts that a large-scale riverine flood event could have on the participating jurisdictions.

In terms of specific infrastructure vulnerability, none of the municipalities that are mapped have infrastructure within or adjacent to a base floodplain. No other above-ground infrastructure within the participating jurisdictions, other than key roads and bridges, were identified as being vulnerable to riverine flooding.

Considerations

While the potential dollar loss scenario was only for a riverine flood event, the participating jurisdictions have been informed through the planning process of the impacts that can result from flash flood events. Macoupin County has experienced multiple flash flood events over the last 19 years as have adjoining and nearby counties. These events illustrate the need for officials to consider the overall monetary impacts of all forms of flooding on their communities. All participants should carefully consider the types of activities and projects that can be taken to minimize their vulnerability.

Figure 62
(Sheet 1 of 4)
General Flood Events Reported in Macoupin County
1982 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
12/2/1982 thru 12/6/1982	n/a	entire county	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #674)*** Heavy rain and thunderstorms produced 5 to 7 inches of rain, mainly between the 2nd and the 3rd throughout the state, leading to record or near record flooding along most Illinois rivers, streams and creeks. Many roads and bridges were washed away and major property damage occurred. COOP observers measured the following rain totals between the 2nd and 6th: - 5.89 inches 1 mile north of Virden (5.55 inches on the 2nd/3rd) - 4.95 inches at Carlinville (4.21 inches on the 2nd/3rd) - 4.93 inches at Medora (4.15 inches on the 2nd/3rd)
Subtotal:			**0**	**0**	**$0**	**0**	

^ Flood event verified in the vicinity of this location(s).

Figure 62
(Sheet 2 of 4)
General Flood Events Reported in Macoupin County
1982 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
4/27/1983 thru 5/3/1983	n/a	entire county	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #684)*** Several rounds of heavy rains in April and early May caused rivers statewide to rise above flood stage. May low-lying areas flooded causing damage to buildings and crop land and closed roads. COOP observers measured the following rain totals between the 27th and 3rd: - 5.89 inches 1 mile north of Virden (5.55 inches on the 2nd/3rd) - 7.08 inches at Medora (5.53 inches on the 1st/2nd) - 5.62 inches at Carlinville (4.06 inches on the 1st/2nd) - 5.42 inches 1 mile north of Virden (3.77 on the 1st/2nd) - 4.73 inches 1 mile east of Mt. Olive (3.45 inches on the 1st/2nd)
Subtotal:			**0**	**0**	**$0**	**0**	

^ Flood event verified in the vicinity of this location(s).

Figure 62
(Sheet 3 of 4)
General Flood Events Reported in Macoupin County
1982 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/13/1993 thru 10/22/1993	n/a	entire county	n/a	n/a	n/a	n/a	Following a wet winter, continuous and persistent heavy rain fell across most of the Upper Midwest throughout the spring and into the summer causing major flooding. - according to the Illinois State Water Survey, Royal Lakes had to issue a boil order for its public water supply due to the flooding - the Royal Lakes Village Clerk indicated that roads within the Village were flooded
4/29/1998	6:30 p.m.	Brighton	n/a	n/a	n/a	n/a	2 to 4 inches of rain fell between 6 p.m. and 8 p.m. across parts of Macoupin County causing localized flooding - US Rte. 67 in Brighton was under water for a time
11/17/2003 thru 11/18/2003	7:00 a.m.	countywide	n/a	n/a	n/a	n/a	2 to 5 inches of heavy rain fell over a 12 to 24 hour period causing widespread flash flooding *Benld area* - IL Rte. 4 flooded near the City *Bunker Hill* - street flood was reported in the City COOP observers measured the following rain totals from the 17th through the 18th: - 3.94 inches 1 mile east of Mt. Olive - 2.92 inches at Virden - 2.65 inches at Medora
Subtotal:			**0**	**0**	**$0**	**0**	

^ Flood event verified in the vicinity of this location(s).

Figure 62
(Sheet 4 of 4)
General Flood Events Reported in Macoupin County
1982 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
1/5/2005	10:00 a.m.	countywide	n/a	n/a	n/a	n/a	3 to 6 inches of rain over 4 to 5 days caused flooding across the area - many small streams and creeks flooded throughout the region - numerous roads were flooded and closed due to flooded streams or excessive ponding of water from the rain COOP observers measured the following rain totals from the 1st through the 5th: - 5.06 inches 1 mile east of Mt. Olive - 5.05 inches at Carlinville - 4.88 inches at Medora - 2.77 inches at Virden
Subtotal:			**0**	**0**	**$0**	**0**	
GRAND TOTAL			**0**	**0**	**$0**	**$0**	

^ Flood event verified in the vicinity of this location(s).

Sources: Illinois State Water Survey. The 1993 Flood on the Mississippi River in Illinois.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Cooperative Observation Forms.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Data.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.
United States Geological Survey. Floods of December 1982 to May 1983 in the Central and Southern Mississippi river and the Gulf of Mexico Basins.

Figure 63
(Sheet 1 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
6/13/1999	2:00 a.m.	southern portion of the county	n/a	n/a	n/a	n/a	Heavy early morning rain caused localized flash flooding - several county roads had to be closed because of high water COOP observers measured the following rain totals from the 11th through the 13th: - 2.67 inches at Carlinville - 2.42 inches 1 mile east of Mt. Olive - 2.26 inches at Medora
7/28/2000	4:30 a.m.	southern portion of the county	n/a	n/a	n/a	n/a	An average of 4 to 5 inches of rain fell across the southern half of the County during the early morning hours *Staunton* - reports indicated that up to 9 inches of rain may have fallen - residents said it was the worst flooding they could remember - at one point there was no way to get in or out of town, all roads were flooded - numerous basements were flooded with up to 4 feet of water - a street collapsed leaving a hole 6' long, 5' wide and 4' deep *Carlinville area* - Old Rte. 66 and IL Rte. 4 were closed *Mt. Olive area* - a combine fell into a 40' wide and 20' deep sink hole which formed in a field the next day - COOP observer measured 3.66 inches of rain from the 27th through the 28th
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 2 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
6/6/2001	3:00 a.m.	northern portion of the county	n/a	n/a	n/a	n/a	4 to 6 inches of rain fell causing flash flooding - streets, basements, state roads, and even a golf course were inundated - IL Rte. 4 between Virden and Girard was flooded *Virden* - 3 to 4 feet of water was reported in the Whispering Pines Mobile Home Park - police reported that about 60 percent of the homes in the City had flooding problems - many basements had at least 3 feet of water inside - COOP observer measured 5.85 inches of rain from the 4^{th} through the 6^{th}, with 4.30 inches falling during the early morning of the 6^{th} and noted flash flooding on the 6^{th}
5/7/2002	3:30 a.m.	countywide	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #1416)*** The first heavy rain event of the month brought 2 to 4 inches of rain and flash flooding. - numerous creeks and small streams flooded, closing area roads COOP observers measured the following rain totals from the 6^{th} through the 7^{th}: - 5.13 inches at Medora - 3.54 inches 1 mile east of Mt. Olive - 2.11 inches at Virden
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 3 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
5/12/2002	5:00 a.m.	countywide	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #1416)*** Up to 4 inches of rain brought creeks and streams out of their banks flooding area roads COOP observers measured the following rain totals from the 11th through the 13th: - 4.74 inches at Virden - 3.65 inches 1 mile east of Mt. Olive - 3.24 inches at Medora
5/12/2002 thru 5/13/2002	8:00 p.m.	countywide	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #1416)*** Water levels had dropped some after the early morning rain, however additional rain during the afternoon produced flooding again - some roads in rural area were washed away - IL Rte. 4 north of Carlinville was closed due to high water
5/9/2003	7:30 p.m.	northern portion of the county	n/a	n/a	n/a	n/a	Heavy rain caused localized flash flooding across the northern portion of the County - IL Rte. 11 & 4 had to be closed due to high water - several county roads became impassable as some small creeks rose out of their banks - COOP observer at Virden measured 2.40 inches of rain
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 4 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
5/27/2004	4:30 p.m.	countywide	n/a	n/a	n/a	n/a	The 2nd Consecutive day of 2 to 3 inches of rain caused flash flooding across much of the area *Gillespie area* - flooding was reported on roads in the area COOP observers measured the following rain totals from the 25th through the 27th: - 4.28 inches 1 mile east of Mt. Olive - 3.24 inches at Medora
8/27/2006	7:15 p.m.	southern portion of the county	n/a	n/a	n/a	n/a	Heavy rain caused localized flash flooding across the southern portion of the County *Gillespie area* - Spanish Needle Road was covered by up to 4 feet of water *Piasa/Shipman area* - IL Rte. 16 from its intersection with IL Rte. 111 was impassable at several locations COOP observer at Medora measured 1.73 inches of rain
6/24/2007	1:05 p.m.	Staunton^	n/a	n/a	n/a	n/a	A couple of county roads became impassable due to heavy rain - COOP observer 1 mile east of Mt. Olive measured 2.49 inches of rain from the 23rd through the 24th
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 5 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
2/5/2008	4:41 p.m.	countywide	n/a	n/a	n/a	n/a	2 to 4 inches of rain over portions of the County during the evening hours of the 5th *Shipman* - viaduct on IL Rte. 16 in the Village was flooded *Carlinville* - viaducts on IL Rte. 4 on the north and south side of the City were flooded - Briar Creek on the east side of the City overflowed its banks causing minor flooding on several streets in the area *Standard City area* - water was reported over several roads including Enslow Road COOP observers measured the following rain totals from the 4th through the 6th: - 3.81 inches at Carlinville - 3.24 inches at Medora - 2.99 inches 1 mile east of Mt. Olive - 2.61 inches at Virden
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 6 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
5/25/2008	8:30 p.m.	southern portion of the county	n/a	n/a	$5,000	$5,000	2 to 5 inches of heavy rain caused flash flooding across the southern third of the County - IL Rte. 16 & IL Rte. 159 were flooded _Brighton_ - some roads in the Village had water up to 5 feet deep _Piasa_ - some roads had water up to 5 feet deep _Shipman area_ - portions of Prairie Dell Road were temporarily barricaded _Bunker Hill area_ - portions of Moulton Road and Brighton-Bunker Hill Road were temporarily barricaded - Two vehicles were disabled by flooding on Brighton-Bunker Hill Road - a flooded culvert on another part of Brighton-Bunker Hill Road washed away a large portion of an embankment and took out about 4 feet of the road _Gillespie_ - portions of Spanish Needle Road were temporarily barricaded _Mt. Olive area_ - portions of Panther Creek Road were temporarily barricaded COOP observers measured the following rain totals from the 25th through the 26th: - 3.92 inches 1 mile east of Mt. Olive - 3.31 inches at Medora
Subtotal:			**0**	**0**	**$5,000**	**$5,000**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 7 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
8/5/2008 thru 8/6/2008	8:30 p.m.	Brighton[^]	n/a	n/a	n/a	n/a	Very heavy rain fell in a short amount of time on already saturated soils causing flash flooding - IL Rte. 111 was closed north of Brighton due to flooding
9/14/2008	6:00 a.m.	countywide	n/a	n/a	n/a	n/a	***This event was part of a federally-declared disaster (Declaration #1800)*** Up to 5 inches of rain from the remnants of Hurricane Ike fell on already saturated soils causing flash flooding - numerous roads were flooded in Carlinville, Gillespie, Virden and Mt. Olive areas - Three water rescues had to be performed in just an hour as 3 people drove into flooded roadways and became stranded. One driver got out of his car and was swept downstream about ¼ mile before grabbing onto a tree until he was rescued. - numerous culverts were washed out countywide *Carlinville* - IL Rte. 4 was closed in the City due to flooding *Gillespie* - rain soaked soil collapsed the basement wall and foundation of a home on South Macoupin Street COOP observers measured the following rain totals from the 11th through the 14th: - 8.37inches at Carlinville (4.88 inches on the 13th/14th) - 7.61 inches at Medora (4.91 inches on the 13th/14th) - 6.27 inches at Virden (3.55 inches on the 13th/14th) - 4.33 mile east of Mt. Olive (3.86 inches on the 13th/14th)
Subtotal:			**0**	**0**	**$0**	**$0**	

[^] Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 8 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
12/27/2008	3:07 p.m.	Shipman^	n/a	n/a	n/a	n/a	Several inches of rain fell in a short amount of time on frozen ground causing flash flooding - 2 to 3 feet of water over IL Rte. 16 near the Village forced its closure - COOP observer at Medora measured 1.67 inches of rain
5/25/2009	3:00 p.m.	Woodburn^ Bunker Hill^ Staunton^	n/a	n/a	n/a	n/a	Up to 5 inches of rain fell in a short amount of time causing flash flooding - several roads were closed due to the flooding
7/15/2009	8:30 a.m.	southern portion of the county	n/a	n/a	n/a	n/a	Up to 4 inches of rain fell in a short amount of time causing flash flooding *Medora area* - water was flowing over IL Rte. 111 south the Village *Staunton* - several roads in the City were flooded COOP observers measured the following rain totals: - 2.21 inches within 6 hours 1 mile east of Mt. Olive - 1.78 inches at Medora
9/2/2010	10:30 p.m.	northern portion of the county	n/a	n/a	n/a	n/a	Up to 3 inches of rain fell in a short amount of time causing flash flooding *Virden area* - several roads were flooded including Nine Mile Road and Lead Line Road COOP observer at Virden measured 1.70 inches of rain on the 1st and 3.10 inches of rain on the 2nd
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 9 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
6/10/2011 thru 6/11/2011	10:00 p.m.	southeastern portion of the county	n/a	n/a	n/a	n/a	Up to 3 inches of rain fell in a short amount of time causing flash flooding - several roads were flooded *Mt. Olive* - Old Rte. 66 flooded at the train track viaduct COOP observer 1 mile east of Mt. Olive measured 1.68 inches of rain in 11 hours
6/18/2011	5:00 a.m.	northern portion of the county	n/a	n/a	n/a	n/a	Up to 3 inches of rain fell in a short amount of time causing flash flooding *Virden area* - numerous roads were flooded
5/20/2013 thru 5/21/2013	9:25 p.m.	countywide	n/a	n/a	n/a	n/a	Up to 4 inches of rain fell in a short amount of time causing flash flooding *Girard* - several road were flooded in the City *Carlinville* - several road were flooded in the City COOP observers measured the following rain totals from the 20th into the 21st: - 3.72 inches at Carlinville - 2.92 inches at Medora and the observer noted wide-spread flash flooding overnight, especially in the flat, upland areas and all area creeks were out of their banks by morning
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 10 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
6/11/2014	12:29 a.m.	northern portion of the county	n/a	n/a	n/a	n/a	Up to 5 inches of rain fell in a short amount of time causing flash flooding - numerous roads were flooded *Scottville area* - a vehicle was submerged on West County Line Rd. near Quail Lane *Carlinville area* - IL Rte. 4 just south of the City was flooded
10/2/2014	10:20 a.m.	central portion of the county	n/a	n/a	n/a	n/a	Up to 7 inches of rain fell in a short amount of time causing flash flooding - several roads were flooded in the area - numerous ditches were overflowing and several creeks were out of their banks COOP observer at Medora measured 7.02 inches of rain from the 1st through the 2nd
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 11 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
12/26/2015 thru 12/27/2015	8:00 p.m.	countywide	n/a	n/a	n/a	n/a	3 to 4 inches of rain fell causing flash flooding - numerous roads were flooded especially across the southern half of the County *Gillespie area* - Bayless Road, Three Mile Road and Spanish Need Road were flooded *Mt. Olive* - Sunset Street on the west side of the City was flooded *Carlinville area* - Lake Brushy Mound Road was flooded - Moore Cemetery Road east of the bridge that goes over Richardson Branch Creek was flooded COOP observers measured the following rain totals from the 26th into the 28th: - 8.54 inches 1 mile east of Mt. Olive (5.51 inches between 6 a.m. on the 26th and 6 a.m. on the 27th) - 7.14 inches at Medora (4.33 inches between 7 a.m. on the 26th and 7 a.m. on the 27th)
Subtotal:			**0**	**0**	**$0**	**$0**	

^ Flash flood event verified in the vicinity of this location(s).

Figure 63
(Sheet 12 of 12)
Flash Flood Events Reported in Macoupin County
1998 – 2017

Date(s)	Start Time	Location(s)	Injuries	Fatalities	Property Damages	Crop Damages	Magnitude/Description
7/20/2016	9:00 a.m.	southwestern portion of the county	n/a	n/a	n/a	n/a	Up to 4 inches of rain fell in a short amount of time causing flash flooding *Brighton area* - Piasa Road just northeast of the Village flooded COOP observer at Medora measured 3.03 inches of rain from the 19th through the 20th
Subtotal:			**0**	**0**	**$0**	**$0**	
GRAND TOTAL			**0**	**0**	**$5,000**	**$5,000**	

^ Flash flood event verified in the vicinity of this location(s).

Sources: NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Cooperative Observation Forms.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Data.
NOAA, National Environmental Satellite, Data & Information Service, National Centers for Environmental Information, Storm Events Database.

3.6 DROUGHTS

IDENTIFYING THE HAZARD

What is the definition of a drought?

While difficult to define, the National Drought Mitigation Center (NDMC) considers "drought" in its most general sense to be a deficiency of precipitation over an extended period of time, usually a season or more, resulting in a water shortage for some activity, group or environmental sector.

Drought is a normal and recurrent feature of climate and can occur in all climate zones, though its characteristics and impacts vary significantly from one region to another. Unlike other natural hazards, drought does not have a clearly defined beginning or end. Droughts can be short, lasting just a few months, or they can persist for several years. There have been 25 drought events with losses exceeding $1 billion each (CPI-Adjusted) across the United States between 1980 and 2017. This is due in part to the sheer size of the areas affected.

What types of drought occur?

There are four main types of drought that occur: meteorological, agricultural, hydrological and socioeconomic. They are differentiated based on the use and need for water. The following provides a brief description of each type.

- **Meteorological Drought.** Meteorological drought is defined by the degree of dryness or rainfall deficit and the duration of the dry period. Due to climate differences, what might be considered a drought in one location of the country may not be in another location.
- **Agricultural Drought.** An agricultural drought refers to a period when rainfall deficits, soil moisture deficits, reduced ground water or reservoir levels needed for irrigation impact crop development and yields.
- **Hydrological Drought.** Hydrological drought refers to a period when precipitation deficits (including snowfall) impact surface (stream flow, reservoir and lake levels) and subsurface (aquifers) water supply levels.
- **Socioeconomic Drought.** Socioeconomic drought refers to a period when the demand for an economic good (fruit, vegetables, grains, etc.) exceeds the supply as a result of weather-related shortfall in the water supply.

How are droughts measured?

There are numerous quantitative measures (indicators and indices) that have been developed to measure drought. How these indicators and indices measure drought depends on the discipline affected (i.e., agriculture, hydrology, meteorology, etc.) and the region being considered. There is no single index or indicator that can account for and be applied to all types of drought.

Although none of the major indices are inherently superior to the rest, some are better suited than others for certain uses. The first comprehensive drought index developed in the United States was the Palmer Drought Severity Index (PDSI). The PDSI is calculated based on precipitation and temperature data, as well as the local Available Water Content of the soil. It is most effective measuring drought impacts on agriculture. For many years it was the only operational drought index and it is still very popular around the world.

The Standardized Precipitation Index (SPI), developed in 1993, uses precipitation records for any location to develop a probability of precipitation for any time scale in order to reflect the impact of drought on the availability of different water resources (groundwater, reservoir storage, streamflow, snowpack, etc.) In 2009 the World Meteorological Organization recommended SPI as the main meteorological drought index that countries should use to monitor and follow drought conditions.

The first operational 'composite' approach applied in the United States was the U.S. Drought Monitor (USDM). The USDM utilizes five key indicators, numerous supplementary indicators and local reports from expert observers around the country to produce a drought intensity rating that is ideal for monitoring droughts that have many impacts, especially on agriculture and water resources during all seasons over all climate types. NOAA's Storm Events Database records include USDM ratings and utilized them along with additional weather information to describe the severity of the drought conditions impacting affected counties. Therefore, this Plan will utilize USDM ratings to identify and describe previous drought events recorded within the County. The following provides a more detailed discussion of the USDM to aid the Plan's developers and the general public in understanding how droughts are identified and categorized.

U.S. Drought Monitor (USDM)

Established in 1999, the USDM is a relatively new index that combines quantitative measures with input from experts in the field. It is designed to provide the general public, media, government officials and others with an easily understandable "big picture" overview of drought conditions across the United States. It is unique in that it combines a variety of data-based drought indices and indicators with local expert input to create a single composite drought indicator, the results of which are illustrated via a weekly map that depicts drought conditions across the United States. The USDM is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the U.S. Department of Agriculture, and the National Oceanic and Atmospheric Administration.

Five drought intensity categories, D0 through D4, are utilized to identify areas of drought. **Figure 75** provides a brief description of each category. As mentioned previously, the drought intensity categories are based on five key indicators, numerous supplementary indicators and local observers. The five key indicators include: the Palmer Drought Severity Index, the Climate Prediction Center's Soil Moisture Model (percentiles), the United States Geological Survey Weekly Streamflow (percentiles), the Standardized Precipitation Index and the Objective Drought Indicator Blends (percentiles).

Because the ranges of the various indicators often don't coincide, the final drought category tends to be based on what a majority of the indictors show and on local observations. The authors also weight the indices according to how well they perform in various parts of the country and at different times of the year. It is the combination of the best available data, location observations and experts' best judgment that make the U.S. Drought Monitor more versatile than other drought indices.

Figure 75
U.S. Drought Monitor – Drought Severity Classifications

Category	Possible Impacts
D0 (Abnormally Dry)	• Going into drought: - short-term dryness slowing planting, growth of crops or pastures. • Coming out of drought: - some lingering water deficits - pastures or crops not fully recovered
D1 (Moderate Drought)	• Some damage to crops, pastures • Streams, reservoirs, or wells low; some water shortages developing or imminent • Voluntary water-use restrictions requested
D2 (Severe Drought)	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed
D3 (Extreme Drought)	• Major crop/pasture losses • Widespread water shortages or restrictions
D4 (Exceptional Drought)	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies

Source: U.S. Drought Monitor.

In addition to identifying and categorizing general areas of drought, the USDM also identifies whether a drought's impacts are short-term (typically less than 6 months – agriculture, grasslands) or long-term (typically more than 6 months – hydrology, ecology). **Figure 76** shows an example of the USDM weekly map. The USDM is designed to provide a consistent big-picture look at drought conditions in the United States. It is not designed to infer specifics about local conditions.

PROFILING THE HAZARD

When have droughts occurred previously? What is the extent of these previous droughts?

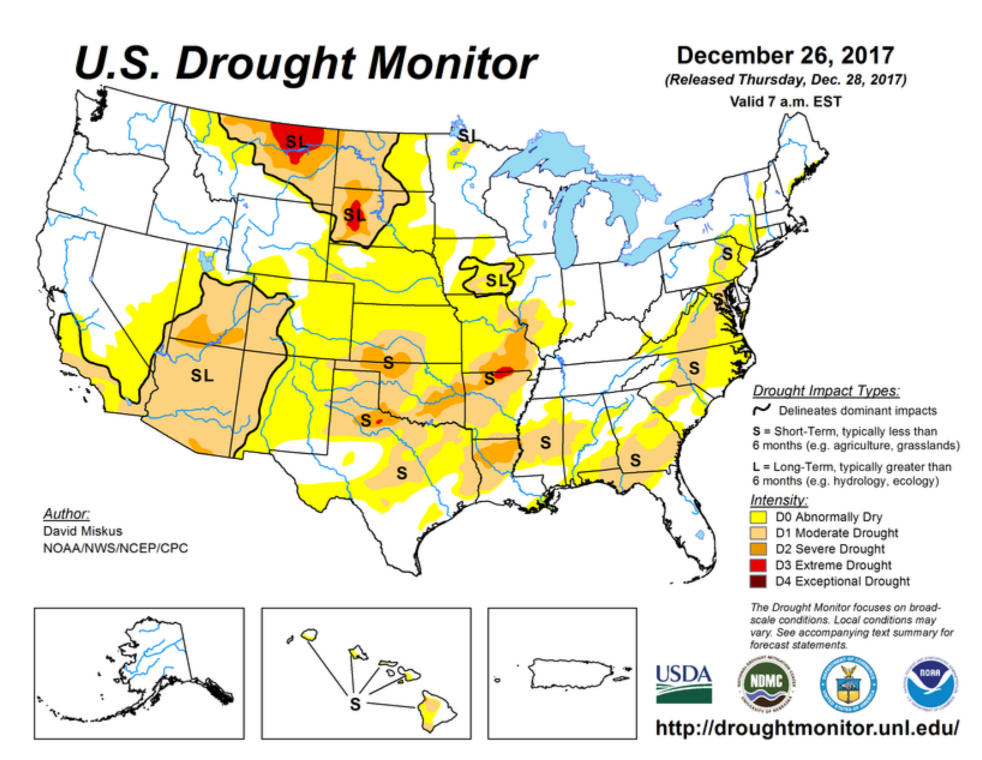
Drought Fast Facts – Occurrences

Number of Drought Events Reported (1983 – 2017): ***4***

According to NOAA's Storm Events Database, the Illinois State Water Survey, the Illinois Emergency Management Agency (IEMA) and the USDA there have been four official drought events reported for Macoupin County between 1983 and 2017. The following provides a summary of these previous occurrences as well as the extent or severity of each event.

- In 1983, all 102 Illinois counties were proclaimed state disaster areas because of high temperatures and insufficient precipitation beginning in mid-June. USDA crop yield statistics indicates that soybean and corn yields were 43.4 to 56.9 percent lower than the previous year.

Figure 76
U. S. Drought Monitor



Map Courtesy of NDMC-UNL. The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration.

- In 1988, approximately half of all Illinois counties (including Macoupin County) were impacted by drought conditions, although none of the counties were proclaimed state disaster areas. Lower than normal precipitation levels were recorded between April and June and unusually dry weather conditions persisted throughout the summer months. Soybean and corn yields were 16.2 and 31.3 percent lower than the previous year, according to USDA crop yield statistics.

- In 2005, drought conditions impacted much of the state, including Macoupin County. A dry winter and spring developed into full-blown drought conditions by the end of May. On June 7, 2005 Macoupin County was designated as D1 – moderate drought. The northwestern portion of the County was upgraded to D2 – severe drought on July 5, 2005 and again to D3 – extreme drought on July 26, 2005. Drought conditions for the entire County were downgraded to D1 – severe drought on September 20, 2005. Abnormally dry to moderate drought conditions continued for another year before all designations were removed on December 5, 2006.

  On July 27, 2005 the USDA designated 93 counties in Illinois, including Macoupin County, as primary natural disaster areas due to the damage and losses caused by drought. According to USDA crop yield statistics, soybean and corn yields were 14.0 to 19.0 percent lower than the previous year.

- In 2011, drought conditions impacted portions of the state. On November 2, 2011 the USDA designated 44 counties in Illinois as primary natural disaster areas due to losses caused by drought and excessive heat. While Macoupin County was not one of the designated counties, it did qualify for natural disaster assistance because it was contiguous to the disaster area. USDA Crop yield statistics show that corn and soybean yields were 10.8% to 27.3% lower than the previous year.
- In 2012, drought conditions impacted all of Illinois and most of the Midwest. On June 19, 2012 Macoupin County was designated as D1 – moderate drought and upgraded to D2 – severe drought on July 10, 2012 due to an abnormally warm and dry spring. Two weeks later, on July 24, 2012 the County was classified as D3 – extreme drought due to the continued hot and dry conditions.

  Extreme drought conditions continued through August before being downgraded to D2 – severe drought on September 4, 2012. On October 2, 2012 the County was downgraded to D1 – moderate drought. Abnormally dry to moderate drought conditions continued throughout the winter before all designations were removed on March 5, 2013.

  Crop stress was extreme for corn and soybeans during this event. On August 1, 2012 the USDA designated 66 counties in Illinois, including Macoupin County, as primary natural disaster areas due to damage and losses caused by drought and excessive heat. Corn yields were 34.6 percent lower than 2011 yield which were already down 10.8 percent from 2010 yields according to the USDA.

The State of Illinois Drought Preparedness and Response Plan identified seven outstanding statewide droughts since 1900 based on statewide summer values of the PDSI provided by NOAA's National Center for Environmental Information,. Those seven droughts occurred in 1902, 1915, 1931, 1934, 1936, 1954 and 1964; however, the extent to which Macoupin County was impacted was unavailable.

What locations are affected by drought?

Drought events affect the entire County. Droughts, like excessive heat and severe winter storms, tend to impact large areas, extending across an entire region and affecting multiple counties. The *2013 Illinois Natural Hazard Mitigation Plan* classifies Macoupin County's hazard rating for drought as "guarded."

What is the probability of future drought events occurring?

Macoupin County has experienced four droughts between 1983 and 2017. With four occurrences over 35 years, the probability or likelihood that the County may experience a drought in any given year is 11.4%. However, if earlier recorded droughts are factored in, then the probability that Macoupin County may experience a drought in any given year decreases to 9.3%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to drought?

Yes. All of Macoupin County is vulnerable to drought. Neither the amount nor the distribution of precipitation; soil types; topography; or water table conditions provides protection for any area within the County. Since 2008, Macoupin County has experienced one drought.

What impacts resulted from the recorded drought events?

Damage information was either unavailable or none was recorded for any of the four drought events experienced between 1983 and 2017. Of the four drought events, disaster relief payment information was only available for one of the events. In 1988, landowners and farmers in Illinois were paid in excess of $382 million in relief payments; however a breakdown by county was unavailable.

Drought Fast Facts – Impacts/Risk

Drought Impacts
- Total Property Damage: ***n/a***
- Infrastructure/Critical Facilities Damage*: ***n/a***
- Total Crop Damage: ***n/a***

Drought Risk/Vulnerability to:
- Public Health & Safety: ***Low***
- Buildings/Infrastructure/Critical Facilities: ***Low / Medium***

* Infrastructure/Critical Facilities Damage totals are included in the Total Property Damage amounts.

No injuries or fatalities were reported as a result of any of the recorded drought events in Macoupin County. Unlike other natural hazards that affect the County, drought events do not typically cause injuries or fatalities. The primary concern centers on the financial impacts that result from loss of crop yields and livestock and potential drinking water shortages. Even taking into consideration the potential impacts that a water shortage may have on the general public, the risk or vulnerability to public health and safety from drought is low.

What other impacts can result from drought events?

Based on statewide drought records available from the Illinois State Water Survey, the most common impacts that result from drought events in Illinois include reductions in crop yields and drinking water shortages.

Crop Yield Reductions

Agriculture is the major enterprise in Macoupin County. Farmland accounts for approximately 79% of all the land in the County. According to the 2012 Census of Agriculture, there were 1,190 farms in Macoupin County occupying 438,592 acres. Of the land in farms, approximately 85% or 371,038 acres is in crop production. Less than 1% of the land in crop production is irrigated.

According to the 2012 Census of Agriculture, crop sales accounted for $180.4 million in revenue while livestock sales accounted for $41.4 million. Macoupin County ranks 27th in Illinois for crop cash receipts and 26th for livestock cash receipts. A severe drought would have a great financial impact on the large agricultural community, particularly if it occurred during the growing season. Dry weather conditions, particularly when accompanied by excessive heat, can result in diminished crop yields and place stress on livestock.

A reduction in crop yields was seen as a result of the 1983, 1988, 2005, and 2012 droughts. **Figure 77** illustrates the reduction yields seen for corn and soybeans during the four recorded drought events.

Figure 77
Crop Yield Reductions Due to Drought in Macoupin County

Year	Corn		Soybeans	
	Yield (bushel)	% Reduction Previous Year	Yield (bushel)	% Reduction Previous Year
1982	130.0	--	38.0	--
1983	**56.0**	**56.9%**	**21.5**	**43.4%**
1984	111.0	--	32.0	--
1987	131.0	--	34.0	--
1988	**90.0**	**31.3%**	**28.5**	**16.2%**
1989	134.0	--	41.0	--
2004	189.0	--	50.0	--
2005	**153.0**	**19.0%**	**43.0**	**14.0%**
2006	**144.0**	**5.9%**	47.0	--
2007	157.0	--	**37.0**	**21.3%**
2010	146.9	--	55.3	--
2011	**131.1**	**10.8%**	**40.2**	**27.3%**
2012	**85.7**	**34.6%**	46.0	--
2013	170.5	--	49.1	--

Source: USDA, National Agricultural Statistics Service.

Records obtained from the USDA's National Agricultural Statistics Service show that the 1983 drought resulted in corn yield reductions of 56.9% and soybean yield reductions of 43.4% while the 1988 drought resulted in corn yield reductions of 31.3% and soybean yield reductions of 16.2%. In 2005, the drought caused a 19.0% reduction in corn yields and a 14.0% reduction in soybean yields while the 2012 drought caused corn yield reductions of 34.6% on top of a 10.8% reduction experienced in 2011 due to abnormally dry to moderate drought conditions experienced from August to November.

Drinking Water Shortages

Municipalities that rely on surface water sources for their drinking water supplies are more vulnerable to shortages as a result of drought. Currently ***all of the participating municipalities in Macoupin County rely on surface water sources*** for their drinking water supplies. Carlinville, Gillespie, Mt. Olive and Staunton rely solely on surface water to obtain their drinking water. Benld and the Ka-Ho Public Water District purchase water from Gillespie. Wilsonville indirectly purchases water from Gillespie through the Benld Community Water Supply. Girard and Virden purchase water from the Otter Lake Water Commission which obtains its water from Otter Lake. Brighton and Royal Lakes purchase water from Illinois American Water while Bunker Hill purchases its water from the Fosterburg Public Water District.

Because all of the participants receive their drinking water from surface water sources, they are more vulnerable to shortages as a result of a prolonged drought or a series of droughts in close succession. Those participants in unincorporated Macoupin County that obtain water from wells are less vulnerable to drinking water shortages, although a prolonged drought or a series of droughts in close succession do have the potential to impact water levels in aquifers used for individual drinking water wells in rural areas.

In October 2018 the not-for-profit Illinois Alluvial Regional Water Company was awarded a $66 million federal funding package to construct a new aquifer-fed drinking water system that will supply areas in Macoupin and Jersey counties with a cleaner, more reliable water supply. The system will feature a new water treatment plant and 47 miles of pipe to supply water to the communities of Carlinville and Bunker Hill as well as the Jersey County Rural Water Company and the Central Macoupin County Rural Water District. Construction is projected to start in 2021 and the system should be operational by 2023.

Are existing buildings, infrastructure and critical facilities vulnerable to drought?

No. In general, existing buildings, infrastructure and critical facilities located in Macoupin County and the participating municipalities are not vulnerable to drought. The primary concern centers on the financial impacts that result from loss of crop yields and livestock.

While buildings do not typically sustain damage from drought events, in rare cases infrastructure and critical facilities may be directly or indirectly impacted. While uncommon, droughts can contribute to roadway damage. Severe soil shrinkage can compromise the foundation of a roadway and lead to cracking and buckling.

Prolonged heat associated with drought can also increase the demand for energy to operate air conditioners, fans and other devices. This increase in demand places stress on the electrical grid, which increases the likelihood of power outages.

Additionally, droughts have impacted drinking water supplies. Reductions in the water levels of wells and surface water supplies can cause water shortages that jeopardize the supply of water needed to provide drinking water and fight fires. While water use restrictions can be enacted in an effort to maintain a sufficient supply of water, they are only temporary and do not address long-term viability issues. All of the participating municipalities should consider mitigation measures that will provide long-term stability before a severe drought or a series of droughts occur. Effective mitigation measures include drilling additional wells, securing agreements with alternative water sources and constructing water lines to provide a backup water supply, and constructing silt basins to capture sediment runoff to preserve the storage capacity of surface water sources.

In general, the risk or vulnerability to buildings, infrastructure and critical facilities from drought is low to medium, even taking into consideration the potential impact a drought may have on drinking water supplies and the stress that prolonged heat may place on the electrical grid.

Are future buildings, infrastructure and critical facilities vulnerable to drought?

No. Future buildings, infrastructure and critical facilities within the County are no more vulnerable to drought than the existing building, infrastructure and critical facilities. As discussed above, buildings do not typically sustain damage from drought. Infrastructure and critical facilities may, in rare cases, be damaged by drought, but very little can be done to prevent this damage.

What are the potential dollar losses to vulnerable structures from drought?

Unlike other natural hazards there are no standard loss estimation models or methodologies for drought. Since drought typically does not cause structure damage, it is unlikely that future dollar losses will be excessive. The primary concern associated with drought is the financial impacts that result from loss of crop yields and the potential impacts to drinking water supplies. Since a majority of the County is involved in farming activities, it is likely that there will be future dollar losses to drought. In addition, reduced water levels and the water conservation measures that typically accompany a drought will most likely impact consumers as well as businesses and industries that are water-dependent (i.e., car washes, landscapers etc.).

3.7 MINE SUBSIDENCE

IDENTIFYING THE HAZARD

What is a mine?

A mine is a pit or excavation made in the earth for the purpose of extracting minerals or ore. Mines were developed in Illinois to extract coal, clay, shale, limestone, dolomite, silica sand, tripoli, peat, ganister, lead, zinc and fluorite.

What is mining?

Mining is the process of extracting minerals or ore from a mine. There are two common mining methods: surface mining and sub-surface (underground) mining. This section focuses on underground mining practices since surface mining was not conducted within or near the County.

Mining has long figured prominently into Illinois' history. According to the Illinois State Geological Survey (ISGS), Illinois has the third largest recoverable reserves of coal in the country, behind only Montana and Wyoming. Coal deposits can be found under 86 of the 102 counties in Illinois and underground mining operations have been conducted in at least 72 counties. **Figure 78** shows the extent of coal deposits (Pennsylvanian rocks) present in Illinois and the mined-out areas from surface and underground coal mining. In 2015, Illinois ranked fourth in the United States in coal production according to the National Mining Association.

The first commercial coal mine in Illinois is thought have started in Jackson County about 1810. Since that time, there have been more than 3,800 underground coal mines and 363 underground metal and industrial mineral mines operated in Illinois. Almost all of these mines have been abandoned over the years. According to ISGS, there were 12 active underground coal mines in Illinois in 2015. The United States Geological Survey identified 10 active metal and industrial mineral underground mines in Illinois.

What methods are used in underground mining?

Much of Illinois coal lies too deep for surface mining and requires extraction using underground mining methods. There are three main methods of underground mining that have been used in Illinois over the years: room-and-pillar, high-extraction retreat and longwall. The following provides a brief description of each.

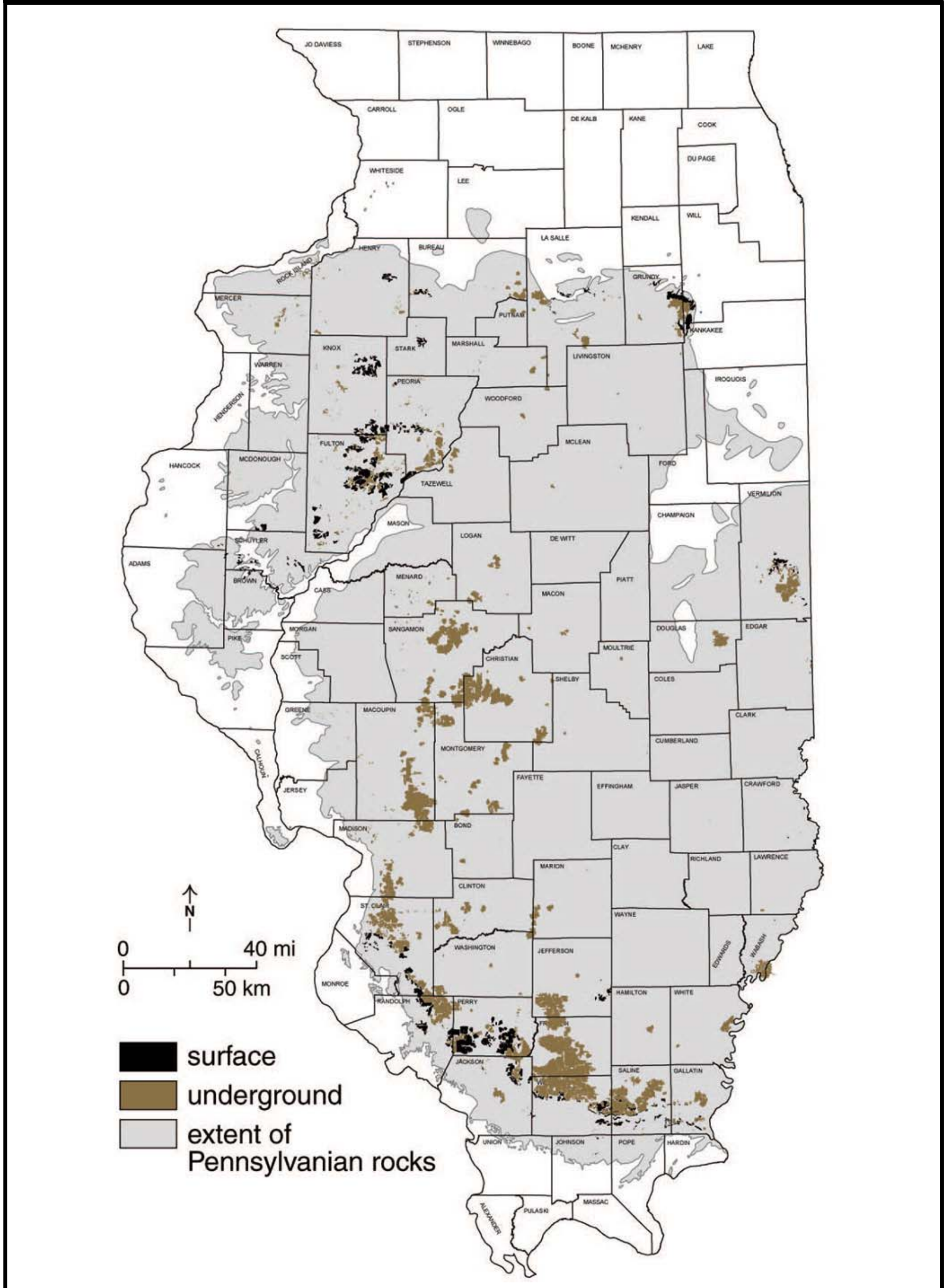
Room-and-Pillar

In the room-and-pillar system, the areas where coal is removed are referred to as "rooms" and the blocks of coal left in place to support the mine's roof and surface are referred to as "pillars". A "panel" refers to a group of rooms isolated from other room groups by surrounding pillars and generally accessed from only one entryway. The room-and-pillar method that was generally used before the early 1900s was characterized by rooms that varied considerably in length, width and sometimes direction, forming irregular mining patterns.

Modern room-and-pillar mines have a regular configuration of production areas (panels) and entryways, and the rooms and entries range from 18 to 24 feet, which is considerably narrower than in older mines. Generally modern room-and-pillar mining methods recover less than 50%

to 60% of the coal in a panel. Most underground mines in Illinois have used a type of room-and-pillar pattern.

Figure 78
Coal Mine Deposits & Mined Areas in Illinois



Source: Illinois Department of Natural Resources & Illinois State Geological Survey.

High-Extraction Retreat

High-extraction retreat mining operations first develop a room-and-pillar production area (panel). The miners then systematically begin taking additional coal from the pillars that are left behind. The secondary extraction occurs in a retreating fashion, working from the outer edges of the panel to the main entries. Most of the coal pillars which support the roof are removed shortly after a few rows of rooms and pillars have been formed, leaving only small pillars.

The size and number of pillars left to maintain worker safety varies depending on underground geologic conditions. Roof collapses are controlled by the use of temporary roof supports and planned subsidence of the surface is initiated immediately. Since planned subsidence is part of this operation, this method requires the legal rights to the ground surface. High-extraction retreat methods recover up to 80% to 90% of the coal in a panel. No Illinois mines currently use high-extraction retreat mining, but from the 1940s to 2002, this method was used in the State.

Longwall

Modern longwall mining methods remove coal along a straight working face within defined panels (in this case a solid block of coal), up to 1 to 2 miles long and about 1,000 feet wide. Room-and-pillar methods must be used in conjunction with longwall mining. Like high-extraction retreat, longwall mining begins at the outer edges and works toward the main entries. This fully-mechanized method uses a rotating cutting drum or shearer that works back and forth across the coal face. The coal falls onto a conveyer below the cutting machine and is transported out of the mine.

All of this is performed under a canopy of steel supports that sustains the weight of the roof along the mining surface. As the coal is mined the steel supports advance. The mine roof immediately collapses behind the moving supports, causing 4 to 6 feet of maximum settling of the ground surface over the panel. Since planned subsidence is part of this operation, this method requires the legal rights to the ground surface. Longwall mining methods recover 100% of the coal in a panel.

What is mine subsidence?

Mine subsidence is the sinking or shifting of the ground surface resulting from the collapse of an underground mine. Subsidence is possible in any area where minerals or ore have been undermined. Most of the mine subsidence in Illinois is related to coal mining, which represents the largest volume extracted and area undermined of any solid commodity in the State.

Mine subsidence can be planned, as with modern high-extraction retreat and longwall mining techniques, or it can occur as the result of age and instability. For many years, underground mining was not tightly regulated and not much thought was given to the long-term stability of the mines since most of the land over the mine was sparsely populated. Once mining operations were complete, the mine was abandoned. As cities and towns grew up around the mines, many urban and residential areas were built over or near undermined areas.

ISGS estimates that approximately 333,000 housing units are located in close proximity to underground mines and may potentially be exposed to mine subsidence while approximately 201,000 acres of urban and developed land overlie or are immediately adjacent to underground mines. Most experts agree that room-and-pillar mines will eventually experience some degree of subsidence, but currently there is no way to know when or exactly where it will occur.

What types of mine subsidence can occur in Illinois?

In Illinois mine subsidence typically takes one of two forms: pit subsidence or sag (trough) subsidence. The following provides a brief description of each.

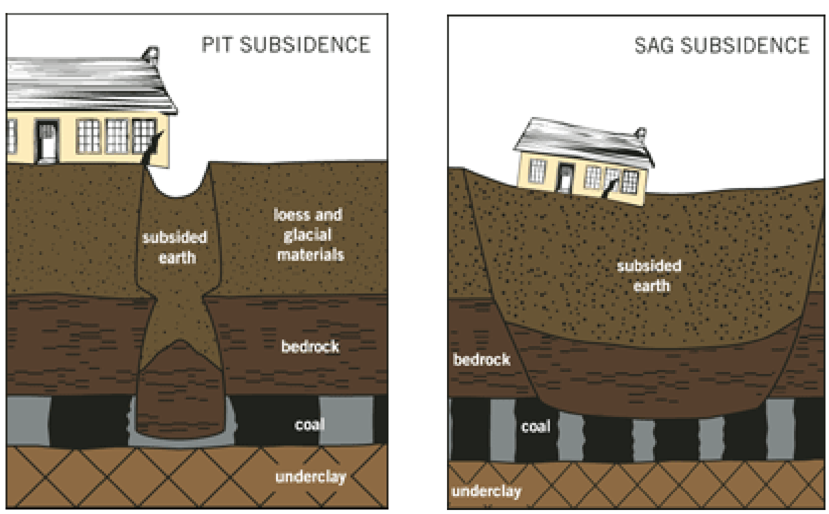
Pit Subsidence

Pit subsidence generally occurs when the roof of a shallow mine (less than 100 feet deep) collapses and forms a bell-shaped hole at the ground's surface, 6 to 8 feet deep and 2 to 40 feet across. **Figure 79** provides an illustration of pit subsidence. This type of subsidence forms very quickly causing sudden and swift ground movement. While the probability of a structure being damaged by pit subsidence is generally low since most pits are relatively small, structural damage can occur if pit subsidence develops under the corner of a building, the support posts of a foundation or another critical spot.

Sag (Trough) Subsidence

Sag or trough subsidence generally forms a gentle depression in the ground's surface that can spread over an entire mine panel and affect several acres of land. A major sag can develop suddenly within a few hours or days, or gradually over years. This type of subsidence may originate over places in the mine where pillars have disintegrated and collapsed or where pillars are being pushed into the relatively soft underclay that forms the floor of most mines. **Figure 79** illustrates sag subsidence. This is the most common type of mine subsidence and can develop over mines of any depth. Given the relatively large area covered by sag subsidence, buildings, roads, driveways, sidewalks, sewer and water pipes and other utilities may experience damage.

Figure 79
Types of Mine Subsidence



Source: Illinois Mine Subsidence Insurance Fund.

What is the Illinois Mine Subsidence Insurance Fund?

Prior to 1979, traditional property owners insurance did not cover mine subsidence nor was mine subsidence coverage available for purchase in Illinois. Since many mining companies in Illinois ceased operations long before mine subsidence occurred and insurance did not cover such damage, property owner who experienced subsidence damage had no recourse. Several high profile incidents in the Metro East St. Louis area ultimately led to the passage of the Mine Subsidence Insurance Act in 1979. The Statute required insurers to make mine subsidence insurance available to Illinois homeowners and established the Illinois Mine Subsidence Insurance Fund (IMSIF). Later amendments to the Act gave the Fund the authority, with approval from the Director of Insurance, to set the maximum limits for mine subsidence coverage.

The IMSIF is a taxable enterprise created by Statute to operate as a private solution to a public problem. The purpose of the Fund is to assure financial resources are available to owners of property damaged by mine subsidence. The Fund fills a gap in the insurance market for the benefit of Illinois property owners at risk of experiencing mine subsidence damage.

All insurance companies authorized to write basic property insurance in Illinois are required to enter into a Reinsurance Agreement with the Fund and offer mine subsidence insurance coverage. Mine subsidence insurance covers damage caused by underground mining of any solid mineral resource. In the 34 counties where underground mining has been most prevalent, the Statute requires mine subsidence coverage be automatically included in both residential and commercial property policies. Coverage may be rejected in writing by the insured. **Figure 80** identifies the 34 counties where mine subsidence insurance is automatically included in property insurance policies.

In addition to providing reinsurance to insurers, the Fund also is responsible for conducting geotechnical investigations to determine if mine subsidence caused the damage, establishing rates and rating schedules, providing underwriting guidance to insurers, supporting and sponsoring mine subsidence related research and initiatives consistent with the public interest and educating the public about mine subsidence issues.

PROFILING THE HAZARD

Are there any underground mines located in the County?

Yes. According to the Illinois State Geological Survey's Directory of Coal Mines, there are 88 documented underground mines located in Macoupin County. A copy of the Directory of Coal Mines in Macoupin County is included in **Appendix M**. **Figure 81** illustrates the locations of these mines. To view detailed quadrangle maps and mine directories for the studied quadrangles see **Appendix N**.

Mine Subsidence Fast Facts – Occurrences

Number of Underground Mines Located within the County: ***88***

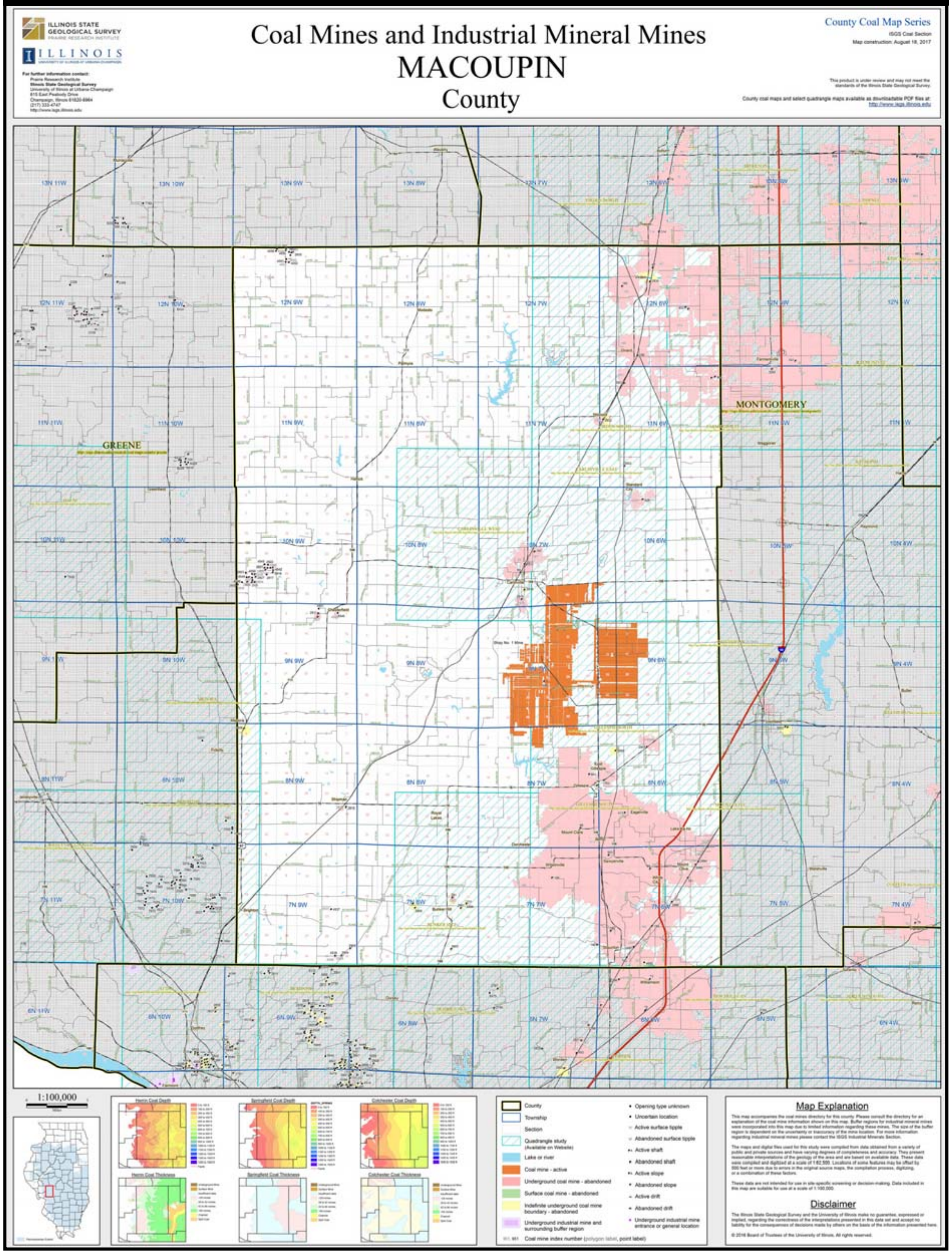
Number of Mine Subsidence Events Reported (2009-2017): ***4***

Probability of Future Mine Subsidence Events: ***High***

Figure 80
Counties Required to include Mine Subsidence Coverage in Property Insurance

Source: Illinois Mine Subsidence Insurance Fund.

Figure 81
Underground Mines Located in Macoupin County



Source: Illinois State Geological Survey

When has mine subsidence occurred previously? What is the extent of these previous occurrences?

No comprehensive, publicly-accessible database detailing mine subsidence occurrences currently exists in Illinois. However, according to news articles and committee member records, there have been at least four mine subsidence events reported in Macoupin County between 2009 and 2017. The following provides a brief summary of these previous occurrences as well as the extent or severity of each event.

- On March 27, 2009 hairline cracks appeared in the cinderblock walls of the new Benld Elementary School. The school, like most of the City, was built over an underground coal mine. Pillars under the school started to collapse and within 24 hours the effects of the mine subsidence were dramatically visible. Cracks wide enough to fit a hand in split the hallways, walls and gym floor. Pipes burst, the metal roof twisted and floors bowed and buckled. In some classrooms the floors dropped as far as two feet.

  This 7-year-old, $7.5 million state-of-the-art facility was declared too dangerous to use and ultimately condemned. Nearly 700 students had to be moved out of the building and temporarily housed at the Gillespie Middle School and High School for the remainder of the school year. The elementary school students were moved into a modular building in November 2009. A new elementary school was opened in the fall of 2013 just west of the Middle School/High School campus in Gillespie after experts advised against rebuilding at the Benld site.

The Benld Elementary School sustained irreparable damage as a result of mine subsidence on March 27, 2009.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

- In November, 2014 mine subsidence occurred along Schmidt Street in Wilsonville. According to former Village President, Annetta Veres, four homes suffered damage. The extent and amount of damage sustained was not available.

- During the early morning hours of April 8, 2015 residents on the southwest side of Benld awoke to loud noises and a local police officer noticed a bump in the pavement on West Dorsey Street at South Illinois Street indicating mine subsidence was occurring. A six-square block area was impacted with approximately 15 homes sustaining foundation damage, including large cracks in basement walls, garage floors and patio areas. Some doors wouldn't open. The roads in the area cracked and buckled. A large buckle in West Dorsey Street stood nearly one foot high and stretched the width of the road while small cracks spread throughout West Dorsey Street and South Illinois Street.

  Methane gas leaks from the coal mine bubbled up into the basements of at least three homes and infiltrated the City's sewer lines. Ameren shut off gas and electric to about 70 customers in the areas to prevent a methane explosion. Temporary evacuations were required and an emergency shelter was opened. Subsidence was clearly visible in a large open lot in the area. During the first two days the ground subsided approximately 19 inches in some areas according to state officials. Within a year, the ground had subsided an additional 21 inches, for a total of 40 inches.

- In January, 2016 another mine subsidence incident impacted Benld in an area just west of the subsidence experience in 2015. An additional five homes were damaged and many of the homes impacted in 2015 suffered additional damages.

On April 8, 2015 approximately 15 homes in Benld sustained foundation damage as the result of mine subsidence.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

According to the *2013 Illinois Natural Hazard Mitigation Plan* prepared by the Illinois Emergency Management Agency, there were 17 confirmed mine subsidence claims submitted to the Illinois Mine Subsidence Insurance Fund for Macoupin County between 1999 and 2012. Anecdotal information shared by Committee Members suggests that additional mine subsidence events have occurred within the County over the years.

What locations are affected by mine subsidence?

According to the Illinois State Geological Survey's (ISGS) *Proximity of Underground Mines to Urban and Developed Lands in Illinois* study published in 2009, there are:

- Approximately 73,792 acres (13.5% of the land area) and 9,973 housing units (47.6% of the total housing units) in Macoupin County are located in Zone 1, land over or adjacent to mapped mines.
- An additional 26,606 acres (4.9% of the land area) and 2,607 housing units (12.5% of the total housing units) in the County are located in Zone 2, land surrounding Zone 1 that could be affected if the mine boundaries are inaccurate or uncertain.

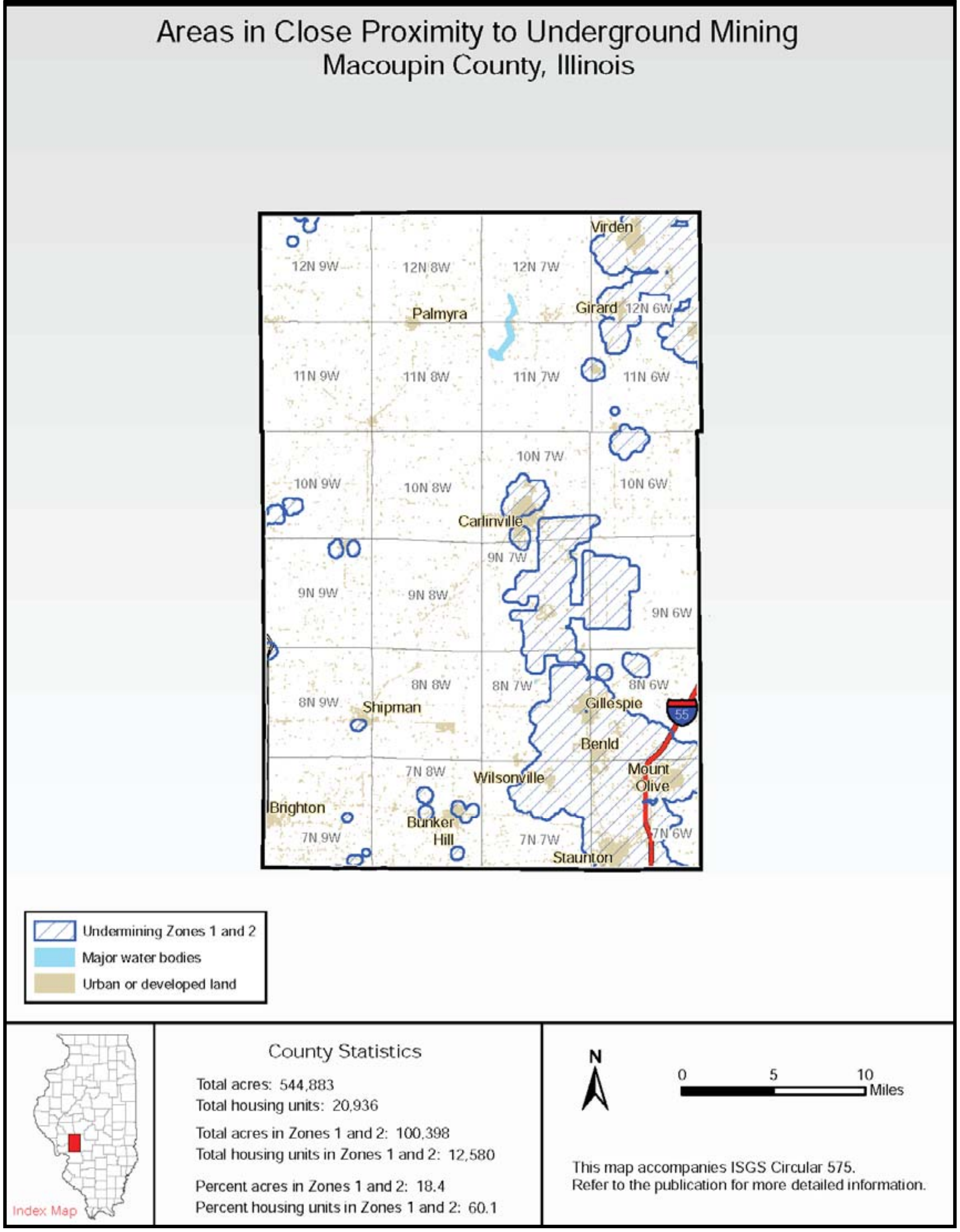
Figure 82 identifies the location of the Zone 1 and 2 areas in Macoupin County. Based on this mapping, mine subsidence has the potential to impact parts of unincorporated Macoupin County as well as the participating municipalities of Benld, Bunker Hill, Carlinville, Gillespie, Girard, Mount Olive, Staunton, Virden and Wilsonville.

What is the probability of future mine subsidence events occurring?

There are many variables that must be considered when calculating the probability of future mine subsidence events including whether subsidence has occurred previously in an area, the size, depth and age of the mine, the magnitude or extent of the failure as well as soil and weather conditions. Given the unpredictability of mine subsidence events, the variables involved and the limited data available for Macoupin County, it is difficult to specifically establish the probability of future mine subsidence events without extensive research.

However, given the past occurrences and the amount of area undermined in the County the probability or likelihood that Macoupin County will experience future mine subsidence events is estimated to be ***high***.

Figure 82
Areas Potentially Impacted by Mine Subsidence in Macoupin County



Source: Illinois State Geological Survey

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to mine subsidence?

Yes. Benld, Bunker Hill, Carlinville, Gillespie, Girard, Mount Olive, Staunton, Virden, Wilsonville and parts of unincorporated Macoupin County are vulnerable to mine subsidence. According to ISGS, approximately 73,792 acres (13.5% of the land area) of Macoupin County are over or adjacent to mapped mines and vulnerable to mine subsidence while an additional 26,606 acres (4.9% of the land area) could be affected by mine subsidence if the mine boundaries are inaccurate or uncertain. None of the other participating municipalities or the remainder of the County are considered vulnerable. Since 2008, Macoupin County has experienced four recorded mine subsidence events.

What impacts resulted from the recorded mine subsidence events?

Property damage information was only available for one of the four mine subsidence events experienced between 2009 and 2017. According to news articles, the 2009 mine subsidence event at the Benld Elementary School resulted in the demolition of the 7-year-old, $7.5 million state-of-the-art facility. The new Ben-Gil Elementary School built to replace the Benld Elementary School opened in the fall of 2013 in Gillespie and cost $26 million to construct. Property damage information was unavailable for the remaining three reported occurrences.

Appendix K contains select photographs provided by Macoupin County EMA Coordinator James Pitchford that illustrate the extent of the property damage sustained at the Benld Elementary School in March, 2009.

Mine Subsidence Fast Facts – Impacts/Risk

Mine Subsidence Impacts
- Total Property Damage: ***$7,500,000***
- Infrastructure/Critical Facilities Damage*: ***$7,500,000***
- Total Crop Damage: ***n/a***
- Injuries: ***n/a***
- Fatalities: ***n/a***

Mine Subsidence Risk/Vulnerability to:
- Public Health & Safety – Zones 1 & 2: ***Low***
- Public Health & Safety – Areas Outside Zones 1 & 2: ***Low***
- Buildings/Infrastructure/Critical Facilities – Zones 1 & 2: ***Medium***
- Buildings/Infrastructure/Critical Facilities – Areas Outside Zones 1 & 2: ***Low***

* Infrastructure/Critical Facilities Damage totals are included in the Total Property Damage amounts.

No injuries or fatalities were reported as a result of any of the recorded mine subsidence events.

In terms of the risk or vulnerability to public health and safety from a mine subsidence event, there are several factors that must be taken into consideration including the age, size and depth of the mine; the mining method employed; the extent of the development and infrastructure in the vicinity of the mine; and soil and weather conditions. When all of the factors are taken into consideration, the overall risk to public health and safety posed by a mine subsidence event in Macoupin County is considered to be low for both Zones 1 and 2 and all other portions of the County.

What other impacts can result from mine subsidence events?

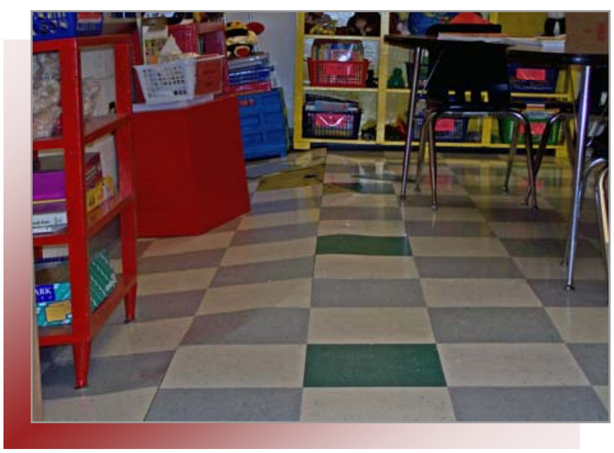
The initial damage to a property from mine subsidence may appear suddenly, or occur gradually over many years. Damage to structures can include:

- cracked, broken or damaged foundations
- cracks in the basement walls, ceilings, garage floors, driveways, sidewalks or roadways
- doors and windows stick, jam or break
- unlevel or tilted walls or floors
- doors swing open or closed
- chimney, porch or steps separate from the rest of the structure
- water, sewer or gas lines may rupture in extreme cases

A structure need not lie directly over a mine to be affected by mine subsidence. It is extremely difficult to accurately gauge how far a property must be from a mine to ensure that it will be unaffected by mine subsidence. Each subsidence is unique and influenced by multiple factors.

Are existing buildings, infrastructure and critical facilities vulnerable to mine subsidence?

Yes. Buildings, infrastructure and critical facilities located within Zones 1 and 2 are vulnerable to mine subsidence. According to ISGS, approximately 9,973 housing units (47.6% of the total housing units in the County) are located over or adjacent to mapped mines and vulnerable to mine subsidence while an additional 2,607 housing units (12.5% of the total housing units) could be affected by mine subsidence if the mine boundaries are inaccurate or uncertain.



Floors bowed, buckled and dropped in the Benld Elementary School, with some classrooms experiencing drops of as much as 2 feet, following the March 27, 2009 mine subsidence event.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

In addition to impacting structures, mine subsidence can damage roads, bridges and utilities. Roadways, culverts and bridges can be weakened by mine subsidence and even destroyed if the subsidence occurs directly underneath of them. Water, sewer, power and communication lines, both above and below ground, are also vulnerable to mine subsidence. Depending on the location of the subsidence, water, sewer and power lines can experience ruptures causing major disruptions to vital services.

As with public health and safety, the risk or vulnerability to buildings, infrastructure and critical facilities is dependent on several factors including the age, size and depth of the mine; the mining method employed; the extent of the development and infrastructure in the vicinity of the mine; and soil and weather conditions. When these factors are taken into consideration, the overall risk posed by mine subsidence to vulnerability to buildings, infrastructure and critical facilities in Macoupin County is considered to be medium for Zone 1 and low for Zone 2 and all other portions of the County.

Are future buildings, infrastructure and critical facilities vulnerable to mine subsidence?

Yes. Any future buildings, infrastructure and critical facilities located within Zones 1 and 2 are vulnerable to mine subsidence. As a result, future buildings, infrastructure and critical facilities face the same vulnerabilities as those of existing buildings, infrastructure and critical facilities described previously.

What are the potential dollar losses to vulnerable structures from mine subsidence?

Unlike other hazards, there are no standard loss estimation models or methodologies for mine subsidence. With only one of the four recorded events listing property damage figures and the unpredictability of mine subsidence, there is no way to accurately estimate future potential dollar losses. Since over half of the total housing units in Macoupin County reside in Zones 1 and 2, it is likely that there will be future dollar losses from mine subsidence.

3.8 EARTHQUAKES

IDENTIFYING THE HAZARD

What is the definition of an earthquake?

An earthquake is a sudden shaking of the ground caused when rocks forming the earth's crust slip or move past each other along a fault (a fracture in the rocks). Most earthquakes occur along the boundaries of the earth's tectonic plates. These slow-moving plates are being pulled and dragged in different directions, sliding over, under and past each other. Occasionally, as the plates move past each other, their jagged edges will catch or stick causing a gradual buildup of pressure (energy).

Eventually, the force exerted by the moving plates overcomes the resistance at the edges and the plates snap into a new position. This abrupt shift releases the pent-up energy, producing vibrations or seismic waves that travel outward from the earthquake's point of origin. The location below the earth's surface where the earthquake starts is known as the hypocenter or focus. The point on the earth's surface directly above the focus is the epicenter.

The destruction caused by an earthquake may range from light to catastrophic depending on a number of factors including the magnitude of the earthquake, the distance from the epicenter, the local geologic conditions as well as construction standards and time of day (i.e., rush hour). Earthquake damage may include power outages, general property damage, road and bridge failure, collapsed buildings and utility damage (ruptured gas lines, broken water mains, etc.).

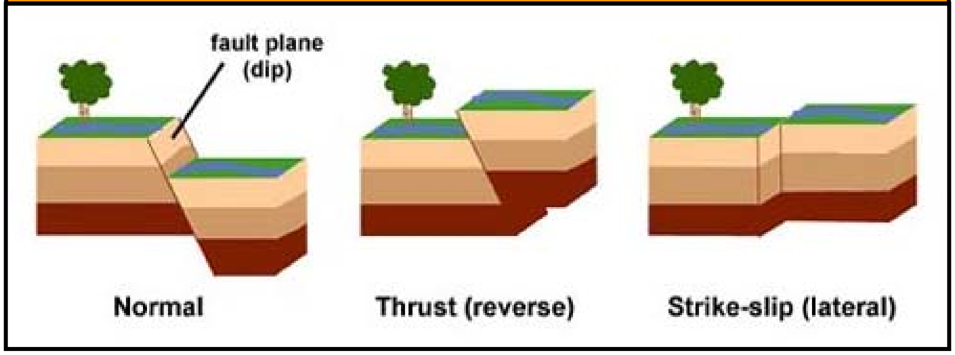
Most of the damage done by an earthquake is caused by its secondary or indirect effects. These secondary effects result from the seismic waves released by the earthquake and include ground shaking, surface faulting, liquefaction, landslides and, in rare cases, tsunamis.

According to the U.S. Geological Survey, more than 143 million Americans in the contiguous United States are exposed to potentially damaging ground shaking from earthquakes. Over 44 million of those Americans, located in 18 states, are exposed to very strong ground shaking from earthquakes. Illinois ranks 10th in terms of the number of individuals exposed to very strong ground shaking. The Federal Emergency Management Agency's HAZUS analysis indicates that the annualized earthquake losses to the national building stock is $6.1 billion per year. A majority of the average annual loss is concentrated in California ($3.7 million). The central United States (including Illinois) ranks third in annualized earthquake losses at $480 billion, behind the Pacific Northwest (Washington and Oregon) with annualized earthquake losses at $710 billion.

What is a fault?

A fault is a fracture or zone of fractures in the earth's crust between two blocks of rock. They may range in length from a few millimeters to thousands of kilometers. Many faults form along tectonic plate boundaries. Faults are classified based on the angle of the fault with respect to the surface (known as the dip) and the direction of slip or movement along the fault. There are three main groups of faults: normal, thrust (reverse) and strike-slip (lateral). **Figure 83** provides an illustration of each type of fault.

Figure 83
Fault Illustration



Source: U. S. Geological Survey.

Normal faults occur in response to pulling or tension along the two blocks of rock causing the overlying block to move down the dip of the fault plane. Most of the faults in Illinois are normal faults. Thrust or reverse faults occur in response to squeezing or compression of the two blocks of rock causing the overlying block to move up the dip of the fault plane. Strike-slip or lateral faults can occur in response to either pulling/tension or squeezing/compression causing the blocks to move horizontally past each other.

Geologists have found that earthquakes tend to recur along faults, which reflect zones of weakness in the earth's crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

What are tectonic plates?

Tectonic plates are large, irregularly-shaped, relatively rigid sections of the earth's crust that float on the top, fluid layer of the earth's mantle. There are about a dozen tectonic plates that make up the surface of the planet. These plates are approximately 50 to 60 miles thick and the largest are millions of square miles in size.

How are earthquakes measured?

The severity of an earthquake is measured in terms of its magnitude and intensity. A brief description of both terms and the scales used to measure each are provided below.

Magnitude

Magnitude refers to the amount of seismic energy released at the hypocenter of an earthquake. The magnitude of an earthquake is determined from measurements of ground vibrations recorded by seismographs. As a result, magnitude is represented as a single, instrumentally determined value. A loose network of seismographs has been installed all over the world to help record and verify earthquake events.

There are several scales that measure the magnitude of an earthquake. The most well-known is the Richter Scale. This logarithmic scale provides a numeric representation of the magnitude of an earthquake through the use of whole numbers and decimal fractions. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in ground vibrations measured. In addition, each whole number increase corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number. It is important to note that the Richter Scale is used only to determine the magnitude of an earthquake, it does not assess the damage that results.

Once an earthquake's magnitude has been confirmed, it can be classified. **Figure 84** categorizes earthquakes by class based on their magnitude (i.e., Richter Scale value). Any earthquake with a magnitude less than 3.0 on the Richter Scale is classified as a micro earthquake while any earthquake with a magnitude of 8.0 or greater on the Richter Scale is considered a "great" earthquake. Earthquakes with a magnitude of 2.0 or less are not commonly felt by individuals. The largest earthquake to occur in the United States since 1900 took place off the coast of Alaska in Prince William Sound on March 28, 1964 and registered a 9.2 on the Richter Scale.

Figure 84
Earthquake Magnitude Classes

Class	Magnitude (Richter Scale)
micro	smaller than 3.0
minor	3.0 – 3.9
light	4.0 – 4.9
moderate	5.0 – 5.9
strong	6.0 – 6.9
major	7.0 – 7.9
great	8.0 or larger

Source: Michigan Technological University, Department of Geological and Mining Engineering and Sciences, UPSeis

Intensity

Intensity refers to the effect an earthquake has on a particular location. The intensity of an earthquake is determined from observations made of the damage inflicted on individuals, structures and the environment. As a result, intensity does not have a mathematical basis; instead it is an arbitrary ranking of observed effects. In addition, intensity generally diminishes with distance. There may be multiple intensity recordings for a region depending on a location's distance from the epicenter.

Although numerous intensity scales have been developed over the years, the one currently used in the United States is the Modified Mercalli Intensity Scale. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. The lower numbers of the intensity scale are based on human observations (i.e., felt only by a few people at rest, felt quite noticeably by persons indoors, etc.)

The higher numbers of the scale are based on observed structural damage (i.e., broken windows, general damage to foundations etc.). Structural engineers usually contribute information when assigning intensity values of VIII or greater. **Figure 85** provides a description of the damages associated with each level of intensity as well as comparing Richter Scales values to Modified Mercalli Intensity Scale values.

Generally the Modified Mercalli Intensity value assigned to a specific site after an earthquake is a more meaningful measure of severity to the general public than magnitude because intensity refers to the effects actually experienced at that location.

Figure 85
Comparison of Richter Scale and Modified Mercalli Intensity Scale

Richter Scale	Modified Mercalli Scale	Observations
1.0 – 1.9	I	Felt by very few people; barely noticeable. No damage.
2.0 – 2.9	II	Felt by a few people, especially on the upper floors of buildings. No damage.
3.0 – 3.9	III	Noticeable indoors, especially on the upper floors of buildings, but may not be recognized as an earthquake. Standing cars may rock slightly; vibrations similar to the passing of a truck. No damage.
4.0	IV	Felt by many indoors and a few outdoors. Dishes, windows, and doors disturbed. Standing cars rocked noticeably. No damage.
4.1 – 4.9	V	Felt by nearly everyone. Small, unstable objects displaced or upset; some dishes and glassware broken. Negligible damage.
5.0 – 5.9	VI	Felt by everyone. Difficult to stand. Some heavy furniture moved. Weak plaster may fall and some masonry, such as chimneys, may be slightly damaged. Slight damage.
6.0	VII	Slight to moderate damage to well-built ordinary structures. Considerable damage to poorly-built structures. Some chimneys may break. Some walls may fall.
6.1 – 6.9	VIII	Considerable damage to ordinary buildings. Severe damage to poorly built buildings. Some walls collapse. Chimneys, monuments, factory stacks, columns fall.
7.0	IX	Severe structural damage in substantial buildings, with partial collapses. Buildings shifted off foundations. Ground cracks noticeable.
7.1 – 7.9	X	Most masonry and frame structures and their foundations destroyed. Some well-built wooden structures destroyed. Train tracks bent. Ground badly cracked. Landslides.
8.0	XI	Few, if any structures remain standing. Bridges destroyed. Wide cracks in ground. Train tracks bent greatly. Wholesale destruction.
> 8.0	XII	Total damage. Lines of sight and level are distorted. Waves seen on the ground. Objects thrown up into the air.

Sources: Michigan Technological University, Department of Geological and Mining Engineering and Sciences, UPSeis.
U.S. Geological Survey.

When and where do earthquakes occur?

Earthquakes can strike any location at any time. However, history has shown that most earthquakes occur in the same general areas year after year, principally in three large zones around the globe. The world's greatest earthquake belt, the circum-Pacific seismic belt (nicknamed the "Ring of Fire"), is found along the rim of the Pacific Ocean, where about 81 percent of the world's largest earthquakes occur.

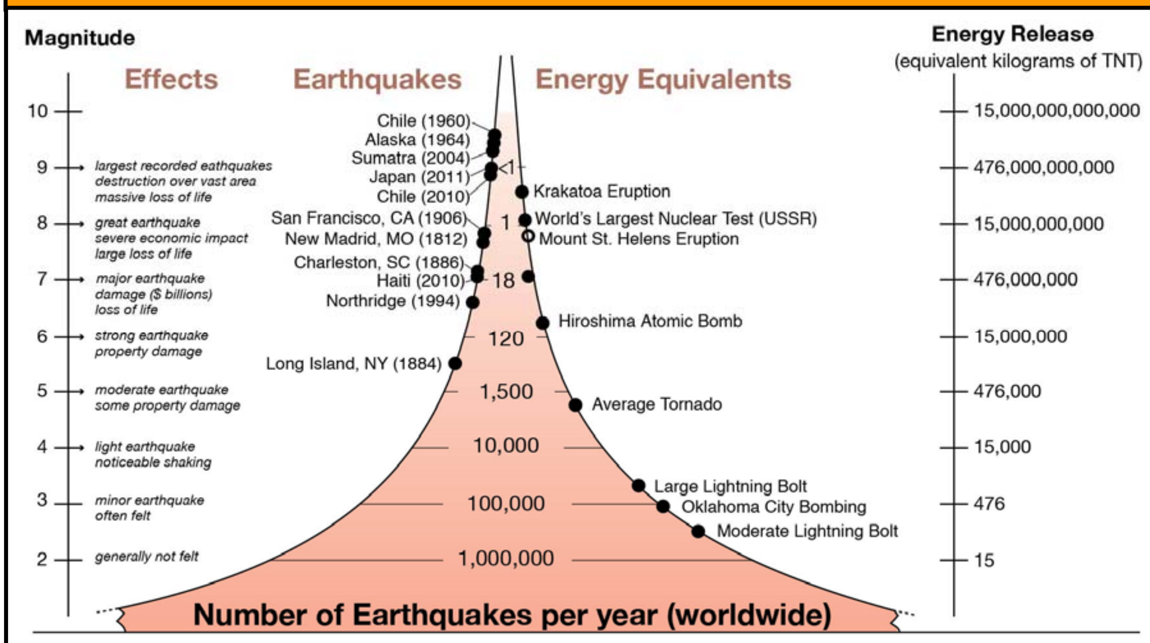
The second prominent belt is the Alpide, which extends from Java to Sumatra and through the Himalayan Mountains, the Mediterranean Sea and out into the Atlantic Ocean. It accounts for about 17 percent of the world's largest earthquakes, including those in Iran, Turkey and Pakistan. The third belt follows the submerged mid-Atlantic Ridge, the longest mountain range in the world, nearly splitting the entire Atlantic Ocean north to south.

While most earthquakes occur along plate boundaries some are known to occur within the interior of a plate. (As the plates continue to move and plate boundaries change over time, weakened boundary regions become part of the interiors of the plates.) Earthquakes can occur along zones of weakness within a plate in response to stresses that originate at the edges of the plate or from deep within the earth's crust. The New Madrid earthquakes of 1811 and 1812 occurred within the North American plate.

How often do earthquakes occur?

Earthquakes occur every day. Magnitude 2 and smaller earthquakes occur several hundred times a day worldwide. These earthquakes are known as micro earthquakes and are generally not felt by humans. Major earthquakes, greater than magnitude 7, generally occur at least once a month. **Figure 86** illustrates the approximate number of earthquakes that occur worldwide per year based on magnitude. This figure also identifies manmade and natural events that release approximately the same amount of energy for comparison.

Figure 86
Approximate Number of Earthquakes Recorded Annually



Source: Incorporated Research Institutions for Seismology, Education and Outreach Series, "How Often Do Earthquakes Occur?"

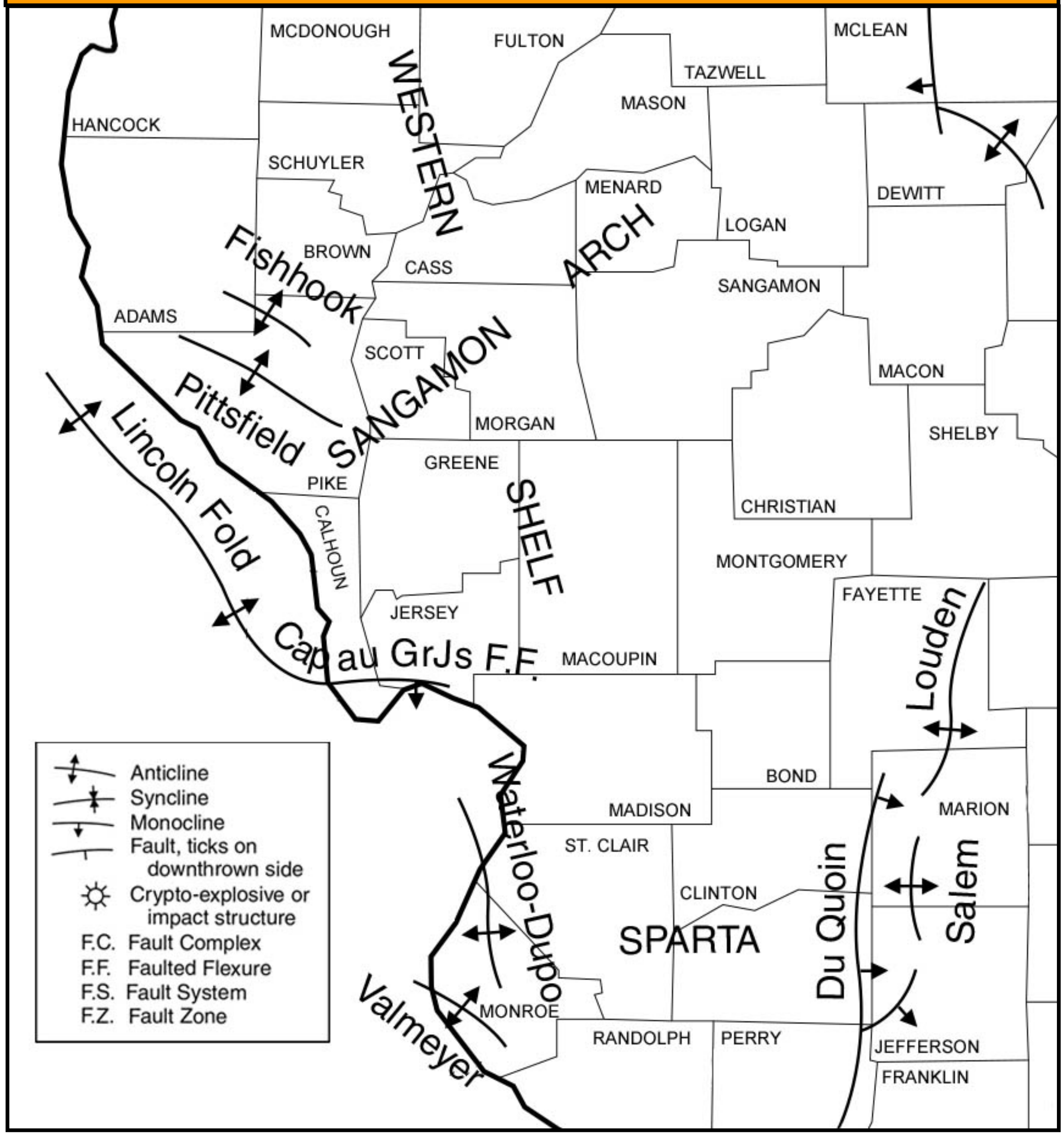
PROFILING THE HAZARD

Are there any faults located within the County?

No. There are no faults or geological structures located in Macoupin County. However, there are several known geological structures in the immediate region: the Lincoln Anticline, the Cap au Gres

Faulted Flexure, the Pittsfield Anticline, the Fishhook Anticline and the Waterloo-Dupo Anticline. **Figure 87** illustrates the location of these structures.

Figure 87
Geological Structures in Southwestern Illinois



Source: Illinois State Geological Survey.

❖ *Lincoln Anticline:* The Lincoln Anticline is at least 165 miles long and as much as 15 miles wide. It is the most prominent structural feature in northeastern Missouri and trends northwest to southeast before swinging eastward into Illinois and terminating in southernmost Jersey County.

- ❖ *Cap au Gres Faulted Flexure:* The Cap au Gres Faulted Flexure is about 60 miles long and arises on the southwest flank of the Lincoln Anticline in Lincoln County, Missouri. It follows the anticline into Illinois, and also terminates in southernmost Jersey County.
- ❖ *Pittsfield Anticline:* The Pittsfield Anticline is located in central Pike County and is the largest anticline in western Illinois north of the Cap au Gres Faulted Flexure. It is a highly elongated anticline that trends northwest.
- ❖ *Fishhook Anticline:* The Fishhook Anticline is approximately 30 miles long and as much as 5 miles wide. It trends northwest, parallel with the Pittsfield Anticline, from northern Pike County into southeastern Adams County.
- ❖ *Waterloo-Dupo Anticline:* The Waterloo-Dupo Anticline is a sharply asymmetrical structure that trends south-southeast from St. Louis County, Missouri through the western tip of St. Clair County terminating in Monroe County.

When have earthquakes occurred previously? What is the extent of these previous quakes?

Earthquake Fast Facts – Occurrences

Earthquakes Originating in the County (1795 – 2015): ***1***

Fault Zones Located within the County: ***None***

Earthquakes Originating in adjacent Counties (1795-2013): ***13***

Fault Zones Located in Nearby Counties: ***None***

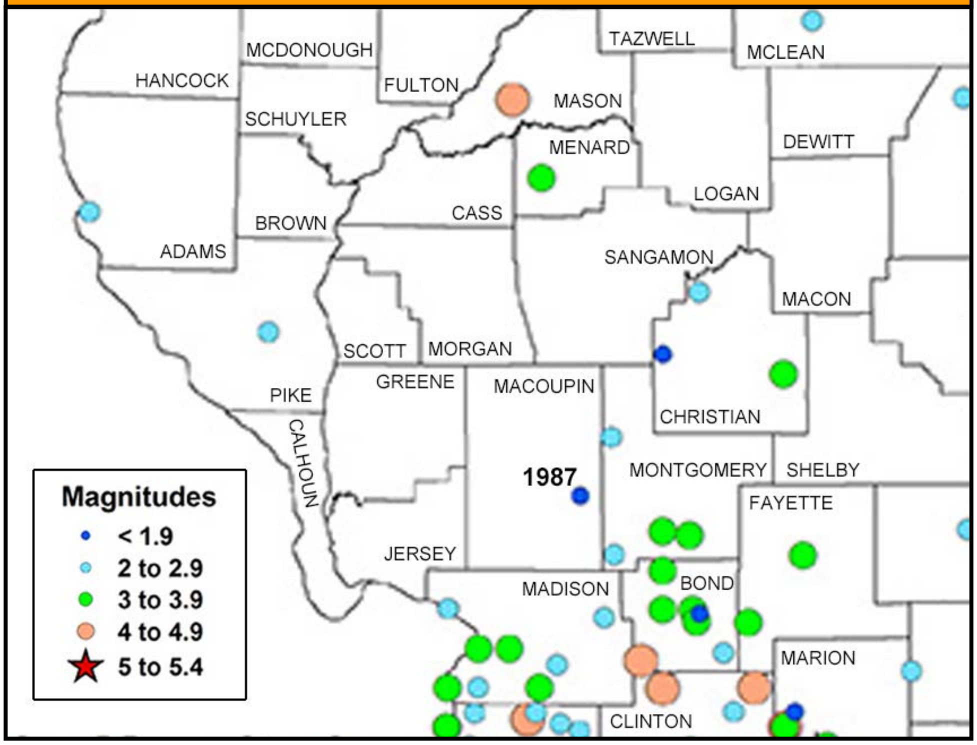
According to the Illinois State Geological Survey (ISGS) *Earthquakes of Illinois: 1795 – 2015* map, one earthquake has originated in Macoupin County during the last 200 years. **Figure 88** illustrates the epicenter of the earthquake. On June 28, 1987 an earthquake with an estimated magnitude of 1.5 originated in unincorporated Macoupin County approximately five miles northeast of Gillespie. Damage information, if any, was unavailable for this event.

Macoupin County residents also felt ground shaking caused by several earthquakes that have originated in southern Illinois. The following provides a brief description of a few of the larger events that have occurred.

- ❖ On April 18, 2008, a magnitude 5.2 earthquake was reported in southeastern Illinois near Bellmont in Wabash County. The earthquake was located along the Wabash Valley seismic zone. Minor structural damage was reported in several towns in Illinois and Kentucky. Ground shaking was felt over all or parts of 18 states in the central United States and southern Ontario, Canada.
- ❖ A magnitude 5.2 earthquake took place on June 10, 1987 in southeastern Illinois near Olney in Richland County. This earthquake was also located along the Wabash Valley seismic zone. Only minor structural damage was reported in several towns in Illinois and Indiana. Ground shaking was felt over all or parts of 17 states in the central and eastern United States and southern Ontario, Canada.
- ❖ The strongest earthquake in the central United States during the 20th century occurred along the Wabash Valley seismic zone in southeastern Illinois near Dale in Hamilton County. This magnitude 5.4 earthquake occurred on November 9, 1968 with an intensity estimated at VII for the area surrounding the epicenter. Moderate structural damage was reported in several towns in south-central Illinois, southwest Indiana and northwest

Kentucky. Ground shaking was felt over all or parts of 23 states in the central and eastern United States and southern Ontario, Canada.

Figure 88
Earthquakes Originating in Macoupin County



Source: Illinois State Geological Survey.

❖ On October 8, 1857 a magnitude 5.3 earthquake took place in northeastern Clinton County about 5 miles southeast of Keyesport, east of Lake Carlyle. At Centralia chimneys were brought down and in St. Louis furniture moved, bricks were dislocated and plaster fell. The largest buildings rocked and possessions fell from mantles. Reports indicate that the Mississippi River was in tumult. Ground shaking was felt in many Illinois towns, along the Mississippi River south of Hannibal, Missouri, and in parts of three other states.

Three of the ten largest earthquakes ever recorded within the continental United States took place in 1811 and 1812 along the New Madrid seismic zone. This zone lies within the central Mississippi Valley and extends from northeast Arkansas through southeast Missouri, western Tennessee, western Kentucky and southern Illinois. These magnitude 7.5 and 7.3 major earthquakes were centered near the town of New Madrid, Missouri and caused widespread devastation to the surrounding region and were felt by people in cities as far away as Pittsburgh, Pennsylvania and Norfolk, Virginia.

The quakes locally changed the course of the Mississippi River creating Reelfoot Lake in northwestern Tennessee. These earthquakes were not an isolated incident. The New Madrid seismic zone is one of the most seismically active areas of the United States east of the Rockies. Since 1974 more than 4,000 earthquakes have been recorded within this seismic zone, most of which were too small to be felt.

What locations are affected by earthquakes?

Earthquake events can affect the entire County. Earthquakes, like drought and excessive heat, impact large areas extending across an entire region and affecting multiple counties. Macoupin County's proximity to multiple fault zones, both large and small, makes the entire area likely to be affected by an earthquake if these faults become seismically active. The *2013 Illinois Natural Hazard Mitigation Plan* classifies Macoupin County's hazard rating for earthquakes as "elevated."

What is the probability of future earthquake events occurring?

As with flooding, calculating the probability of future earthquakes changes depending on the magnitude of the event. According to the ISGS, Illinois is expected to experience a magnitude 3.0 earthquake every year, a magnitude 4.0 earthquake every four years and a magnitude 5.0 earthquake every 20 years. The likelihood of an earthquake with a magnitude of 6.3 or greater occurring somewhere in the central United States within the next 50 years is between 86% and 97%.

While the major earthquakes of 1811 and 1812 do not occur often along the New Madrid fault, they are not isolated events. In recent decades, scientists have collected evidence that earthquakes similar in size and location to those felt in 1811 and 1812 have occurred several times before within the central Mississippi Valley around 1450 A.D., 900 A.D. and 2350 B.C.

The general consensus among scientists is that earthquakes similar to the 1811-1812 earthquakes are expected to recur on average every 500 years. The U.S. Geological Survey and the Center for Earthquake Research and Information (CERI) at the University of Memphis estimates that for a 50-year period the probability of a repeat of the 1811-1812 earthquakes is between 7% and 10% and the probability of an earthquake with a magnitude of 6.0 or larger is between 25% and 40%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to earthquakes?

Yes. All of Macoupin County is vulnerable to earthquakes. The unique geological formations topped with glacial drift soils found in the central United States conduct an earthquake's energy farther than in other parts of the Nation. Consequently, earthquakes that originate in the Midwest tend to be felt at greater distances than earthquakes with similar magnitudes that originate on the West Coast.

This vulnerability, found throughout most of Illinois and all of Macoupin County, is compounded by relatively high water tables within the region. When earthquake shaking mixes the groundwater and soil, ground support is further weakened thus adding to the potential structural damages experienced by buildings, roads, bridges, electrical lines and natural gas pipelines.

The *Projected Earthquake Intensities Map* prepared by the Missouri State Emergency Management Agency predicts that if a magnitude 6.7 earthquake were to take place anywhere along the New Madrid seismic zone, then the highest projected intensity felt in Macoupin County would be a VI on the Modified Mercalli Intensity Scale. If a magnitude 8.6 earthquake were to occur, then the highest projected intensity felt would be a VIII.

The infrequency of major earthquakes, coupled with relatively low magnitude/intensity of past events, has led the public to perceive that Macoupin County is not vulnerable to damaging earthquakes. This perception has allowed the County and participating municipalities to develop largely without regard to earthquake safety.

What impacts resulted from the recorded earthquake events?

Property damage information was either unavailable or none was recorded for the one documented earthquake that originated in Macoupin County. While Macoupin County residents felt the earthquakes that occurred in 2008, 1987 and 1968, no damages were reported as a result of these events. Given the magnitude of the great earthquakes of 1811 and 1812, it is almost certain that individuals in what is now Macoupin County felt those quakes; however historical records do not indicate the intensity or impacts that these quakes had on the County.

Earthquake Fast Facts – Risk

Earthquake Risk/Vulnerability to:

- Public Health & Safety – Light/Moderate Quake: ***Low***
- Public Health & Safety – Major/Great Quake Wabash Valley seismic zone: ***Low/ Medium***
- Public Health & Safety – Major/Great Quake New Madrid seismic zone: ***Medium/High***
- Buildings/Infrastructure/Critical Facilities – Light/ Moderate Quake: ***Low***
- Buildings/Infrastructure/Critical Facilities – Major/ Great Quake: ***Medium/High***

The risk or vulnerability to public health and safety from an earthquake is dependent on the intensity and location of the event. Since there are no known faults in Macoupin County, the likelihood that an earthquake will originate in the County is very small, decreasing the changes for catastrophic damages. However, if a light earthquake originates within the County or from the faults in the immediate region, the risk or vulnerability to public health and safety is considered low. This risk is elevated from low to low/medium for a major earthquake originating along the Wabash Valley seismic zone. Finally, if a major or great earthquake similar to those experienced in 1811 and 1812 were to occur along the New Madrid seismic zone, then the risk or vulnerability to public health and safety is elevated again to medium/high.

What other impacts can result from earthquakes?

Earthquakes can impact human life, health and public safety. **Figure 89** details the potential impacts that may be experienced by the County should a magnitude 6.0 or greater earthquake occur in the region.

Figure 89
Potential Earthquake Impacts

Direct	Indirect
Buildings • Temporary displacement of businesses, households, schools and other critical services where heat, water and power are disrupted • Long-term displacement of businesses, households, schools and other critical services due to structural damage or fires *Transportation* • Damages to bridges (i.e., cracking of abutments, subsidence of piers/supports, etc.) • Cracks in the pavement of critical roadways • Increased traffic on Interstate and State Routes (especially if the quake originates along the New Madrid fault) as residents move out of the area to seek shelter and medical care and as emergency response, support services and supplies move south to aid in recovery • Misalignment of rail lines due to landslides (most likely near stream crossings), fissures and/or heaving *Utilities* • Downed power and communication lines • Breaks in drinking water and sanitary sewer lines resulting in the temporary loss of service • Disruptions in the supply of natural gas due to cracking and breaking of pipelines *Health* • Injuries/deaths due to falling debris and fires *Other* • Cracks in the earthen dams of the lakes and reservoirs within the County which could lead to dam failures	*Health* • Use of County health facilities (especially if the quake originates along the New Madrid Fault) to treat individuals injured closer to the epicenter • Emergency services (ambulance, fire, law enforcement) may be needed to provide aid in areas where damage was greater *Other* • Disruptions in land line telephone service throughout an entire region (i.e., central and southern Illinois) • Depending on the seasonal conditions present, more displacements may be expected as those who may not have enough water and food supplies seek alternate shelter due to temperature extremes that make their current housing uninhabitable

Are existing buildings, infrastructure and critical facilities vulnerable to earthquakes?

Yes. All existing buildings, infrastructure and critical facilities located in Macoupin County and the participating municipalities are vulnerable to damage from earthquakes. While four of the participating municipalities have building codes in place, these codes do not contain seismic provisions that address structural vulnerability for earthquakes.

Unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward. Steel and wood buildings have more ability to absorb the energy from an earthquake while wood buildings with proper foundation ties have rarely collapsed in earthquakes. Depending on the intensity of the earthquake, building damage in Macoupin County could range from negligible to moderate in well-built structures and considerable in poorly-built structures.

An earthquake has the ability to damage infrastructure and critical facilities such as roads and utilities. In the event of a major earthquake, bridges are expected to experience moderate damage such as cracking in the abutments and subsidence of piers and supports. The structural integrity may be compromised to the degree where safe passage is not possible, resulting in adverse travel times as alternate routes are taken. Some rural families may become isolated where alternate paved routes do not exist. In addition, cracks may form in the pavement of key roadways.

An earthquake may also down overhead power and communication lines causing power outages and disruptions in communications. Cracks or breaks may form in natural gas pipelines and drinking water and sewage lines resulting in temporary loss of service. In addition, an earthquake could cause cracks to form in the earthen dams located within the County, increasing the likelihood of a dam failure.

As with public health and safety, the risk or vulnerability to buildings, infrastructure and critical facilities is dependent on the intensity and location of the event. The risk to buildings, infrastructure and critical facilities from a light to moderate earthquake is likely to be low, while the risk from a major or great earthquake is likely to be medium to high.

Are future buildings, infrastructure and critical facilities vulnerable to earthquakes?

Yes. All future buildings, infrastructure and critical facilities located in Macoupin County and the participating municipalities are vulnerable to damage from earthquakes. While four of the participating municipalities have building codes in place, these codes do not contain seismic provisions that address structural vulnerability for earthquakes. As a result, there is the potential for future buildings, infrastructure and critical facilities to face the same vulnerabilities as those of existing buildings, infrastructure and critical facilities described previously.

What are the potential dollar losses to vulnerable structures from earthquakes?

Since property damage information was either unavailable or none was recorded for the documented earthquakes that impacted Macoupin County, there is no way to accurately estimate future potential dollar losses to vulnerable structures. In addition, there is insufficient data available to make useful predictions regarding potential earthquake damages through the use of computer modeling.

Given Macoupin County's proximity to both major and minor faults and the fact that all structures within the County are vulnerable to damage, it is likely that there will be future dollar losses from any earthquake ranging from strong to great. As a result, participating jurisdictions were asked to consider mitigation projects that could provide wide ranging benefits for reducing the impacts or damages associated with earthquakes.

3.9 DAMS

IDENTIFYING THE HAZARD

What is the definition of a dam?

A dam is an artificial barrier constructed across a stream channel or a man-made basin for the purpose of storing, controlling or diverting water. Dams typically are constructed of earth, rock, concrete or mine tailings. The area directly behind the dam where water is impounded or stored is referred to as a reservoir.

According to the U.S. Army Corps of Engineers' National Inventory of Dams (NID), there are approximately 90,580 dams in the United States and Puerto Rico, with 1,607 dams located in Illinois. (The NID is maintained by the U.S. Army Corps of Engineers and is updated approximately every two years.) Of the 1,607 dams in Illinois, approximately 92% are constructed of earth.

What is the definition of a dam failure?

A dam failure is the partial or total collapse, breach or other failure of a dam that causes flooding downstream. In the event of a dam failure, the people, property and infrastructure downstream could be subject to devastating damages. The potential severity of a full or partial dam failure is influenced by two factors:

- the capacity of the reservoir and
- the density, type and value of development/infrastructure located downstream.

There are two categories of dam failures, "flood" or "rainy day" failures and "sunny day" failures. A "flood" or "rainy day" failure usually results when excess precipitation and runoff cause overtopping or a buildup of pressure behind a dam which leads to a breach. Even normal storm events can lead to "flood" failures if debris plugs the water outlets. Given the conditions that lead to a "flood" failure (i.e., rainfall over a period of hours or days), there is usually a sufficient amount of time to warn and evacuate residents downstream.

Unlike a "flood" failure, there is generally no warning associated with a "sunny day" failure. A "sunny day" failure is usually the result of improper or poor dam maintenance, internal erosion, vandalism or an earthquake. This unexpected failure can be catastrophic because it may not allow enough time to warn and evacuate residents downstream.

No one knows precisely how many dam failures have occurred in the United States; however, it's estimated that hundreds have taken place over the last century. Some of the worst failures have caused catastrophic property and environmental damage and have taken hundreds of lives. The worst dam failure in the last 50 years occurred on February 26, 1972 in Buffalo Creek, West Virginia. A tailings dam owned by the Buffalo Mining Company failed, taking 125 lives, injuring 1,000 individuals, destroying 507 homes and causing property damage in excess of $50 million (approximately $298.6 million in 2017 based on the Bureau of Labor Statistics Consumer Price Index Inflation Calculator.)

Dam failures have been documented in every state, including Illinois. According to the Dam Incident Database compiled by the National Performance of Dams Program, there have been 10 reported dam failures with uncontrolled releases of the reservoir in Illinois since 1950.

What causes a dam failure?

Dam failures can result from one or more of the following:

- ***prolonged periods of rainfall and flooding*** (the cause of most failures);
- ***inadequate spillway capacity*** resulting in excess flow overtopping the dam;
- ***internal erosion*** caused by embankment or foundation leakage ;
- ***improper maintenance*** (including failure to remove trees, repair internal seepage problems, maintain gates, valves and other operational components, etc.);
- ***improper design*** (including use of improper construction materials and practices);
- ***negligent operation*** (including failure to remove or open gates or valves during high flow periods);
- ***failure of an upstream dam on the same waterway***;
- ***landslides into reservoirs*** which cause surges that result in overtopping of the dam;
- ***high winds*** which can cause significant wave action and result in substantial erosion; and
- ***earthquakes*** which can cause longitudinal cracks at the tops of embankments that can weaken entire structures.

How are dams classified?

The U.S. Army Corps of Engineers assigns each dam listed on the National Inventory of Dams a hazard potential classification rating per the "Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams." The classification system is based on the potential for loss of life and damage to property in the event of a dam failure. There are three classifications: High, Significant and Low. **Figure 90** provides a brief description of each hazard potential classification. It is important to note that the hazard potential classification assigned is not an indicator of the adequacy of the dam or its physical integrity and in no way reflects the current condition of the dam.

Figure 90
Dam Hazard Classification System

Hazard Potential Classification	Description
High	Those dams where failure or mis-operation result in probable loss of human life, regardless of the magnitude of other losses. The probable loss of human life is defined to signify one or more lives lost.
Significant	Those dams where failure or mis-operation result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities or can impact other concerns. Significant hazard potential classification dams are often located in predominately rural or agricultural areas but could be located in areas with population and significant infrastructure.
Low	Those dams where failure or mis-operation results in no probable loss of human life and low economic and/or or environmental losses. Losses are principally limited to the dam owner's property.

Sources: Federal Emergency Management Agency
U.S. Army Corps of Engineers

Are there any classified dams owned by any of the participating jurisdictions?

Yes. There are fourteen classified dams within the County owned by seven municipalities: Bunker Hill, Carlinville, Gillespie, Lake Ka-Ho, Mount Olive, Royal Lakes and Staunton. **Figure 91** provides a brief description of each dam.

Figure 91
Publicly-Owned Classified Dams Located in Macoupin County

Name	Associated Waterway	Owner	Type	Purpose	Completion Date
Hazard Classification: Significant					
Carlinville Lake II Dam	Tributary Honey Creek	Carlinville	Earth	Water Supply	1981
Lake Ka-Ho 2 Dam	Tributary Panther Creek	Lake Ka-Ho	Earth	Recreation	1955
New Gillespie Lake Dam	Dry Fork	Gillespie	Earth	Water Supply	1956
Old Mt. Olive Lake Dam	Sugar Creek	Mount Olive	Earth	Water Supply / Recreation	1900
Hazard Classification: Low					
Bunker Hill Old Lake Dam	East Fork Wood River	Bunker Hill	Earth	Recreation	1936
Bunker Hill Reservoir 2 Dam	Tributary East Fork Wood River	Bunker Hill	Earth	Recreation	1962
Lake Carlinville Dam	Honey Creek	Carlinville	Earth	Water Supply / Recreation	1938
Lake Ka-Ho 1 Dam	Tributary Panther Creek	Lake Ka-Ho	Earth	Recreation	1955
Meshach Lake Dam	Tributary Coop Branch	Royal Lakes	Earth	Recreation	n/a
Mt. Olive City Lake Dam	Panther Creek	Mount Olive	Earth	Water Supply	1938
Old Gillespie Lake Dam	Dry Fork	Gillespie	Earth	Water Supply	1923
Shad Lake Dam	Coop Branch	Royal Lakes	Other	Recreation	1950
Staunton Old Mine Refuse Dam	Tributary Sugar Creek	Staunton	Earth	Recreation	1984
Staunton Reservoir Dam	East Creek	Staunton	Earth	Water Supply / Recreation	1926

Sources: Stanford University, National Performance of Dams Program, NPDP Dams Database.
U.S. Army Corps of Engineers, National Inventory of Dams Interactive Report.

Are there any other publicly-owned classified dams within the County?

Yes. There are five other publicly-owned classified dams within the County owned four entities: Illinois Department of Natural Resources, Otter Lake Water Commission, Palmyra-Modesto Water Commission and the Village of Shipman. **Figure 92** provides a brief description of each dam.

Figure 92
Other Publicly-Owned Classified Dams Located in Macoupin County

Name	Associated Waterway	Owner	Type	Purpose	Completion Date
Hazard Classification: Significant					
Otter Lake Dam	West Fork Otter Creek	Otter Lake Water Commission	Earth	Water Supply / Recreation	1969
Palmyra-Modesto City Lake Dam	Tributary Nassa Creek	Palmyra-Modesto Water Commission	Earth	Water Supply	1965
Shipman Reservoir Dam	Tributary Coop Branch	Shipman	Earth	Water Supply	1967
Hazard Classification: Low					
Beaver Lake Dam	Tributary Macoupin Creek	Illinois Department of Natural Resources	Earth	Recreation	1912
Otter Lake Low Flow Dam	Otter Creek	Otter Lake Water Commission	Rockfill	Debris Control	2008

Sources: Stanford University, National Performance of Dams Program, NPDP Dams Database.
U.S. Army Corps of Engineers, National Inventory of Dams Interactive Report.

Are there any privately-owned classified dams within the County?

Yes. There are 69 privately-owned classified dams within Macoupin County. **Figure 93** provides a brief description of the three dams that have a hazard classification of "High" or "Significant". Of the remaining 66 privately-owned classified dams, 30 have a hazard classification of "Low" and the remaining 36 are classified as "Unknown".

Figure 93
Privately-Owned Classified Dams Located in Macoupin County

Name	Associated Waterway	Owner	Type	Purpose	Completion Date
Hazard Classification: High					
Macoupin Energy Refuse Disposal Area 6	Tributary Spanish Needle Creek	Macoupin Energy, LLC	Earth	Tailings	n/a
Springfield Coal/Crown 3/Fine Refuse Ext. 2 Dam	Tributary Horse Creek	Springfield Coal Company, LLC	Earth	Tailings	n/a
Hazard Classification: Significant					
Jones Lake Dam	Honey Cut Branch	Individual	Earth	Recreation	n/a

Of the 69 privately-owned classified dams in Macoupin County:

- 44 are owned by individuals;
- 10 are owned by coal/quarry companies;
- 8 are owned by country clubs/lake associations;
- 1 is owned by a fishing club;
- 1 is owned by a boy scouts council;
- 1 is owned by a Christian center;
- 1 is owned by a business; and
- 3 do not identify an owner.

PROFILING THE HAZARD

When have dam failures occurred previously? What is the extent of these previous dam failures?

Dam Failure Fast Facts – Occurrences

Number of Dam Failures Reported: ***1***

There has been one recorded dam failure in Macoupin County. On September 2, 2010 the Virden Recreation Club Lake Dam, a "Low" hazard classification dam, northwest of Virden suffered a catastrophic failure. The breach was almost certainly precipitated by heavy rains. At total of 4.80 inches of rain fell within a 48-hour period from the 1st to the 2nd causing flash flooding in the Virden area. While damage information was unavailable, the failure resulted in the closure of the Club and the conversion of the Lake back into farmland.

According to the data from Stanford University's National Performance of Dams Incident Database and discussions with Planning Committee members, there are no other known recorded dam failures in Macoupin County.

What locations are affected by dam failure?

Dam failures have the potential to impact Lake Ka-Ho, Mount Olive, Royal Lakes, Shipman, Staunton, White City and unincorporated areas of Macoupin County. **Figure 94** shows the locations of select classified dams in Macoupin County.

What is the probability of future dam failure events occurring?

Macoupin County has only experienced one dam failure (Virden Recreation Club Lake Dam) during the life of all 89 of its classified dams. The Virden Recreation Club Lake Dam will not experience another failure since it is no longer in existence. Since none of the other dams have experienced a dam failure, it is difficult to specifically establish the probability of a future failure; however, it is estimated to be relatively low.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to dam failures?

Yes. Lake Ka-Ho, Mount Olive, Royal Lakes, Staunton and portions of unincorporated Macoupin County are vulnerable to the dangers presented by dam failures. While Mount Olive and Staunton are vulnerable, most residents would not be impacted by a dam failure. None of the rest of the participating municipalities are considered vulnerable.

Dam Failure Fast Facts – Risk

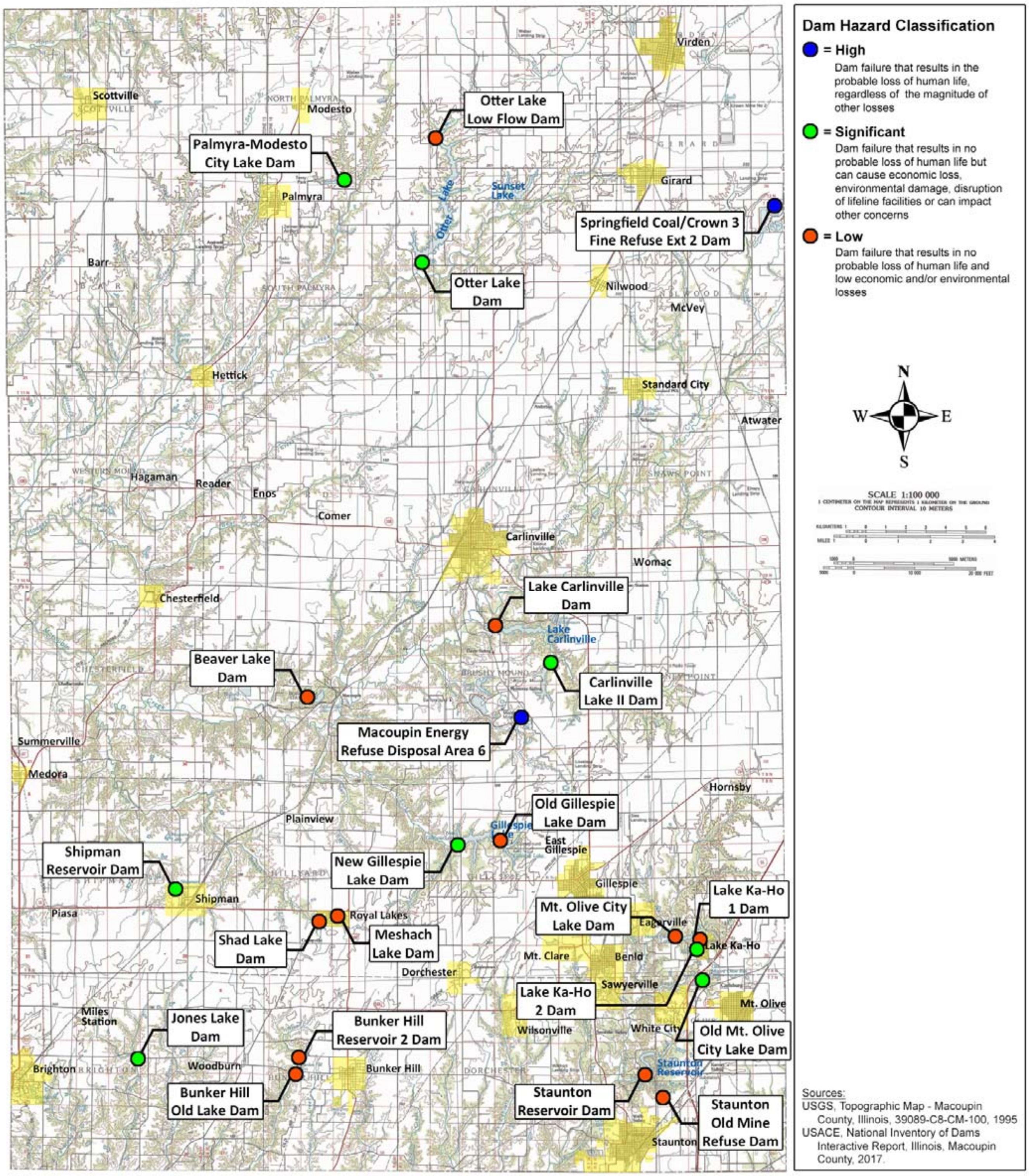
Dam Failure Risk/Vulnerability to:

- Public Health & Safety: "High" & "Significant" Hazard Classification Dams – ***Medium***
- Public Health & Safety: "Low" Hazard Classification & "Unknown" Dams – ***Low***
- Buildings/Infrastructure/Critical Facilities: "High" & "Significant" Hazard Classification Dams – ***Medium***
- Buildings/Infrastructure/Critical Facilities: "Low" Hazard Classification & "Unknown" Dams – ***Low***

What impacts resulted from the recorded dam failures?

Damage information was either unavailable or none was recorded as a resulted of the catastrophic failure experienced at Virden Recreation Club Lake Dam on September 2, 2010.

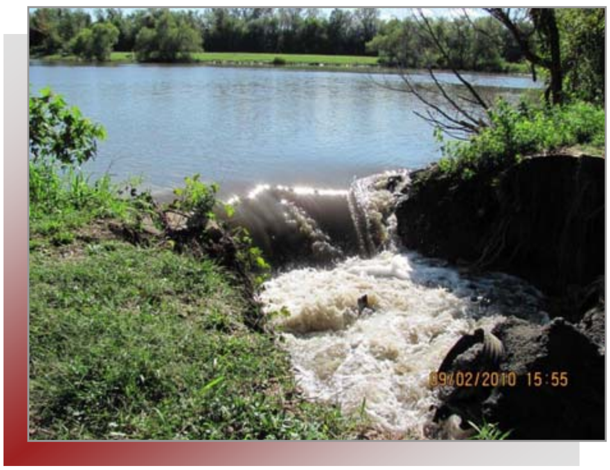
Figure 94
Location of Select Classified Dams in Macoupin County



In terms of the risk or vulnerability to public health and safety from a dam failure, there are several factors that must be taken into consideration including the severity of the event, the capacity of the reservoir and the extent and type of development and infrastructure located downstream. When these factors are taken into consideration, the overall risk to public health and safety posed by a dam failure in Macoupin County is considered to be low for the "Low" hazard classification and "Unknown" dams and medium for the "High" and "Significant" hazard classification dams.

What other impacts can result from dam failures?

The impacts from a dam failure are similar to those of a flood. There is the potential for injuries, loss of life, property damage and crop damage. Depending on the type of dam failure, there may be little, if any warning that an event is about to occur, similar to flash flooding. As a result, one of the primary threats to individuals is from drowning. Motorists who choose to drive over flooded roadways run the risk of having their vehicles swept off the road and downstream. Flooding of roadways is also a major concern for emergency response personnel who would have to find alternative routes around any section of road that becomes flooded due to a dam failure.



The Virden Recreation Club Lake Dam suffered a catastrophic dam failure on September 2, 2010 that resulted in the conversion of the Lake back to farmland.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

In addition to concerns about injuries and death, the water released by a dam failure poses the same biological and chemical risks to public health as floodwaters. The flooding that results from a dam failure has the potential to force untreated sewage to mix with floodwaters. The polluted floodwaters then transport the biological contaminants into buildings and basements and onto roads and public areas. If left untreated, the floodwaters can serve as breeding grounds for bacteria and other disease-causing agents. Even if floodwaters are not contaminated with biological material, basements and buildings that are not properly cleaned can grow mold and mildew, which can pose a health hazard, especially for small children, the elderly and those with specific allergies.

Flooding from dam failures can also cause chemical contaminants such as gasoline and oil to enter floodwaters if underground storage tanks or pipelines crack and begin leaking during a dam failure event. Depending on the time of year, the water released by a dam failure may also carry away agricultural chemicals that have been applied to farm fields and cause damage to or loss of crops.

Are existing buildings, infrastructure and critical facilities vulnerable to dam failures?

Yes. While Emergency Action Plans were not available for any of the classified dams, a visual inspection of the area surrounding these dams indicates that there are buildings, infrastructure and critical facilities that are vulnerable to dam failures.

Depending on whether there is a full or partial dam failure, all of the vulnerable buildings, infrastructure and critical facilities may be inundated by water and structural damage may result. Because none of the reservoirs within the County are immense in size, the damage sustained from dam failure flooding may not be to the structure, but to the contents of the building or nearby infrastructure.

In addition to impacting structures, a dam failure can damage roads and utilities. Roadways, culverts and bridges can be weakened by dam failure floodwaters and may collapse under the weight of a vehicle. Power and communication lines, both above and below ground, are also vulnerable to dam failure flooding. Depending on their location and the velocity of the water as it escapes the dam, power poles may be snapped causing disruptions to power and communication. Water may also get into any buried lines causing damage and disruptions.

As with public health and safety, the risk or vulnerability to buildings, infrastructure and critical facilities is dependent on several factors including the severity of the event, the capacity of the reservoir and the extent and type of development and infrastructure located downstream. When these factors are taken into consideration, the overall risk posed by a dam failure in Macoupin County is considered to be low for the "Low" hazard classification and "Unknown dams" and medium for the "High" and "Significant" hazard classification dams.

Are future buildings, infrastructure and critical facilities vulnerable to dam failures?

Yes. Any future buildings, infrastructure and critical facilities located within the flood path of a classified dam are vulnerable to damage from a dam failure. As a result, future buildings, infrastructure and critical facilities face the same vulnerabilities as those of existing buildings, infrastructure and critical facilities described previously.

What are the potential dollar losses to vulnerable structures from dam failures?

Unlike other hazards, there are no standard loss estimation models or methodologies for dam failures. Given that there have been only one recorded dam failure in Macoupin County, sufficient information was not available to prepare a reasonable estimate of future potential dollar losses to vulnerable structure from dam failures.

3.10 Man-Made Hazards

While the process to develop this Plan focused on natural hazards, the Planning Committee recognized that man-made hazards can also pose risks to public health and property. The extent and magnitude of the impacts that result from man-made hazard events can be influenced by natural hazard events. For example, severe winter storms can cause accidents involving trucks transporting hazardous substances. These accidents may lead to the release of these substances which can result in injury and potential contamination of the natural environment.

Consequently, the Planning Committee decided to profile the more prominent man-made hazards in Macoupin County. The man-made hazards assessed in this Plan include:

- Hazardous Substances
  - Generation
  - Transportation
  - Storage/Handling
- Waste Disposal
- Hazardous Material Incidents
- Waste Remediation
- Terrorism

3.10.1 Hazardous Substances

Hazardous substances broadly include any flammable, explosive, biological, chemical, or physical material that has the potential to harm public health or the environment. For the purposes of this Plan, the term hazardous substance includes hazardous product and hazardous waste. A hazardous waste is defined as the byproduct of a manufacturing process that is either listed or has the characteristics of ignitability, corrosivity, reactivity or toxicity and cannot be reused. A hazardous product is all other hazardous material.

Hazardous substances can pose a public health threat to individuals at their workplace and where they reside. The type and quantity of the substance, the pathway of exposure (inhalation, ingestion, dermal, etc.), and the frequency of exposure are factors that will determine the degree of adverse health effects experienced by individuals. Impacts can range from minor, short-term health issues to chronic, long-term illnesses.

In addition to impacting public health, hazardous substances can also cause damage to buildings, infrastructure and the environment. Accidents involving hazardous substances can range from minor (scarring on building floors and walls) to catastrophic (i.e., destruction of entire buildings, structural damage to roadways, etc.) and lead to injuries and fatalities. The number of accidents involving hazardous substances in Illinois and across the Nation every year underscores the need for trained and equipped emergency responders to minimize damages.

Since 1970, significant changes have occurred in regards to how hazardous substances are transported and disposed. Comprehensive regulations and improved safety and industrial hygiene practices have reduced the frequency of incidents involving hazardous substances. Based on the small number of facilities in Macoupin County that generate and use hazardous substances, the population size, transportation patterns, and land use, the probability of a release occurring in Macoupin County should remain relatively low compared to other counties in Illinois. The relatively low numbers of transportation accidents should not diminish municipal or county commitment to emergency management.

The following subsections identify the general pathways – generation, transportation and storage/handling – by which hazardous substances pose a risk to public health and the environment in Macoupin County.

3.10.1.1 Generation

Macoupin County has three (3) facility that generates reportable quantities of hazardous substances as a result of their operations according to the U.S. Environmental Protection Agency (USEPA) Toxic Release Inventory. **Figure 95** identifies the hazardous substance generators located in Macoupin County and summarizes the substances generated. Both Prairie Farms Dairy Inc. and Mennel Mining Co. of Illinois have generated hazardous substances in prior years and there remains the potential that they will generate hazardous substances again in the future.

Figure 95
Generators of Solid & Liquid Hazardous Substances – 2016

Name	Hazardous Substances Generated	Amount Generated (Pounds)
Carlinville		
Macoupin Energy	Lead	6,317
	Mercury	80
	Total:	*6,397*
Prairie Farms Dairy Inc.	Nitric Acid	*0*
Mount Olive		
Mennel Milling Co. of Illinois	Chlorine	n/a

Source: U.S. Environmental Protection Agency, TRI Explorer, Releases: Facility Report.

3.10.1.2 Transportation

<u>Roadways</u>

Illinois has one of the nation's largest highway systems, claiming the third largest interstate system and third largest inventory of bridges. According to the Illinois Department of Transportation (IDOT), there were almost 147,000 miles of highways and streets in Illinois in 2017. Most of the truck traffic in Macoupin County is carried on I-55 and Illinois Route 4. Interstate 55 crosses the southeastern corner of the County connecting Springfield and Chicago with St. Louis and beyond. Illinois Route 4 bisects the County, connecting Springfield to southwestern Illinois. Other major roadways that carry truck traffic include Illinois Route 16, Illinois Route 108, Illinois Route 111, Illinois Route 138 and Illinois Route 159. While this modern roadway system provides convenience

A propane truck rolled over as the result of a traffic accident on Illinois Route 111 north of Brighton on March 13, 2008.

Photo provided by James Pitchford, Macoupin County EMA Coordinator and efficiency for commuters, it also aids in-state and intra-state commerce which includes the transportation of hazardous substances.

According to records obtained from the Illinois Emergency Management Agency (IEMA), there were four recorded roadway accidents involving the shipment of hazardous waste and/or products in Macoupin County from 2008 through 2017. **Figure 96** provides information on these accidents.

Figure 96
Roadway Accidents Involving Shipments of Hazardous Products: 2008 – 2017

Date	Area	Location	Hazardous Product Released	Quantity Released
3/13/2008	Brighton^	IL Rte. 111	propane	trace amount
3/31/2012	Staunton^	Old Rte. 66	gasoline	40 gallons
4/12/2017	Virden	County Line Rd.	oil	less than 10 gallons
5/9/2017	Virden	East Lincoln St.	hydraulic fluid	8 gallons

^ Accident verified in the vicinity of this location.

Source: Illinois Emergency Management Agency, Hazardous Materials Incident Reports.

<u>*Railways*</u>

Illinois' rail system is the country's second largest, with the East St. Louis and Chicago terminals being two of the nation's busiest. In Macoupin County there are four rail lines: Burlington Northern and Santa Fe, Norfolk Southern, Union Pacific/Amtrak and Union Pacific.

Between 2000 and 2012 (the latest year for which data is available), hazardous substances moving through Illinois have accounted for between 6.0 percent and 11.0 percent of the total freight traffic. Annual tonnage of hazardous substances moving through Illinois has varied in recent years between 29 million tons to 47 million tons. In comparison, the Association of American Railroads estimates that approximately 7.5 percent of all rail traffic in 2016 in the United States involves the movement of hazardous substances.

The Illinois Commerce Commission (ICC) is required to maintain records on railway accidents which involve hazardous substances. Their records are divided into three categories. These three categories are described in **Figure 97**.

Figure 97
ICC Hazardous Substances Railroad Accident Classification Categories

Category	Description
A	railroad derailments resulting in the release of the hazards substance(s) being transported
B	railroad derailments where hazards substance(s) were being transported but no release occurred
C	releases of hazardous substance(s)s from railroad equipment occurred, however no railroad derailment was involved

Since 2007, there has been one (1) rail accident involving hazardous substances in Macoupin County according to the ICC. In comparison, ICC records indicate that since 2007 the annual number of railway accidents in Illinois involving hazardous substances has ranged between 35 and 122. **Figure 98** provides a breakdown by category of the ICC recorded railway accidents/incidents involving hazardous substances. Included is a comparison of the number of accidents/incidents in Macoupin County to those in Cook and the Collar Counties as well as the rest of Illinois.

Figure 98
ICC Recorded Railway Accidents/Incidents Involving Hazardous Substances: 2007 – 2016

Year	Category	Accident/Incident Location			
		Illinois	Macoupin County	Cook & Collar Counties	All Other Counties
2007	A	7	0	5	2
	B	10	0	8	2
	C	81	0	46	35
2008	A	7	0	4	3
	B	4	0	2	2
	C	62	0	36	26
2009	A	5	0	1	4
	B	5	0	3	2
	C	25	0	14	11
2010	A	3	0	2	1
	B	20	0	17	3
	C	80	0	42	38
2011	A	8	0	1	7
	B	10	0	9	1
	C	60	0	33	27
2012	A	4	0	2	2
	B	13	0	11	2
	C	73	0	42	31
2013	A	5	0	3	2
	B	23	0	16	7
	C	82	0	51	31
2014	A	2	0	2	0
	B	36	0	21	15
	C	84	0	40	44
2015	A	4	0	3	1
	B	27	1	15	11
	C	69	0	36	33
2016	A	4	0	1	3
	B	14	0	6	8
	C	65	0	33	32

Source: Illinois Commerce Commission.

According IEMA's hazardous materials incident records for the same time period, there were an additional eight rail accidents/incidents involving the release of hazardous substances. **Figure 99** provides information on these incidents by rail line. No derailments were associated with any of these accidents/incidents.

Figure 99
IEMA Recorded Railway Accidents/Incidents Involving Shipments of Hazardous Products: 2007 – 2016

Date	Area	Location	Hazardous Product Released	Quantity Released
Norfolk Southern				
3/15/2010	Mt. Olive^	Milepost D444.8	lube oil	approx. 3 gallons
6/20/2012	Staunton^	Milepost B451	soybean meal	5 bushel
12/24/2012	Carlinville^	Milepost ME 4.4	coal	135 tons
5/13/2014	Mt. Olive^	Milepost D423.6	powdered clay	unknown quantity
7/20/2017	Mt. Olive^	Milepost D445	crushed limestone	10 gallons
Union Pacific/Amtrak				
6/20/2007	Carlinville^	near Alton Rd. & Robinson Ln. crossing	diesel fuel	at least 200 gallons
10/13/2007	Nilwood^	Green Ridge Rd. at-grade crossing	diesel fuel	less than 20 gallons
1/15/2009	Carlinville^	Moore Cemetery Rd. at-grade crossing	diesel fuel	200-300 gallons

The top 20 hazardous substances moved by rail through Illinois include: sodium hydroxide, petroleum gases (liquefied), sulfuric acid, anhydrous ammonia, chlorine, sulfur, vinyl chloride, propane, fuel oil, denatured alcohol, methanol, gasoline, phosphoric acid, hydrochloric acid, styrene monomer, carbon dioxide (refrigerated liquid), ammonium nitrate, sodium chlorate, and diesel fuel.

Pipelines

Energy gases (natural gas and liquefied petroleum gas), petroleum liquids (crude oil and gasoline) and liquid and gas products used in industrial processes are carried in above-ground and buried pipelines across Illinois. According to the U.S. Department of Transportation's National Pipeline Mapping System, there are five (5) interstate hazardous liquids pipelines and two (2) intrastate natural gas pipeline systems in Macoupin County. Two of the hazardous liquids pipelines are owned by Buckeye Partners, L.P., one is owned by Explorer Pipeline Company, one is owned by Marathon Pipeline LLC and another is owned by Nustar Pipeline Operating Partnership LP. The two natural gas pipeline systems are owned by Ameren Illinois Company.

Debris resulting from the May 11, 2016 natural gas pipeline explosion in Carlinville.

Photo provided by James Pitchford, Macoupin County EMA Coordinator

Two (2) pipeline releases occurred in Macoupin County during a ten year period from 2008 through 2017. The first incident took place in Carlinville on October 9, 2013. According to IEMA's incident records, a natural gas pipeline was punctured during the replacement of an at-grade crossing of the Union Pacific/Amtrak rail line near the intersection of West Nicholas and North Oak Streets. No evacuations were ordered and no damage estimates were available.

The second incident also took place in Carlinville on May 11, 2016. According to the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Division, a half inch plastic natural gas residential service line was cut by a third party contractor. An explosion occurred at a nearby house, injuring two individuals. One of the individuals required inpatient hospitalization for non-life threatening injuries. The incident resulted in the evacuation of 14 individuals and disrupted service to 32 residential customers and one commercial customer. Property damages were estimated at $284,378.

There have been several high profile incidents across the Nation, including one in Illinois, which have raised public concerns about our aging pipeline infrastructure. The following provides a brief description of each incident.

- On July 25, 2010 a 30-inch liquid product pipeline rupture near Marshall, Michigan and released at least 840,000 gallons of oil into a creek that led to the Kalamazoo River, a tributary of Lake Michigan.
- Soon afterward on September 9, 2010, another pipeline release received national attention. A 34-inch liquid product pipeline in the Chicago Suburb of Romeoville, Illinois released over 360,000 gallons of crude oil that flowed through sewers and into a retention pond narrowly avoiding the Des Plaines River. This release triggered numerous odor complaints from residents in the adjacent municipalities of Lemont and Bolingbrook. The property damage/cleanup costs were estimated at $46.6 million.
- Also on September 9, 2010, a 30-inch high pressure natural gas pipeline ruptured in the San Francisco suburb of San Bruno, California that resulted in an explosion that killed eight people, injured 51, destroyed 38 homes and damaged an entire neighborhood. The property damage was estimated at around $55 million.
- On March 12, 2014 a gas main rupture in Manhattan, New York that resulted in an explosion that killed eight people, injured 48 and leveled two multi-use, five story buildings.
- On May 19, 2015, a 24-inch liquid product pipeline ruptured near Refugio State Beach in Santa Barbara County, California and released approximately 100,000 gallons of crude oil. The release occurred along a rustic stretch of coastline that forms the northern boundary of the Santa Barbara Channel, home to a rich array of sea life. Oil ran down a ravine and entered the Pacific Ocean, blackening area beaches, creating a 9-mile oil slick and impacting birds, marine mammals, fish and coastal and subtidal habitats.

Continual monitoring and maintenance of these pipelines is necessary to prevent malfunctions from corrosion, aging, or other factors that could lead to a release. In addition, to normal wear and tear experienced by pipelines, the possibility of sabotage and seismic activity triggering a release must be considered when contemplating emergency response scenarios.

3.10.1.3 Storage/Handling

Beyond knowing where hazardous substances are generated and the methods and routes used to transport them, it is important to identify where hazardous substances are handled and stored. This information will help government officials and emergency management professionals make informed choices on how to better protect human health, property and the environment and what resources are needed should an incident take place.

Records obtained from IEMA's Tier II database were used to gather information on the facilities that generate, use and store chemicals in excess of reportable threshold quantities within Macoupin County. The Tier II information was then compared with USEPA's Toxic Release Inventory (TRI) and information from IEPA's databases. This review identified 34 facilities within Macoupin County that store and handle hazardous substances.

Of these 34 facilities, 18 reported the presence of Extremely Hazardous Substances (EHSs) at their facilities. An "Extremely Hazardous Substance" is any USEPA-identified chemical that could cause serious, irreversible health effects from an accidental release. There are approximately 400 chemicals identified as EHSs. Stationary sources who possess one or more of these substances at or above threshold reporting quantities are required to notify IEMA.

Figure 100 identifies the types of EHSs and the facilities that store and handle them. Aside from EHSs, there are other chemicals, such as water reactives, that can pose risks that are equal to or greater than the risks posed by EHSs. These risks can be identified through a Threat and Hazard Identification and Risk Assessment (THIRA).

Figure 100
(Sheet 1 of 2)
Extremely Hazardous Substances by Tier II Facility

Facility Name	Extremely Hazardous Substance(s)
Atwater	
M&M Service	anhydrous ammonia
Brighton	
AT&T - Q51420	sulfuric acid
Bunker Hill	
M&M Service – Bunker Hill	Paraquat dichloride
M&M Service – Bunker Hill Lot	anhydrous ammonia
Carlinville	
M&M Service – Carlinville North	anhydrous ammonia
M&M Service – Carlinville	paraquat dichloride
Prairie Farms Dairy	anhydrous ammonia, nitric acid
Chesterfield	
M&M Service	anhydrous ammonia
Girard	
M&M Service	paraquat dichloride
Otter Lake Water Commission Plant	chlorine

Figure 100
(Sheet 2 of 2)
Extremely Hazardous Substances by Tier II Facility

Facility Name	Extremely Hazardous Substance(s)
Mt. Olive	
Georgia-Pacific Corrugated	sulfuric acid
Mennel Milling Co. of Illinois	chlorine
Palmyra	
M&M Service	anhydrous ammonia
Plainview	
Level 3 Communications	sulfuric acid
Shipman	
Crown Castle – 842145	sulfuric acid
CHS Inc. – Shipman Main	phosfume pellets, Gramoxone SL 2.0, Dimate 4E, anhydrous ammonia
Staunton	
Tubular Steel	sulfuric acid
Virden	
M&M Service	anhydrous ammonia

Sources: Illinois Emergency Management Agency, Tier II Hazardous Chemical Reports.
U.S. Environmental Protection Agency, TRI Explorer.

3.10.2 Waste Disposal

<u>*Solid Waste*</u>

Waste disposal has caused surface water and ground water contamination in Illinois and across the Nation. Beginning in the late 1970s substantial regulatory changes strengthened the design, operating and monitoring requirements for landfills where the majority of waste is disposed. These regulatory changes have helped reduce the public health threat posed by landfills. Although the rise in recycling activity has reduced the amount of waste disposed, the majority of solid waste (waste generated in households) continues to be disposed of in landfills. As of January 1, 2016 (the latest year for which data is available) there were 38 landfills operating in Illinois.

According IEPA's Annual Landfill Capacity Report issued in July 2017, there are no commercial landfills currently operating in Macoupin County. There are currently two Illinois landfills that serve Macoupin and the adjacent counties. These landfills are:

- ❖ Litchfield-Hillsboro Landfill (Montgomery County); and
- ❖ Sangamon Valley Landfill Inc. (Sangamon County).

<u>*Medical Waste*</u>

According to IEPA's list of permitted Potentially Infectious Medical Waste (PIMW) Facilities, there are no facilities permitted to accept medical waste for disposal in Macoupin County.

Hazardous Waste

According to IEPA's Storage, Treatment, Recycling, Incinerating, Transfer Stations and Processing list, there are currently no off-site hazardous waste treatment or disposal facilities located in Macoupin County.

3.10.3 Hazardous Material Incidents

Hazardous materials, also known as hazardous substances, broadly include any flammable, explosive, biological, chemical, or physical material that has the potential to harm public health or the environment. A hazardous material or hazmat incident refers to any accident involving the release of hazardous substances. These accidents can take place where the substances are used, generated or stored or while they are being transported. In addition, hazmat incidents also include the release of hazardous substances, such as fuel, used to operate vehicles. These releases can be the result of an accident or a leak. **Figure 101**, located at the end of this section, provides information on the hazmat incidents recorded in Macoupin County.

From 2008 through 2017, there were 54 hazmat incidents recorded in Macoupin County. Of these incidents, approximately ***76% occurred at fixed facilities and 24% involved transportation incidents/accidents***.

Based on the recorded incidents, ***Macoupin County experienced an average of 5 hazmat incidents annually***. The types of existing industries; the major transportation corridors through the County which include interstate and Illinois highways, rail and pipeline; and chemical use within and adjacent to the County suggest that hazmat incidents are likely to continue to take place at the rate reflected in the 10-year study period. Constant vigilance, proper training and equipment, and prompt response are needed to minimize the potential impacts of each incident.

3.10.4 Waste Remediation

Hazardous waste remediation in Illinois is primarily handled through two programs: the federal Superfund program and the state Site Remediation Program. Sites that pose the largest threat to public health and the environment are typically found in the Superfund program. Most other hazardous waste sites are handled through the Site Remediation Program.

Superfund (CERLCA) Program/National Priorities List

According to USEPA's National Priorities List (MPL) Sites database, there are 45 Superfund sites in Illinois. There are ***no sites*** in Macoupin County being ***managed through the Superfund program***.

Illinois Site Remediation Program (non-Superfund)

Sites that do not qualify for the federal Superfund program, but where hazardous waste exists that poses a risk to public health and the environment, are regulated through the Illinois Site Remediation Program (SRP). Since the mid-1980s, remediation activities have been conducted and monitored at nearly 4,000 sites in Illinois. When inspections and sampling results indicate that remediation objectives have been achieved, the IEPA issues a No Further Remediation (NFR) Letter to the property owner. This letter describes what remediation activities have been taken and whether any portion of the property, based on future property use, might need additional remediation.

There are ***eight SRP sites*** in Macoupin County. Three of the eight SRP sites have received NFR letters while another two sites have received Section 4(y) letters. The remaining three sites do not pose an immediate threat to public health or the environment.

<u>*Leaking Underground Storage Tank Program*</u>
Petroleum products leaking from underground storage tanks are regulated through the Leaking Underground Storage Tank (LUST) Program. This program began in the late 1980s as a result of the threats posed by vapors in homes and businesses, contaminated groundwater, and contaminated soil. In Illinois over 14,500 acres of soil contaminated by leaking underground tanks have been remediated since 1988.

In Macoupin County there are ***148 cases involving remediation of leaks and contaminated soil*** through this Program. Approximately 70% of these sites have received NFR, Non-Lust or 4(y) Letters or remediation is virtually complete.

3.10.5 Terrorism

Terrorism has different definitions across the globe. For the purpose of this Plan, terrorism will be defined as any event that includes ***violent acts*** which ***threaten or harm lives, health or property*** conducted by ***domestic or foreign*** individuals or groups ***aimed at civilians, the federal government or symbolic locations*** intended to ***cause widespread fear***.

The attack on the World Trade Center and the Pentagon on September 11, 2001 by foreign terrorists galvanized national action against terrorism and resulted in the creation of the United States Department of Homeland Security. While the number of terrorist activities garnering national attention in the U.S. has been relatively small, over 170,000 terrorist events have occurred worldwide between 1970 and 2016, according to the National Consortium for the Study of Terrorism and Responses to Terrorism (the Consortium). During this same time span, the Consortium documented 2,758 terrorist events within the U.S.

Acts of terrorism have resulted in fatalities and injuries as a result of kidnappings, hijackings, bombings, and the use of chemical and biological weapons. The Global Terrorism Database has documented 3,277 American fatalities in the United States between 1995 and 2016 from terrorist attacks. The attacks on September 11, 2001 account for 2,902 of the 2,158 fatalities. A search of the Global Terrorism Database identified 110 incidents of terrorism in Illinois between 1970 and 2016. These incidents resulted in 5 fatalities and 32 injuries.

The Federal Bureau of Investigation's (FBI) provides supporting documentation on domestic terrorist attacks in a series of reports on terrorism. These reports provide a chronological summary of terrorist incidents in the United States with detailed information on attacks between 1980 and 2005. During this time period, 192 incidents were documented within the United States. Six of these incidents occurred in Illinois; five in the Chicago area and one downstate.

More recently a single individual from Macon County sought to carry out his anger at the federal government by detonating a van filled with explosive outside of the Federal Courthouse in Springfield on September 24, 2009. This attempt was thwarted by the FBI.

It is impossible to predict with any reasonable degree of accuracy how many terrorism events might be expected to occur in Macoupin County or elsewhere in Illinois. Although targets for terrorist activity are more likely centered in larger urban areas, recruitment, training and other support activities, such as the one described above, have occurred in rural areas.

The economic resources available to some terrorist groups coupled with the combination of global tensions, economic uncertainty and frustration towards government appear to have recently raised the frequency of attempts. Enhanced efforts by law enforcement officials and civilian vigilance for unusual activity or behavior will be needed to repel terrorists whether they are domestic or foreign in origin.

Figure 101
(Sheet 1 of 2)
Hazmat Incidents in Macoupin County: 2008 – 2017

Date	Location	Hazardous Substances Released
2008		
03/18	Brighton^	Propane†
05/06	Virden	unknown petroleum product
05/26	Carlinville^	non-PCB transformer oil
06/05	Mount Olive^	diesel fuel
06/21	East Gillespie	anhydrous ammonia
2009		
01/15	Carlinville^	diesel fuel§
04/28	Staunton^	gasoline & diesel fuel
06/25	Carlinville	diesel fuel
09/22	Virden	anhydrous ammonia
2010		
02/21	Barr^	hog waste
03/15	Mount Olive^	lube oil§
04/22	Virden^	anhydrous ammonia
08/17	Gillespie	gasoline
10/05	Gillespie	transformer oil
11/03	East Gillespie^	livestock waste
11/06	Carlinville^	anhydrous ammonia
2011		
03/02	Barr^	hog waste
04/20	Girard^	non-PCB oil
04/21	Girard^	transformer oil
04/22	Girard^	transformer oil
07/01	Comer^	anhydrous ammonia
07/02	Gillespie	anhydrous ammonia
07/19	Barr^	hog waste
10/20	Carlinville	diesel fuel
11/16	Palmyra^	anhydrous ammonia
12/21	Palmyra	diesel fuel & gasoline
2012		
03/31	Staunton^	gasoline†
04/25	Shipman^	grass herbicide mix
06/20	Staunton^	soybean meal§
12/24	Carlinville^	coal§
12/27	Brighton	gasoline & diesel fuel

^ Incident verified in the vicinity of this location.
† Incident involved the transportation of a hazardous substance by roadway.
§ Incident involved the transportation of a hazardous substance by rail.
* Incident involved the transportation for a hazardous substance by pipeline.

Figure 101
(Sheet 2 of 2)
Hazmat Incidents in Macoupin County: 2008 – 2017

Date	Location	Hazardous Substances Released
2013		
10/09	Carlinville	natural gas*
2014		
05/13	Mount Olive^	powdered clay§
06/18	Carlinville^	benzene§
09/16	Girard	carbon dioxide
10/10	Girard	gasoline
10/30	Eagerville^	diesel fuel
12/18	Virden	gasoline
2015		
01/07	Girard	diesel fuel
05/04	Atwater	anhydrous ammonia
08/23	Gillespie^	hog waste
10/23	Girard	gasoline
2016		
02/10	Gillespie	gasoline
03/17	Bunker Hill	gasoline
05/09	Carlinville^	non-PCB oil
05/11	Carlinville	natural gas*
2017		
02/15	Carlinville	diesel fuel & gasoline
02/17	Bunker Hill	gasoline & diesel fuel
04/12	Virden	oil†
05/06	Virden	diesel fuel
05/09	Virden	hydraulic fluid†
05/16	Bunker Hill^	cattle waste
06/27	Carlinville	kerosene
07/20	Mount Olive^	crushed limestone§

^ Incident verified in the vicinity of this location.
† Incident involved the transportation of a hazardous substance by roadway.
§ Incident involved the transportation of a hazardous substance by rail.
* Incident involved the transportation for a hazardous substance by pipeline.

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4.0 MITIGATION STRATEGY

4.0 MITIGATION STRATEGY

The mitigation strategy identifies how participating jurisdictions are going to reduce or eliminate the potential loss of life and property damage that results from the natural and man-made hazards identified in the Risk Assessment section of this Plan. The strategy includes:

- Reviewing and updating the mitigation goals. Mitigation goals describe the objective(s) or desired outcome(s) that the participants would like to accomplish in term of hazard and loss prevention. These goals are intended to reduce or eliminate long-term vulnerabilities to natural and man-made hazards.
- Evaluating the status of the existing mitigation actions and identifying a comprehensive range of jurisdiction-specific mitigation actions including those related to continued compliance with the National Flood Insurance Program (NFIP). Mitigation actions are projects, plans, activities or programs that achieve at least one of the mitigation goals identified.
- Analyzing the existing and new mitigation actions identified for each jurisdiction. This analysis ensures each action will reduce or eliminate future losses associated with the hazards identified in the Risk Assessment section.
- Reviewing and updating the mitigation actions prioritization methodology. The prioritization methodology outlines the approach used to prioritize the implementation of each identified mitigation action.
- Identifying the entity(s) responsible for implementing and administering. For each mitigation action, the entity(s) responsible for implementing and administering that action is identified as well as the timeframes for completing the actions and potential funding sources.
- Conducting a preliminary cost/benefit analysis of each mitigation action. The qualitative cost/benefit analysis provides participants a general idea which actions are likely to provide the greatest benefit based on the financial cost and staffing efforts needed.

As part of the Plan update, the mitigation strategy was reviewed and revised. A detailed discussion of each aspect of the mitigation strategy and any updates that were made is provided below.

4.1 MITIGATION GOALS REVIEW

As part of the Plan update process, the mitigation goals developed in the original Plan were reviewed. Taking into account the risk assessment findings, the Planning Committee decided to revise and expand the original list of hazard mitigation goals to identify a more comprehensive range of improvements participants want to achieve.

The updated list of mitigation goals was distributed to the Planning Committee members at the first meeting on September 14, 2017. Members were asked to review the updated list before the second meeting and consider whether any changes needed to be made or if additional goals should be included. At the Planning Committee's January 23, 2018 the group discussed the updated list of goals and approved them with no changes or additions. **Figure 102** lists the approved mitigation goals.

Figure 102 **Mitigation Goals**	
Goal 1	Educate people about the natural and man-made hazards they face and the ways they can protect themselves, their homes, and their businesses from those hazards.
Goal 2	Protect the crops and lives, health, and safety of the people and animals in the County from the dangers of natural and man-made hazards.
Goal 3	Protect existing infrastructure and design new infrastructure (roads, bridges, utilities, water supplies, sanitary sewer systems, etc.) to be resilient to the impacts of natural and man-made hazards.
Goal 4	Incorporate natural and man-made hazard mitigation into community plans and regulations.
Goal 5	Place a priority on protecting public services, including critical facilities, utilities, roads and schools.
Goal 6	Preserve and protect the rivers/streams and floodplains in our County.
Goal 7	Ensure that new developments do not create new exposures to damage from natural and man-made hazards.
Goal 8	Protect historic, cultural, and natural resources from the effects of natural and man-made hazards.

4.2 EXISTING MITIGATION ACTIONS REVIEW

The Plan update process included a review and evaluation of the ***existing hazard mitigation actions*** listed in the original Plan. A copy of these original actions is included in **Appendix O**. A review of the existing hazard mitigation actions revealed the following shortcomings:

- Actions were not jurisdiction-specific. Many of the actions were applied to every participant no matter their level of interest, ability to implement or relevance to their jurisdiction.
- Actions were applied to non-participating municipalities. Many of the actions covered jurisdictions that did not participate in the development of the original Plan, and therefore should not have been included in the mitigation actions lists.
- Actions focused on emergency response and not mitigation. Several of the actions identified were aimed at addressing emergency response and not mitigation needs.

As a result of these findings, the Planning Committee decided to delete any action that was: a) vague or too general/broad in scope; b) excessively challenging to implement; c) not the responsibility of any of the participating jurisdictions; or d) focused on emergency response and not mitigation. In addition, those actions listed for fire were also eliminated as the County concluded that it was a minimal risk and chose not to include it in the Plan update. As a result, mitigation actions 4, 8, 16, 18, 26 and 29 were deleted.

The remaining existing mitigation actions were summarized and presented to the Planning Committee members for their review and evaluation at the second meeting held on January 23, 2018. Each of the participating jurisdictions were asked to identify those actions that were either in progress or that had been completed since the original Plan was adopted in 2010.

Figure 103 through **Figure 111** located at the end of this section, summarize the results of this evaluation by jurisdiction. Each action listed includes a reference number to the original mitigation action list found in **Appendix O**. Benld, Brighton and Mount Olive did not participate in the development of the original Plan and therefore are not included in the summary.

4.3 New Mitigation Actions Identification

Given the shortcomings of the existing mitigation actions and recommendations, it was essential that a comprehensive range of ***new, jurisdiction-specific mitigation actions*** be identified for each participating jurisdiction as part of the Plan update process. Instead of focusing on all-inclusive actions covering multiple jurisdictions, participants were asked to identify mitigation actions that met the specific needs and risks associated with their jurisdiction.

Representatives of the following jurisdictions were also asked to identify mitigation actions that would ensure their continued compliance with the National Flood Insurance Program.

- Brighton
- Carlinville
- Gillespie
- Macoupin County
- Staunton
- Virden

The compiled lists of new mitigation actions were reviewed to assure the appropriateness and suitability of each action. Those actions that were not deemed appropriate and/or suitable were either reworded or eliminated.

4.4 Mitigation Actions Analysis

Next, those existing mitigation actions retained and all of the new mitigation actions identified were assigned to one of six broad mitigation activity categories which allowed Committee members to compare and consolidate similar actions. **Figure 112** identifies each mitigation activity category and provides a brief description.

Each mitigation action was then analyzed to determine:

- the hazard or hazards being mitigated;
- the degree to which the impacts associated with a particular hazard(s) would be mitigated (i.e., reduced or eliminated);
- the general size of the population affected (i.e., small, medium or large);
- the goal or goals fulfilled;
- whether the action would reduce the effects on new or existing buildings and infrastructure; and
- whether the action would ensure continued compliance with the National Flood Insurance Program.

Figure 112
Types of Mitigation Activities

Category	Description
Regulatory Activities (RA)	Regulatory activities are designed to reduce a jurisdiction's vulnerability to specific hazard events. These activities are especially effective in hazard prone areas where development has yet to occur. Examples include: planning and zoning, floodplain regulations and local ordinances (i.e., building codes, etc.).
Structural Projects (SP)	Structural projects lessen the impact that a hazard has on a particular structure through design and engineering. Examples include: storm sewers, road and bridge projects, storm/tornado shelters, flood walls and seismic retrofits.
Public Information & Awareness (PI)	Public information and awareness activities are used to educate individuals about the potential hazards that affect their community and the mitigation strategies that they can take part in to protect themselves and their property. Examples include: outreach programs, school programs, brochures and handout materials, evacuation planning and drills, volunteer activities (i.e., culvert cleanout days, initiatives to check on the elderly/disabled during hazard events, etc.).
Studies (S)	Studies are used to identify activities that can be undertaken to reduce the impacts associated with certain hazards. Examples include: hydraulic and drainage studies.
Miscellaneous Projects (MP)	Miscellaneous projects is a catchall for those activities or projects that help to reduce or lessen the impact that a hazard may have on a critical facility or community service. Examples include: snow fences, generators, warning sirens, etc.
Property Protection (PP)	Property protection activities are designed to retrofit existing structures to withstand natural hazards or to remove structures from hazard prone areas. In Illinois, this category of activities primarily pertains to flood protection. Examples include: acquisition, relocation, elevation, insurance (i.e., flood, homeowners, etc.) and retrofitting (i.e., impact resistant windows, etc.).

4.5 Mitigation Actions Prioritization Methodology Review

The methodology developed to prioritize mitigation actions in the original Plan was reviewed by the Planning Committee as part of the Plan update process. The original prioritization methodology was based on the STAPLE+E planning factors (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) and applied a rating of high, medium or low to each mitigation action. Taking into account the number and types of factors assessed and the complexity associated with the STAPLE+E analysis, the Planning Committee decided to replace the original prioritization methodology with one focused on just two key factors: 1) the frequency of the hazard and 2) the degree of mitigation attained. This updated prioritization methodology was presented to the Planning Committee members at the third meeting held on May 1, 2018. The group reviewed and discussed the updated methodology and chose to approve it with no changes.

Figure 113 identifies and describes the four-tiered prioritization methodology adopted by the Committee. The methodology developed provides a means of objectively determining which actions have a greater likelihood of eliminating or reducing the long-term vulnerabilities associated with the most frequently-occurring natural hazards.

While prioritizing the actions is useful and provides participants with additional information, it is important to keep in mind that implementing any the mitigation actions is desirable regardless of which prioritization category an action falls under.

Figure 113 **Mitigation Action Prioritization Methodology**			
		Hazard	
		Most Significant Hazard **(M)** (i.e., severe storms, severe winter storms, excessive heat, tornadoes)	Less Significant Hazard **(L)** (i.e., floods, drought, mine subsidence, earthquakes, dam failures)
Mitigation Action	Mitigation Action with the Potential to Virtually Eliminate or Significantly Reduce Impacts **(H)**	**HM** mitigation action will virtually eliminate damages and/or significantly reduce the probability of fatalities and injuries from the most significant hazards	**HL** mitigation action will virtually eliminate damages and/or significantly reduce the probability of fatalities and injuries from less significant hazards
	Mitigation Action with the Potential to Reduce Impacts **(L)**	**LM** mitigation action has the potential to reduce damages, fatalities and/or injuries from the most significant hazards	**LL** mitigation action has the potential to reduce damages, fatalities and/or injuries from less significant hazards

4.6 Mitigation Actions Implementation, Administration & Cost/Benefit Analysis

Finally, each participating jurisdiction was asked to identify how the mitigation actions will be implemented and administered. This included:

- Identifying the party or parties responsible for oversight and administration.
- Determining what funding source(s) are available or will be pursued.
- Describing the time frame for completion.

In addition, a preliminary qualitative cost/benefit analysis was conducted on each mitigation action. The costs and benefits were analyzed in terms of the general overall cost to complete an action as well as the action's likelihood of permanently eliminating or reducing the risk associated with a specific hazard. The general descriptors of high, medium and low were used. These terms are not meant to translate into a specific dollar amount, but rather to provide a relative comparison between the actions identified by each jurisdiction.

This analysis is only meant to give the participants a starting point to compare which actions are likely to provide the greatest benefit based on the financial cost and staffing effort needed. It was repeatedly communicated to the Planning Committee members that when a grant application is submitted to IEMA/FEMA for a specific action, a detailed cost/benefit analysis will be required to receive funding.

4.7 Mitigation Strategy Results

Figures 114 through **125**, located at the end of this section, summarize the results of the mitigation strategy. The mitigation actions are arranged alphabetically by participating jurisdiction following the County and include both existing and new actions.

Figure 103
(Sheet 1 of 2)
Macoupin County – Status of Existing Mitigation Actions

Activity/Project Description	Status: No Progress (✓)	Status: In Progress (✓)	Status: Completed (✓)	Year Completed	Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)
Conduct a Commodity Flow Study. (Mitigation Item 3)	✓				
Distribute weather radios to critical facilities. (Mitigation Item 5)			✓		
Create a database for identification of special needs population and institute a plan for rescue and recovery. (Mitigation Item 7)			✓		
Trim trees to minimize the amount/duration of power outages. (Mitigation Item 9)		✓		Ongoing	Utility companies are doing a lot of work keeping the trees cut back from lines in the County.
Enforce codes requiring mobile homes to have tie-downs. (Mitigation Item 10)	✓				
Conduct a new flood study (DFIRM). (Mitigation Item 11)	✓				
Improve emergency radio coverage throughout the County. (Mitigation Item 12)		✓		Ongoing	
Implement new plans for public education including distribution of first aid kits and weather radios and pamphlets that address the importance of retrofitting infrastructure. (Mitigation Item 13)		✓		Ongoing	
Purchase new transfer switches for all critical facilities. (Mitigation Item 14)		✓		Ongoing	Highway building, 911 tower and jail all now have emergency generator hookups. Several nursing homes are also adding the necessary hookups.
Institute Reverse 911 or similar mass notification system. (Mitigation Item 17)	✓				
Conduct a study to evaluate the strength of the County's critical facilities infrastructure. Harden infrastructure as necessary. (Mitigation Item 19)	✓				
Create maps of undermined areas of the County. (Mitigation Item 20)		✓		Ongoing	GIS Officer being hired by the County to build database. Need layer for abandoned coal mines to predict future mine subsidence areas.
Conduct a study to evaluate bridge infrastructure strength. (Mitigation Item 21)	✓				

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 103
(Sheet 2 of 2)
Macoupin County – Status of Existing Mitigation Actions

Activity/Project Description	**Status**			**Year Completed**	**Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)**
	No Progress (✓)	**In Progress (✓)**	**Completed (✓)**		
Establish shelters/warming centers/cooling centers in mobile home parks and recreational parks and within each incorporated community. (Mitigation Item 22)		✓		Ongoing	Database has been completed and continues to be updated.
Assess and upgrade drainage systems throughout the County. (Mitigation Item 23)	✓				
Conduct a study to determine areas throughout the County that need new sirens. Purchase and install new warning sirens within the County. (Mitigation Item 24)		✓		Ongoing	Several new sirens have been installed in the last 4 years.
Develop or adapt guidelines or ordinances which require higher building and safety standards for new public and governmental buildings. (Mitigation Item 25)	✓				
Develop ordinances to bury new power lines in subdivisions. (Mitigation Item 28)	✓				

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 104
Bunker Hill – Status of Existing Mitigation Actions

Activity/Project Description	Status			Year Completed	Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)
	No Progress (✓)	In Progress (✓)	Completed (✓)		
Distribute weather radios to critical facilities. (Mitigation Item 5)			✓	2010	
Establish shelter/warming center/cooling center for City residents. (Mitigation Item 22)			✓	2010	

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 105 Carlinville – Status of Existing Mitigation Actions					
Activity/Project Description	**Status**			**Year Completed**	**Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)**
	No Progress (✓)	**In Progress (✓)**	**Completed (✓)**		
Purchase and install new warning sirens within the County. (Mitigation Item 1)		✓			Installing final upgraded siren in 2018/2019
Implement Nixle for mass media release via e-mail, telephone and text messages. (Mitigation Item 2)			✓	2011	Nixle has been in use to notify residents since 2011
Distribute weather radios to critical facilities. (Mitigation Item 5)			✓	2011	Weather radios have been distributed to all critical care facilities in the City
Conduct a sewer upgrade to separate stormwater and sanitary sewer lines. (Mitigation Item 15)	✓				
Establish shelter/warming center/cooling center for City residents. (Mitigation Item 22)	✓				
Re-route rail line through Carlinville. (Mitigation Item 27)	✓				

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 106
Gillespie – Status of Existing Mitigation Actions

Activity/Project Description	Status			Year Completed	Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)
	No Progress (✓)	In Progress (✓)	Completed (✓)		
Distribute weather radios to critical facilities. (Mitigation Item 5)		✓		Ongoing	Provided weather radios to critical facilities as they are identified
Establish shelter/warming center/cooling center for City residents. (Mitigation Item 22)		✓			Location has been established but is primarily utilized for major utility outages or for overflow from Macoupin County Public Health Clinic warming/cooling center

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 107 **Girard – Status of Existing Mitigation Actions**					
Activity/Project Description	**Status**			**Year Completed**	**Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)**
	No Progress (✓)	**In Progress (✓)**	**Completed (✓)**		
Purchase and install new warning sirens within the County. (Mitigation Item 1)			✓	2017	Replaced storm sirens at west location on Pleasant Hill Rd.
Distribute weather radios to critical facilities. (Mitigation Item 5)			✓	2016	Distributed weather radios to nursing homes, assisted living center, middle school, library, community center and early childhood learning center
Establish shelter/warming center/cooling center for City residents. (Mitigation Item 22)		✓		2011	Open City Hall on critical days during office hours

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 108 **Royal Lakes – Status of Existing Mitigation Actions**					
Activity/Project Description	**Status**			**Year Completed**	**Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)**
	No Progress (✓)	**In Progress (✓)**	**Completed (✓)**		
Distribute weather radios to critical facilities. (Mitigation Item 5)	✓				
Establish shelter/warming center/cooling center for Village residents. (Mitigation Item 22)	✓				

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 109
Staunton – Status of Existing Mitigation Actions

Activity/Project Description	Status			Year Completed	Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)
	No Progress (✓)	In Progress (✓)	Completed (✓)		
Purchase and install new warning sirens within the County. (Mitigation Item 1)			✓	2008	New sirens were installed in 2008
Distribute weather radios to critical facilities. (Mitigation Item 5)	✓				
Conduct a drainage study and make necessary improvements. (Mitigation Item 6)		✓			Completed a study and are in the process of design/engineering
Establish shelter/warming center/cooling center for Village residents. (Mitigation Item 22)		✓			

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 110 Virden – Status of Existing Mitigation Actions					
Activity/Project Description	**Status**			**Year Completed**	**Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)**
	No Progress (✓)	**In Progress (✓)**	**Completed (✓)**		
Purchase and install new warning sirens within the County. (Mitigation Item 1)			✓	2012	
Distribute weather radios to critical facilities. (Mitigation Item 5)	✓				
Establish shelter/warming center/cooling center for City residents. (Mitigation Item 22)	✓				

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure 111
Wilsonville – Status of Existing Mitigation Actions

Activity/Project Description	Status			Year Completed	Summary/Details of Completed Activity/Project (i.e., location, scope, etc.)
	No Progress (✓)	In Progress (✓)	Completed (✓)		
Distribute weather radios to critical facilities. (Mitigation Item 5)			✓	2017	Omni directional storm and emergency siren erected at 99 Wilson Ave. and operated by City of Gillespie through the National Weather Service
Establish shelter/warming center/cooling center for City residents. (Mitigation Item 22)			✓	2017	Using Village Hall as a cooling center

(Mitigation Item "No.") refers to the original action by number detailed in Appendix O.

Figure114
(Sheet 1 of 5)
Macoupin County Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
County Board													
LM	Conduct a county-wide flood study.*	F, SS, SWS	S	Reduces	Medium	2, 3, 5, 6	n/a	n/a	County Board	To Be Determined	To Be Determined	Medium/Medium	Existing (2010)
HM	Trim trees to minimize the amount/duration of power outages.	SS, SWS, T	MP	Reduces	Medium	2, 3, 5	Yes	Yes	County Board	To Be Determined	To Be Determined	Low/High	Existing (2010)
HM	Enforce codes requiring mobile homes to have tie-downs.	SS, T	RA	Reduces	Small	1, 2, 7	Yes	Yes	County Board	To Be Determined	County	Low/High	Existing (2010)
LM	Assess the drainage system throughout the County.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	Yes	Yes	County Board	To Be Determined	To Be Determined	Medium/Medium	Existing (2010)
HM	Upgrade the drainage system throughout the County.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	County Board	To Be Determined	To Be Determined	High/High	Existing (2010)
HM	Purchase and install electrical transfer switches at all critical facilities for use with emergency backup generators to provide uninterrupted power and maintain operations during power outages.	DF, EH, EQ, F, MMH, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	County Board	To Be Determined	To Be Determined	Medium/High	Existing (2010)
County Clerk													
LL	Create digital data sets (maps) of undermined areas within the County for incorporation into the County's GIS system. This information will assist the public and local government officials in considering where to construct new buildings and identify structures vulnerable to subsidence.	MS	MP	Reduces	Medium	1, 2, 3, 5, 7	Yes	Yes	County Clerk	To Be Determined	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought	SWS	Severe Winter Storms & Excessive Cold
EH	Excessive Heat	T	Tornado
EQ	Earthquake		
F	Flood		
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure114
(Sheet 2 of 5)
Macoupin County Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
County Clerk Continued…													
LL	Review and present for adoption the revised Flood Insurance Rate Maps when they become available.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	County Clerk	To Be Determined	County	Low/Medium	New
LL	Make the most recent Flood Insurance Rate Maps available at the County Clerk's Office to assist the public in considering where to construct new buildings and make county officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	County Clerk	To Be Determined	County	Low/High	New
LL	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Small	1, 2, 3, 5, 6, 7	Yes	Yes	County Clerk	To Be Determined	County	Low/High	New
LM	Develop or adapt guidelines or ordinances which require higher building and safety standards for new public and governmental buildings.	EQ, F, MMH, MS, SS, T	RA	Reduces	Small	2, 3, 5, 6	Yes	n/a	County Clerk	To Be Determined	County	Low/Medium	Existing (2010)
LM	Develop ordinance to bury new power lines in subdivisions.	DF, EQ, F, MMH, SS, SWS, T	RA	Reduces	Medium	2, 3, 5	Yes	Yes	County Clerk	To Be Determined	County	Low/Medium	Existing (2010)

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure114
(Sheet 3 of 5)
Macoupin County Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
Emergency Management Agency													
LL	Conduct a Commodity Flow Study.	MMH	S	Reduces	Medium	2, 3, 5	Yes	Yes	EMA	To Be Determined	80% Federal 20% Local	Low/Medium	Existing (2010)
HM	Establish shelters/warming and cooling centers in mobile home parks and recreational areas in the unincorporated portions of the County.	DF, EH, EQ, F, MMH, MS, SS, SWS, T	MP	Reduces	Small	2	n/a	n/a	EMA	To Be Determined	County	Low/High	Existing (2010)
LM	Conduct a study to determine areas in the County that need new sirens.	SS, T	S	Reduces	Medium	2	n/a	n/a	EMA	To Be Determined	To Be Determined	Low/Medium	Existing (2010)
HM	Purchase and install new warning siren systems within the County.	SS, T	MP	Reduces	Large	2	n/a	n/a	EMA	To Be Determined	To Be Determined	Medium/High	Existing (2010)
LM	Develop and distribute educational materials (including first aid kits, weather radios and pamphlets) to the general public that identify the measures that can be taken to protect their lives and property from natural hazard events.	DF, EH, EQ, F, SS, SWS, T	PI	Reduces	Medium	1, 2	n/a	n/a	County Board	To Be Determined	To Be Determined	Low/High	Existing (2010)
ETSB													
LM	Improve emergency radio coverage throughout the County.	DF, EH, EQ, F, MMH, SS, SWS, T	MP	Reduces	Large	2	Yes	Yes	ETSB	To Be Determined	To Be Determined	Medium/Medium	Existing (2010)
HM	Institute Reverse 911 or similar mass notification system.	DF, EH, EQ, F, MMH, SS, SWS, T	MP	Reduces	Large	2	n/a	n/a	ETSB	To Be Determined	To Be Determined	Medium/High	Existing (2010)

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought	SWS	Severe Winter Storms & Excessive Cold
EH	Excessive Heat	T	Tornado
EQ	Earthquake		
F	Flood		
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 114
(Sheet 4 of 5)
Macoupin County Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
Health Department													
HM	Purchase and install an automatic emergency backup generator at the Maple Street Clinic to provide uninterrupted power and maintain operations during a power outage. The Clinic is used as a designated warming/cooling center and a medical, behavioral and dispensing site in the event of a bioterrorism incident.	EH, EQ, F, MMH, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	n/a	Yes	Health Department	To Be Determined	To Be Determined	Medium/High	New
HM	Design and construct an Emergency Operations Center at the Health Department (retrofit an existing area or construct a new multi-function room) to use during natural hazard and other emergency events.	DF, EH, EQ, F, MMH, SS, SWS, T	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Health Department	To Be Determined	To Be Determined	High/High	New
LM	Develop a database that identifies access and functional needs populations within the County.	DF, EH, EQ, F, MMH, SS, SWS, T	PI	Reduces	Small	2, 4	n/a	n/a	Health Department	To Be Determined	To Be Determined	Low/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 114
(Sheet 5 of 5)
Macoupin County Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
Highway Department													
LL	Conduct a study to evaluate bridge infrastructure strength.	DF, EQ, F, MS	S	Reduces	Medium	2, 3, 5	n/a	Yes	Highway Department	To Be Determined	To Be Determined	Low/Medium	Existing (2010)
Supervisor of Assessments													
LM	Develop Digital Flood Insurance Rate Maps (DFIRMs) for the entire County, including all incorporated municipalities. Create digital data sets of these maps for incorporation into the County's GIS system. FIRMs have not yet been developed for the County. Only three of the municipalities have FIRMs, but these maps have not been updated since the 1980s.*	F, SS, SWS	S	Reduces	Medium	1, 2, 3, 5, 6, 7	Yes	n/a	Supervisor of Assessments	To Be Determined	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 115
(Sheet 1 of 2)
Benld Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Purchase and install an automatic emergency backup generator at City Hall to provide uninterrupted power and maintain operations during a power outage.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	n/a	Yes	City Council	2-5 years	To Be Determined	Medium/High	New
HM	Purchase portable emergency backup generators for use at lift stations to maintain operations during power outages.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council	2-5 years	To Be Determined	Low/High	New
HM	Repair/reline sewer line sections/mains to reduce stormwater infiltration and prevent sewage backups.	F, SS, SWS	SP	Eliminates	Medium	2, 3, 5	Ye	Yes	City Council	2-5 years	75% Federal 25% Local	Medium/High	New
HM	Remove debris, vegetative overgrowth, snags and drifts from streams and creeks within the City to maintain/increase carrying capacity, better manage stormwater runoff and reduce/prevent drainage problems.	F, SS, SWS	MP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	Ongoing	City	Low/High	New
HM	Clean out and replace/upsize roadway culverts and reshape/regrade waterways/drainage ditches within the City to increase carrying capacity, alleviate drainage issues and prevent roadway overtopping and subsequent washouts/pavement failures.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	Ongoing	To Be Determined	Medium/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 115
(Sheet 2 of 2)
Benld Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Purchase and install an automatic emergency backup generator at the Police Station to provide uninterrupted power and maintain operations during a power outage.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	n/a	Yes	City Council	2-5 years	To Be Determined	Medium/High	New
HM	Designate the Benld Senior Citizens Center as a warming/cooling center for City residents.	EH, SWS	MP	Reduces	Small	2	n/a	n/a	City Council	To Be Determined	City	Low/High	New
HM	Retrofit the Benld Senior Citizens Center (equipped with HVAC, upgraded bathrooms and insulated) to serve as a heating and cooling center for City residents.	EH, SWS	MP	Reduces	Small	2, 3, 5	n/a	Yes	City Council	2-5 years	TBD	Medium/High	New
HM	Purchase and install an automatic emergency backup generator at the Benld Senior Citizens Center to provide uninterrupted power and maintain operations during a power outage.	EH, SWS	MP	Eliminates	Small	2, 3, 5	n/a	Yes	City Council	2-5 years	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought	SWS	Severe Winter Storms & Excessive Cold
EH	Excessive Heat	T	Tornado
EQ	Earthquake		
F	Flood		
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 116
Brighton Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Replace and expand the City's storm sewer system along West Central Street to increase capacity and better manage stormwater runoff.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	Village Board / Public Works	1-2 years	75% Federal 25% Local	High/High	New
LM	Conduct sewer line reconnaissance study to identify locations where storm water infiltrates the lines.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	Yes	Yes	Village Board / Public Works	1-2 years	75% Federal 25% Local	Medium/High	New
HM	Repair/reline sewer line sections where storm water infiltration is occurring to prevent sewage backups.	F, SS, SWS	SP	Eliminates	Medium	2, 3, 5	Ye	Yes	Village Board / Public Works	1-2 years	75% Federal 25% Local	High/High	New
HM	Purchase and install new outdoor warning siren system.	SS, T	MP	Reduces	Large	2	n/a	n/a	Village Board / Public Safety	1-3 years	To Be Determined	Medium/High	New
HM	Install new storm water drainage system (ditches, culverts, etc.) in the Georgene Acres Subdivision to alleviate drainage/flooding problems.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	Village Board / Public Works	2 years	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 117
(Sheet 1 of 3)
Bunker Hill Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
HM	Clean debris/obstructions out of culverts to maximize carrying capacity, reduce/prevent drainage problems and prevent roadway overtopping and washouts/pavement failures prevent roadway overtopping and washouts/pavement failures.	F, SS, SWS	MP	Reduces	Medium	2, 3, 5	Yes	Yes	Street Department	Ongoing	City	Low/High	New
HM	Replace/upsize roadway culverts as need to increase carrying capacity, alleviate drainage problems and prevent roadway overtopping and washouts/pavement failures.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Street Department	Ongoing	To Be Determined	Medium/Medium	New
HM	Reshape/regrade existing waterways/ drainage ditches where needed to maintain/increase carrying capacity, alleviate drainage problems, prevent roadway overtopping and washouts/pavement failures.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Street Department	Ongoing	To Be Determined	Medium/Medium	New
LM	Upgrade/retrofit drinking water system (lines, water mains, fire hydrants, pumping system, etc.) to ensure a constant supply of water for residents and aid in fire suppression during natural hazard events.	DR, EH, EQ, F, SS, SWS, T	SP	Reduces	Large	2, 3, 5	Yes	Yes	Water Department	To Be Determined	To Be Determined	High/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 117 (Sheet 2 of 3) Bunker Hill Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LM	Conduct sewer line reconnaissance study to identify locations where stormwater infiltrates the lines.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	Yes	Yes	Sewer Department	Ongoing	75% Federal 25% Local	Medium/High	New
HM	Repair/reline sewer line sections/mains to reduce stormwater infiltration and prevent sewage backups.	F, SS, SWS	SP	Eliminates	Medium	2, 3, 5	Ye	Yes	Sewer Department	To Be Determined	75% Federal 25% Local	High/High	New
HM	Remove debris, vegetative overgrowth, snags and drifts from streams and creeks within the City to maintain/increase carrying capacity, better manage stormwater runoff and reduce/prevent drainage problems.	F, SS, SWS	MP	Reduces	Small	2, 3, 5, 6	Yes	Yes	City Council	Ongoing	City	Low/High	New
LM	Conduct drainage/hydraulic study to determine the cause(s) and identify the appropriate remedy(s) to alleviate recurring drainage/flooding problems along Washington St.	F, SS, SWS	MP	Reduces	Small	2, 3, 5	Yes	Yes	Street Department	To Be Determined	75% Federal 25% Local	Medium/Medium	New
HM	Purchase portable emergency backup generators for use at lift stations to maintain operations during power outages.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	Sewer Department	2-5 years	To Be Determined	Low/High	New
HM	Purchase and install new outdoor warning siren system.	SS, T	MP	Reduces	Large	2	n/a	n/a	City Council	1-3 years	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
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HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 117
(Sheet 3 of 3)
Bunker Hill Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Develop/purchase an automated telephone warning system(reverse 911) to notify residents/responders of emergency information	DF, EH, EQ, MMH, SS, SWS, T	MP	Reduces	Large	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Medium/High	New
HM	Install a lift station at Foot Street and New Lake Road to increase capacity, better manage stormwater runoff, and alleviate drainage problems and backups.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	Medium/Medium	New

Acronyms

Priority

- HM Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
- LM Mitigation action with the potential to reduce impacts from the most significant hazards
- HL Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
- LL Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

- DF Dam Failure
- DR Drought
- EH Excessive Heat
- EQ Earthquake
- F Flood
- MMH Man-made Hazards
- SS Severe Storms (Thunderstorms, Hail, Lightning)
- SWS Severe Winter Storms & Excessive Cold
- T Tornado

Type of Mitigation Activity:

- RA Regulatory Activities
- SP Structural Projects
- PI Public Involvement
- S Studies
- MP Miscellaneous Projects
- PP Property Protection

Figure 118
(Sheet 1 of 3)
Carlinville Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LM	Develop and implement an outreach program that works with local businesses to identify the risks to their employees and properties from natural hazard events, the actions they can take to reduce or eliminate those risks and the steps they can take to maintain operations after a natural hazard event.	DF, EQ, F, SS, SWS, T	PI	Reduces	Small	1, 2	n/a	n/a	City Council	To Be Determined	To Be Determined	Low/High	New
LM	Develop/distribute public information materials that inform residents about the risks to life and property associated with natural hazards and the proactive actions that they can take to reduce or eliminate their risk.	DF, DR, EH, EQ, F, SS, SWS, T	PI	Reduces	Large	1, 2	Yes	Yes	City Council	To Be Determined	To Be Determined	Low/High	New
HM	Clean debris/obstructions out of culverts to maximize carrying capacity and reduce/prevent drainage problems.	F, SS, SWS	MP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	Ongoing	City	Low/High	New
HM	Develop/purchase an automated telephone warning system(reverse 911) to notify residents/responders of emergency information	DF, EH, EQ, MMH, SS, SWS, T	MP	Reduces	Large	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 118
(Sheet 2 of 3)
Carlinville Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LM	Create volunteer networks to: 1) check on/assist access and functional needs residents during natural hazard events; 2) assess building conditions following a natural hazard event; 3) conduct sandbagging operations to reduce flood damages.	DF, EQ, EH, F, SS, SWS, T	PI	Reduces	Small	2	n/a	n/a	City Council	To Be Determined	City	Low/High	New
LL	Review and present for adoption the revised Flood Insurance Rate Maps when they become available.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/Medium	New
LL	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make city officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
LL	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Small	1, 2, 3, 5, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
HM	Conduct a sewer upgrade to separate stormwater and sanitary lines.	F, SS, SWS	SP	Eliminates	Large	2, 3, 5	Yes	Yes	City Council	1 year	75% Federal 25% Local	High/High	Existing (2010)

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 118
(Sheet 3 of 3)
Carlinville Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
HM	Establish shelters/warming/cooling centers for City residents.	EH, EQ, F, SS, SWS, T	MP	Reduces	Medium	2	n/a	n/a	City Council	3 years	City	Low/High	Existing (2010)
HL	Re-route rail line around Carlinville.	MMH	MP	Eliminates	Small	2, 3, 5	Yes	Yes	City Council	5 years	To Be Determined	High/Medium	Existing (2010)

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 119
(Sheet 1 of 4)
Gillespie Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Purchase and install electrical hookups at the Gillespie Municipal Building/Civic Center (a designated emergency shelter and warming/cooling center) for use with portable emergency backup generator to provide uninterrupted power and maintain operations during a power outage.	DF, EH, EQ, F, SS, SWS, T	MP	Eliminates	Small	2	n/a	Yes	City Council / Aldermen	To Be Determined	To Be Determined	Low/High	New
LL	Evaluate the vulnerability of the City's wastewater treatment facility (including lagoons and outflow structure) to earthquakes.	EQ	S	Reduces	Large	2, 3, 5	n/a	Yes	City Council / Aldermen	To Be Determined	To Be Determined	Low/Medium	New
HL	Seismically harden the identified vulnerable components of the City's wastewater treatment facility.	EQ	SP	Reduces	Large	2, 3, 5	n/a	Yes	City Council / Aldermen	To Be Determined	To Be Determined	High/Medium	New
HM	Purchase and install new outdoor warning siren system.	SS, T	MP	Reduces	Large	2	n/a	n/a	City Council / EMA	To Be Determined	To Be Determined	Medium/High	New
HM	Separate the combined sewer system on the City's west side to maximize the carrying capacity of the sewer system, accommodate stormwater flow and reduce the potential for sewer backups and drainage problems.	F, SS, SWS	SP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council / Sewer Department	To Be Determined	75% Federal 25% Local	High/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 119
(Sheet 2 of 4)
Gillespie Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Construct retention pond adjacent to the wastewater treatment facility to manage excess storm water runoff that overwhelms the facility's capacity during heavy rain events due to infiltration of the sewer system and the partially combined sewer system on the City's west side.	F, SS, SWS	SP	Reduces	Large	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	High/High	New
HM	Install additional stormwater relief drains and catch basins along the existing system to alleviate recurring drainage/flooding problems.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	Medium/Medium	New
HM	Remove debris, vegetative overgrowth, snags and drifts from streams and creeks within the City to maintain/increase carrying capacity, better manage stormwater runoff and reduce/prevent drainage problems.	F, SS, SWS	MP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	Ongoing	City	Low/High	New
HM	Clean out and replace/upsize roadway culverts and reshape/regrade waterways/drainage ditches within the City to increase carrying capacity, alleviate drainage issues and prevent roadway overtopping and subsequent washouts/pavement failures.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council / Street Department	To Be Determined	To Be Determined	Medium/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 119
(Sheet 3 of 4)
Gillespie Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Purchase and install an automatic emergency backup generator at the Gillespie Municipal Building/Civic Center (a designated emergency shelter and warming/cooling center) to provide uninterrupted power and maintain operations during a power outage.	DF, EH, EQ, F, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	n/a	Yes	City Council / Aldermen	To Be Determined	To Be Determined	Medium/High	New
HM	Purchase and install an automatic emergency backup generator at lift stations to provide uninterrupted power and maintain operations during a power outage.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council / Aldermen	To Be Determined	To Be Determined	Medium/High	New
HL	"Harden" the New Gillespie Lake Dam to make it resistant to natural hazard events. Potential hardening activities include: replacing the spillway panels, reinforcing the dam, sealing below the spillway to prevent water infiltration and leaks that have the potential to lead to a dam/spillway failure.	EQ, DF, F, SS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	High/Medium	New
LL	Review and present for adoption the revised Flood Insurance Rate Maps when they become available.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/Medium	New

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 119
(Sheet 4 of 4)
Gillespie Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LL	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make city officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
LL	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Small	1, 2, 3, 5, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
HM	Distribute weather radios to critical facilities.	EH, EQ, F, SS, SWS, T	MP	Reduces	Medium	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Low/High	Existing (2010)
HM	Establish shelters/warming/cooling centers for Village residents.	EH, EQ, F, SS, SWS, T	MP	Reduces	Medium	2	n/a	n/a	City Council	To Be Determined	City	Low/High	Existing (2010)

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 120
(Sheet 1 of 2)
Girard Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
HM	Purchase and install an automatic emergency backup generator at the Girard Community Center (a designated emergency shelter) to provide uninterrupted power and maintain operations during a power outage.	EQ, F, SS, T	MP	Eliminates	Medium	2, 3, 5	n/a	Yes	City Council / Community Center Board of Directors	1 year	To Be Determined	Medium/High	New
HM	Purchase and install an automatic emergency backup generator at the Girard Fire House to provide uninterrupted power and maintain operations during a power outage.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	n/a	Yes	City Council / Fire Protection District	1 year	To Be Determined	Medium/High	New
HM	Upgrade/retrofit storm sewer system to better manage stormwater runoff in an effort to alleviate flooding/drainage problems.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council / Street Department	2 years	To Be Determined	Medium/Medium	New
LM	Upgrade/retrofit drinking water system (lines, water mains, fire hydrants, pumping system, etc.) to ensure a constant supply of water for residents and aid in fire suppression during natural hazard events.	DR, EH, EQ, F, SS, SWS, T	SP	Reduces	Large	2, 3, 5	Yes	Yes	City Council / Street Department	2 years	To Be Determined	High/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 120
(Sheet 2 of 2)
Girard Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LM	Evaluate the need and cost of implementing an automated telephone warning system (reverse 911) to notify residents/responders of emergency information.	DF, EH, EQ, MMH, SS, SWS, T	S	Reduces	Large	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Low/High	New
HM	Establish shelters/warming/cooling centers for City residents.	EH, EQ, F, SS, SWS, T	MP	Reduces	Medium	2	n/a	n/a	City Council	To Be Determined	City	Low/High	Existing (2010)

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 121
(Sheet 1 of 3)
Mount Olive Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Purchase and install an automatic emergency backup generator at the wastewater treatment plant to provide uninterrupted power and maintain operations during a power outage.	DF, EH, EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	n/a	Yes	City Council	To Be Determined	To Be Determined	Medium/High	New
HM	"Harden" the wastewater treatment plant's trickling filter dome to make it resistant to natural hazard events.	EQ, SS, SWS, T	SP	Reduces	Large	2, 3, 5	n/a	Yes	City Council	To Be Determined	To Be Determined	Medium/High	New
HM	Purchase and install an automatic emergency backup generator at the drinking water treatment facility to provide uninterrupted power and maintain operations during a power outage.	DF, EH, EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	n/a	Yes	City Council	To Be Determined	To Be Determined	Medium/High	New
LM	Prepare an emergency operations plan for the City's public water system.	DF, DR, EQ, F, MMH, SS, SWS, T	S	Reduces	Large	2, 3, 4, 5,	Yes	Yes	City Council	To Be Determined	To Be Determined	Low/High	New
HM	Install a lift station at Lake Street and 4th or 5th Streets to increase capacity, better manage stormwater runoff, and alleviate drainage problems and backups.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	Medium/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 121
(Sheet 2 of 3)
Mount Olive Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Design and construct an Emergency Operations Center at the Police Station (retrofit an existing area or construct a new multi-function room) to use during natural hazard and other emergency events.	DF, EH, EQ, F, MMH, SS, SWS, T	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	High/High	New
HM	Purchase portable emergency backup generators for use at lift stations to maintain operations during power outages.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	Low/High	New
LM	Conduct sewer line reconnaissance study to identify locations where storm water infiltrates the lines.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	Medium/High	New
HM	Repair/reline sewer line sections/mains to reduce stormwater infiltration and prevent sewage backups.	F, SS, SWS	SP	Eliminates	Medium	2, 3, 5	Ye	Yes	City Council	To Be Determined	75% Federal 25% Local	Medium/High	New
LL	Evaluate the vulnerability of the City's wastewater treatment facility (including lagoons and outflow structure) to earthquakes.	EQ	S	Reduces	Large	2, 3, 5	n/a	Yes	City Council	To Be Determined	To Be Determined	Low/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 121
(Sheet 3 of 3)
Mount Olive Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
HL	"Harden" both the Mt. Olive City Lake Dam and the Old Mt. Olive City Lake Dam to make them resistant to natural hazard events. Potential hardening activities include: replacing the spillway panels, reinforcing the dams, sealing below the spillways to prevent water infiltration and leaks that have the potential to lead to a dam/spillway failure.	EQ, DF, F, SS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	High/Medium	New
LM	Upgrade/retrofit drinking water system (lines, water mains, fire hydrants, pumping system, etc.) to ensure a constant supply of water for residents and aid in fire suppression during natural hazard events.	DR, EH, EQ, F, SS, SWS, T	SP	Reduces	Large	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	High/Medium	New
LM	Prepare an emergency operations plan for the City with functional and hazard-specific annexes addressing: 1) health and medical services and emergency mortuary services for mass casualty incidents; 2) mass care for temporary shelter and essential life support needs for residents displaced by a disaster; and 3) hazardous materials incident response.	EH, EQ, F, SS, SWS, T	S	Reduces	Large	2, 3, 4, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	Low/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 122
Royal Lakes Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Design and construct a community safe room (tornado shelter) equipped with emergency backup generator and HVAC units that can also serve as an emergency shelter/warming and cooling center for Village residents.	EH, F, SS, SWS, T	SP	Reduces	Large	2	Yes	n/a	Village Board	To Be Determined	75% Federal 25% Local	High/High	New
HM	Install new storm water drainage system (ditches, culverts, etc.) in select areas of the Village to alleviate drainage/flooding problems.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Village Board	To Be Determined	To Be Determined	High/High	New
HM	Distribute weather radios to critical facilities.	EH, EQ, F, SS, SWS, T	MP	Reduces	Large	2	n/a	n/a	Village Board	To Be Determined	To Be Determined	Medium/High	Existing (2010)
HM	Establish shelters/warming/cooling centers for Village residents.	EH, EQ, F, SS, SWS, T	MP	Reduces	Medium	2	n/a	n/a	Village Board	To Be Determined	Village	Low/High	Existing (2010)

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought	SWS	Severe Winter Storms & Excessive Cold
EH	Excessive Heat	T	Tornado
EQ	Earthquake		
F	Flood		
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 123
(Sheet 1 of 2)
Staunton Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
HM	Design and construct a stormwater retention basin on the southeast edge of the City to store stormwater runoff and reduce the likelihood of flooding.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	High/Medium	New
LM	Conduct sewer line reconnaissance study to identify locations where storm water infiltrates the lines.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	Medium/High	New
HM	Repair/reline sewer line sections where storm water infiltration is occurring to prevent sewage backups.	F, SS, SWS	SP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	High/High	New
HM	Install upsized stormwater drain on Lafayette St. between Caldwell St. and Union St. down to Pennsylvania St. to better manage stormwater runoff and alleviate recurring drainage/flooding problems.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	High/Medium	New
HM	Purchase and install automatic emergency backup generator at lift stations to provide uninterrupted power and maintain operations during a power outage.	DF, EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	Medium/High	New
HM	Install riprap along Ginseng Creek through the City to stabilize the banks, reduce erosion, maintain carrying capacity and prevent future potential flooding problems on adjacent properties.	DF, F, SS, SWS	SP	Reduces	Small	2, 3, 5	n/a	Yes	City Council	To Be Determined	To Be Determined	Medium/Medium	New

\Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 123
(Sheet 2 of 2)
Staunton Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LL	Review and present for adoption the revised Flood Insurance Rate Maps when they become available.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/Medium	New
LL	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make city officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
LL	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Small	1, 2, 3, 5, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
HM	Distribute weather radios to critical facilities.	EH, EQ, F, SS, SWS, T	MP	Reduces	Large	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Low/High	Existing (2010)

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 124
(Sheet 1 of 3)
Virden Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
LM	Prepare an emergency operations plan for the City with functional and hazard-specific annexes addressing: 1) health and medical services and emergency mortuary services for mass casualty incidents; 2) mass care for temporary shelter and essential life support needs for residents displaced by a disaster; and 3) hazardous materials incident response.	EH, EQ, F, SS, SWS, T	S	Reduces	Large	2, 3, 4, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	Low/Medium	New
HM	Designate warming & cooling centers within the City	EH, SWS	MP	Reduces	Small	2	n/a	n/a	City Council	To Be Determined	City	Low/High	New
HM	Designate emergency shelters within the City.	EQ, F, SS, SWS, T	MP	Reduces	Medium	2	n/a	n/a	City Council	To Be Determined	City	Low/High	New
HM	Retrofit a public building to include a community safe room (tornado shelter) and/or design and construct a new community safe room for use by City residents. The community safe room would be equipped with automatic emergency backup generator and heating/air conditioning units that can also serve as an emergency shelter and warming/cooling center.	EH, EQ, F, SS, SWS, T	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	75% Federal 25% Local	High/High	New
LL	Once completed, review the County's GIS mapping of undermined areas to identify vulnerable areas in the City.	MS	S	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	City	Low/Medium	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure
DR	Drought
EH	Excessive Heat
EQ	Earthquake
F	Flood
MMH	Man-made Hazards
SS	Severe Storms (Thunderstorms, Hail, Lightning)
SWS	Severe Winter Storms & Excessive Cold
T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities
SP	Structural Projects
PI	Public Involvement
S	Studies
MP	Miscellaneous Projects
PP	Property Protection

Figure 124
(Sheet 2 of 3)
Virden Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
LM	Develop ordinance to bury new power lines in subdivisions.	DF, EQ, F. SS, SWS, T	RA	Reduces	Small	2, 3, 5	Yes	Yes	City Council	To Be Determined	City	Low/Medium	New
LM	Conduct a comprehensive drainage/hydraulic study to determine the cause(s) and identify the appropriate remedy(s) to alleviate recurring drainage problems within the City. The study should contain an inventory of the storm sewer system and mapping showing inlets, pipe sizes, length, type condition, etc.).	F, SS, SWS	S	Reduces	Large	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	Medium/Medium	New
HM	Select, design and construct the appropriate drainage remedy(s) to alleviate recurring drainage problems within the City.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	To Be Determined	To Be Determined	Medium/Medium	New
LL	Review and present for adoption the revised Flood Insurance Rate Maps when they become available.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/Medium	New
LL	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make city officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Small	1, 2, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure
DR	Drought
EH	Excessive Heat
EQ	Earthquake
F	Flood
MMH	Man-made Hazards
SS	Severe Storms (Thunderstorms, Hail, Lightning)
SWS	Severe Winter Storms & Excessive Cold
T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities
SP	Structural Projects
PI	Public Involvement
S	Studies
MP	Miscellaneous Projects
PP	Property Protection

Figure 124
(Sheet 3 of 3)
Virden Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
							New	Existing					
LL	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Small	1, 2, 3, 5, 6, 7	Yes	Yes	City Council	To Be Determined	City	Low/High	New
HM	Purchase and install new warning sirens within the City.	SS, T	MP	Reduces	Medium	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Medium/High	Existing (2010)
HM	Distribute weather radios to critical facilities within the City.	EH, EQ, F, SS, SWS, T	MP	Reduces	Large	2	n/a	n/a	City Council	To Be Determined	To Be Determined	Low/High	Existing (2010)

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought		
EH	Excessive Heat	SWS	Severe Winter Storms & Excessive Cold
EQ	Earthquake		
F	Flood	T	Tornado
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 125
Wilsonville Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure: New	Reduce Effects of Hazard(s) on Buildings & Infrastructure: Existing	Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis	Status
HM	Purchase and install an automatic emergency backup generator at the Community Center to provide uninterrupted power during power outages.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	n/a	Yes	Village Board	5 years	To Be Determined	Medium/High	New
HM	Purchase and install an automatic emergency backup generator at the Village/Police Complex, a designated cooling center, to provide uninterrupted power during power outages.	EH, EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	n/a	Yes	Village Board	7 years	To Be Determined	Medium/High	New

Acronyms

Priority

HM	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the most significant hazards
LM	Mitigation action with the potential to reduce impacts from the most significant hazards
HL	Mitigation action with the potential to virtually eliminate or significantly reduce impacts from the less significant hazards
LL	Mitigation action with the potential to reduce impacts from the less significant hazards

Hazard(s) to be Mitigated:

DF	Dam Failure	SS	Severe Storms (Thunderstorms, Hail, Lightning)
DR	Drought	SWS	Severe Winter Storms & Excessive Cold
EH	Excessive Heat	T	Tornado
EQ	Earthquake		
F	Flood		
MMH	Man-made Hazards		

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

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5.0 PLAN MAINTENANCE

5.0 PLAN MAINTENANCE

This section focuses on the Federal Emergency Management Agency (FEMA) requirements for maintaining and updating the Plan once it has been approved by FEMA and adopted by the participating jurisdictions. These requirements include:

- establishing the method and schedule for monitoring, evaluating and updating the Plan;
- describing how the mitigation strategy will be incorporated into existing planning processes; and
- detailing how continued public input will be obtained.

These requirements ensure that the Plan remains an effective and relevant document. Provided below is detailed discussion of each requirement.

5.1 MONITORING, EVALUATING & UPDATING THE PLAN

The County must establish a method and schedule for monitoring, evaluating and updating the Plan. This method allows the participating jurisdictions to review and adjust the planning process as needed, make necessary changes and updates to the Plan and track the implementation and results of the mitigation actions that have been undertaken.

5.1.1 Monitoring and Evaluating the Plan

The updated Plan will be monitored and evaluated by a Plan Maintenance Subcommittee on an annual basis. The Plan Maintenance Subcommittee will be composed of key members from the Planning Committee, including representatives from all of the participating jurisdictions. The Subcommittee will be chaired by the Macoupin County Emergency Management Agency (EMA). All meetings held by the Subcommittee will be open to the public. The information gathered at each Subcommittee meeting will be documented and provided to all participating jurisdictions for their review and use in the Plan update.

The Macoupin County EMA will be responsible for monitoring the status of the mitigation actions identified in the updated Plan and providing the Illinois Emergency Management Agency (IEMA) with an annual progress report. It will be the responsibility of each participating jurisdiction to provide a progress report on the status of their mitigation actions at each Subcommittee meeting.

Monitoring & Evaluating

- A Plan Maintenance Subcommittee will be formed to monitor and evaluate the updated Plan.
- The updated Plan will be monitored and evaluated on an ***annual basis***.
- Each participating jurisdiction will be responsible for providing an annual progress report on the status of their mitigation actions.
- New mitigation actions can be added by participating jurisdictions during the annual evaluation.

The Plan Maintenance Subcommittee will also evaluate the updated Plan on an annual basis to determine the effectiveness of the planning process and the implemented mitigation actions. In addition, the Subcommittee will decide whether any changes need to be made. As part of the evaluation of the planning process, the Subcommittee will review the goals to determine whether they are still relevant or if new goals need to be added; assess whether other natural or man-made hazards need to be addressed or included in the updated Plan and review any new hazard data that may affect the Risk Assessment portion of the updated Plan. The Subcommittee will also evaluate whether other County departments should be invited to participate.

In terms of evaluating the effectiveness of the mitigation actions that have been implemented, the Subcommittee will assess whether a project is on time, in line with the budget and moving ahead as planned; whether the project achieved the goals outlined and had the intended result; and whether losses were avoided as a result of the project. In addition, each of the participating jurisdictions will be given an opportunity to add new mitigation actions to the updated Plan and modify or withdraw mitigation actions already identified. In some cases a project may need to be removed from the list of mitigation actions because of unforeseen problems with implementation.

5.1.2 Updating the Plan

The Plan must be updated within five years of the date the first participating jurisdiction adopts the updated Plan. (This date can be found in Section 7, Plan Adoption.) This ensures that all the participating jurisdictions will remain eligible to receive federal grant money to implement those mitigation actions identified in this Plan.

The Macoupin County EMA, with assistance from the Plan Maintenance Subcommittee, will be responsible for updating the Plan. The Plan update will incorporate all of the information gathered and changes proposed at the previous annual monitoring and evaluation meetings. In addition, any government entity that did not take part in the previous planning process that now wishes to participate may do so. It will be the responsibility of these entities to provide all of the information needed to be integrated into the updated Plan.

A public forum will be held to present the updated Plan to the public for review and comment. The comments received at the public forum will be reviewed and incorporated into the updated Plan. The updated Plan will then be submitted to IEMA and FEMA for review and approval. ***Once the updated Plan has received state and federal approval, FEMA requires that each of the participating jurisdictions re-adopt the Plan to remain eligible to receive federal grant money to implement the identified mitigation actions.***

Updating the Plan

- The Schuyler County EMA, with assistance from the Plan Maintenance Subcommittee, will be responsible for updating the Plan.
- The Plan ***must be updated within 5 years*** of the date ***the first participating jurisdiction adopts*** the updated Plan.
- Any government entities that did not take part in the previous planning process but who now wish to participate may do so.
- Once the updated Plan has received FEMA/IEMA approval, each participating jurisdiction ***must re-adopt the Plan*** to remain eligible to receive federal grant money.

5.2 Incorporating the Mitigation Strategy into Existing Planning Mechanisms

As part of the planning process, the Planning Committee identified current plans, policies/ordinances and maps that supplement or help support mitigation planning efforts. **Figure 7** identifies the existing planning mechanism available by jurisdiction. It will be the responsibility of each participating jurisdiction to incorporate, where applicable, the mitigation strategy and other information contained in the updated Plan into the planning mechanisms identified for their jurisdiction.

5.3 CONTINUED PUBLIC INVOLVEMENT

The County and participating jurisdictions understand the importance of continued public involvement and will seek public input on the updated Plan throughout the plan maintenance process. A copy of the approved updated Plan will be maintained and available for review at the Macoupin County EMA Office. Individuals will be encouraged to provide feedback and submit comments for the next Plan update to the Macoupin County EMA.

The comments received will be compiled and presented at the annual Plan Maintenance Subcommittee meetings where members will consider them for incorporation into the updated Plan. All meetings held by the Plan Maintenance Subcommittee will be noticed and open to the public. A separate public forum will be held prior to the next Plan update to provide the public an opportunity to comment on the proposed changes.

6.0 PLAN ADOPTION

6.0 PLAN ADOPTION

The final step in the planning process is the adoption of the approved updated Plan by each participating jurisdiction. Each jurisdiction must formally re-adopt the Plan to remain eligible for federal grant money to implement mitigation actions identified in this Plan.

6.1 PLAN ADOPTION PROCESS

Before the updated Plan can be adopted by the participating jurisdictions, it must be made available for public review and comment through a public forum and comment period. Any comments received are incorporated into the updated Plan and the Plan is then submitted to the Illinois Emergency Management Agency (IEMA) and the Federal Emergency Management Agency (FEMA) for their review and approval.

Once IEMA and FEMA have reviewed and approved the updated Plan, it will be presented to the County and each participating jurisdiction for adoption. ***Each participating jurisdiction must formally adopted*** the updated Plan to remain or become eligible to receive federal grant money to implement the mitigation actions identified in this Plan. If any of the jurisdiction choose not to adopt the updated Plan, their choice will not affect the eligibility of those that do adopt the updated Plan.

Figure 126 identifies the participating jurisdictions and the date each formally adopted the updated Plan. Signed copies of the adoption resolutions are located in **Appendix P**.

Figure 126
Plan Adoption Dates

Participating Jurisdiction	Plan Adoption Date
Macoupin County	
Benld, City of	
Brighton, Village of	
Bunker Hill, City of	
Carlinville, City of	
Gillespie, City of	
Girard, City of	
Mount Olive, City of	
Royal Lakes, Village of	
Staunton, City of	
Virden, City of	
Wilsonville, Village of	

7.0 REFERENCES

7.0 REFERENCES

Provided below is a listing, by section, of the resources utilized to create this document.

1.0 INTRODUCTION

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1.3 Land Use and Development Trends

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2.0 PUBLIC INVOLVEMENT

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2.4 INCORPORATING EXISTING PLANNING DOCUMENTS

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4.0 MITIGATION STRATEGY

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2. Macoupin County Multi-Jurisdictional All Hazards Mitigation Planning Committee. New Hazard Mitigation Projects. Form. 23 January 2018.