

Jackson County, Illinois Multi-Hazard Mitigation Plan

A 2015 Update of the 2009 Countywide MHMP



FEMA



Multi-Hazard Mitigation Plan
Jackson County, Illinois

Adoption Date: -- _____ --

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Section 1. Introduction

Hazard mitigation is any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) makes reducing hazards one of its primary goals; hazard-mitigation planning and the subsequent implementation of mitigation projects, measures, and policies is a primary mechanism in achieving FEMA's goal.

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is required in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs. In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt an MHMP.

In recognition of the importance of planning in mitigation activities, FEMA created Hazus Multi-Hazard (Hazus-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to estimate losses from floods, hurricanes, earthquakes, and other natural hazards and to measure the impact of various mitigation practices that might help reduce those losses. The Illinois Emergency Management Agency (IEMA) has determined that Hazus-MH should play a critical role in the risk assessments performed in Illinois.

Jackson County completed their first Multi-Hazard Mitigation Plan in 2009. Throughout the five-year planning cycle, the Jackson County Emergency Management Agency and Mitigation Planning Team reconvened to monitor, evaluate, and update the plan on an annual basis. Southern Illinois University Carbondale (SIU), Greater Egypt Regional Planning and Development Commission (Greater Egypt) and Jackson County have joined efforts in updating the County's first mitigation plan. The update process addressed changes in the probability and impact of specific hazards to the county, as well as changes in land-use, population, and demographics. The plan incorporates detailed GIS and Hazus-MH Level 2 analyses to improve the risk assessment, and finally revised and updated mitigation strategies. This document hereby serves as Jackson County's Multi-Hazard Mitigation Plan update.

Section 2. Planning Process

2.1 Timeline

The MHMP update process is broken into a series of four meetings. These meetings were organized by SIU, Greater Egypt and hosted by the Jackson County Emergency Management Agency. At these meetings, various tasks were completed by SIU, Greater Egypt, and the Jackson County Mitigation Planning Team.

Meeting 1: Introduction of the MHMP process and organize resources. SIU gathered local resources that contributed to the detailed county risk assessment and presented the county's historical hazards. Based on this information, the Planning Team identified natural hazards to include in the plan, and ranked hazards by potential damages and occurrences.

Meeting 2: SIU presented the draft risk assessment, derived from the Hazus-MH and GIS modeling of the identified disasters, to the Planning Team. The general public was invited to this meeting through a series of newspaper articles and/or radio spots. At the end of the meeting, SIU encouraged the general public to ask questions and provide input to the planning process, fulfilling one of FEMA's requirements for public input.

Meeting 3: This meeting also consisted of a "brainstorming session." The Planning Team lent local knowledge to identify and prioritize mitigation strategies and projects that can address the threats identified in the risk assessment. FEMA requires the plan to contain mitigation strategies specific to each hazard and for each incorporated area within the county. At this meeting, SIU and Greater Egypt presented options for funding implementation of different mitigation strategies, including a written guide to be distributed to all participants.

Meeting 4: The Planning Team reviewed the draft plan and, proposed revisions, and accepted the plan after SIU incorporated the necessary changes. Subsequently, SIU forwarded the county MHMP to the mitigation staff at the Illinois Emergency Management Agency (IEMA) for review prior to submitting it to FEMA.

2.2 Jurisdiction Participation Information

Approximately twenty-four jurisdictions participated in the development of this MHMP with the intent of formally adopting the plan and subsequently fulfill the requirements of the DMA 2000. Various representatives from each jurisdiction were present at the meetings (see Section 2.3 Planning Team Information). Each jurisdiction falls under the one of the following categories: County, City, Village, Town, School, or Non-Profit Organization.

Participating Jurisdictions

Jackson County	Elkville	Kinkaid-Reed's Creek Conservancy District	Desoto CCSD #86
Ava	Gorham	Southern Illinois Healthcare	Elevrado CUSD #196
Campbell Hill	Grand Tower	Southern Illinois Airport	Giant City CCSD #130
Carbondale	Makanda	Southern Illinois University Carbondale	Murphysboro CUSD #186
De Soto	Murphysboro	Carbondale Community High School District #165	Tricounty CUSD #176
Dowell	Vergennes	Carbondale Elementary School District #95	Unity Point CCSD #140

2.3 Planning Team Information

Derek Misener, Jackson County EMA Coordinator, heads the Planning Team. The Planning Team includes representatives from various county departments, municipalities, and public and private utilities. Members of the Planning Team have a common vested interest in the County's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. All members of the Planning Team actively participated in the meetings, reviewed and provided comments on the draft plan, participated in the public input process and the county's formal adoption of the plan.

Jackson County Planning Team Members

Jurisdiction	Name	Title
Jackson County	Derek Misener	EMA Coordinator
	Shawn Priddy	EMA Deputy Coordinator
	Milton Maxwell	County Board Member
	Paulette Curkin	County Board Member
	Keith Larkin	County Board Member
	Maureen Berkowitz	Chief Assessor
	Tim Brumley	Supervisor of Ambulance Service
	Miriam Link-Mullison	Director of Health Department
	Robert Burns	Sherriff
	Grant Guthman	County Engineer
Ava	Rodger Bower	Alderman
	Rodney Anderson	Fire Chief
Campbell Hill	Ken Lee	Mayor
Carbondale	Mike Hertz	Fire Department Captain
	Michael Bilderback	Fire Chief
De Soto	John Evans	President
	Chris Shelton	Fire Chief
Dowell	Dennis Stewart	Mayor
	David Hock	Fire Chief
Elkville	Lance Bedar	President
Gorham		
Grand Tower	Dennis Wright	Fire Chief
Makanda	Tina Shingleton	President
	Jim Bilderback	Fire Chief
Murphysboro	Will Stephens	Mayor
Vergennes	Wayne Chapman	Mayor
	John Sherman	Fire Chief
Southern Illinois Healthcare	Mike Maddox	Regional Disaster Preparedness Coordinator
	Woddy Thorne	VP Community Affairs
	Rachel Jabr	RN, CHEC II
Southern Illinois Airport	Gary Shafer	Manager
Kinkaid-Reed's Creek Conservancy District	Ryan Guthman	Manager
Southern Illinois University Carbondale	Amy Ruffing	EHS Technician III
Carbondale Community High School #165	Steve Murphy	Superintendent
Carbondale Elementary School #95	Michael Shimshak	Superintendent
Desoto Grade School #86	Nathaniel Wilson	Superintendent
Elverado CUSD #196	Kevin Spain	Superintendent
Giant City CCSD #130	Belinda Hill	Superintendent
Murphysboro CUSD #186	Christopher Grode	Superintendent
Tricounty CUSD #176	Jackie Smith	Superintendent
Unity Point School #140	Deborah Gurley	Dean

The DMA 2000 planning regulations require that Planning Team members from each jurisdiction actively participate in the MHMP process. The Planning Team was actively involved on the following components:

- Attending the MHMP meetings
- Providing available assessment and parcel data and historical hazard information
- Reviewing and providing comments on the draft plans
- Coordinating and participating in the public input process
- Coordinating the formal adoption of the plan by the county

The first MHMP update meeting was held in Carbondale, Illinois on September 4th, 2014. Representatives from SIU explained the rationale behind the MHMP update process and answered questions from the participants. SIU representatives also provided an overview of GIS/Hazus-MH, described the timeline and the process of mitigation planning.

The Jackson County Planning Team assembled for four formal meetings. Each meeting was approximately two hours in length. Additional meeting were held outside of the four formal meetings. Appendix A includes the minutes for all meeting. During these meetings, the Planning Team successfully identified critical facilities, reviewed hazard data and maps, identified and assessed the effectiveness of existing mitigation measures, established mitigation projects for the future, and assisted with preparation of the public participation information.

Planning Meetings

MEETING 1	Sept 4 th , 2014
MEETING 2	Jan 15 th , 2015
MEETING 3	May 13 th , 2015
MEETING 4	Aug 10 th , 2015

2.4 Public Involvement

The Jackson County EMA solicited public input throughout the planning process and a public meeting was held on January 15th, 2015 to review the County's risk assessment. Appendix A contains the minutes from the public meeting. Appendix B contains press releases and/or articles sent to local newspapers throughout the MHMP development process to inform the public of meetings.

2.5 Neighboring Community Involvement

The Planning Team invited participation from various representatives of county government, local city and town governments, community groups, local businesses, and universities. The Planning Team also invited participation from adjacent counties to obtain their involvement in the planning process.

Neighboring Community Participation

Person Participating	Neighboring Jurisdiction	Title/Organization
Ryan Buckingham	Franklin County	EMA Coordinator
Steve Lueker	Jefferson County	EMA Coordinator
David Searby	Perry County	EMA Coordinator
Kelly Huddleston	Williamson County	EMA Coordinator

2.6 Review of Technical Documents

The Jackson County Planning Team identified technical documents from key agencies to assist in the planning process. These documents include land use plans, comprehensive plans, emergency response plans, municipal ordinances, and building codes. The planning process incorporated the existing natural hazard mitigation elements from previous planning efforts. The following technical data, reports, and studies were utilized:

- Federal Emergency Management Agency
 - Developing the Mitigation Plan (April 2003)*
 - Mitigation Ideas (January 2003)*
 - Local Mitigation Planning Handbook*
 - Flood Insurance Study (May 2008)*
- United States Census Bureau
 - County Profile Information*
 - 2010 Census Data*
 - American Community Survey (2009-2013)*
- U.S. Army Corp of Engineers
 - 2010 Executive Summary - Grand Tower / Degognia Levee System*
- NOAA National Climatic Data Center
 - Climate Data*
- NOAA / National Water Service Storm Prediction Center
 - Severe Weather Data*
- Illinois Emergency Management Agency
 - 2013 Illinois Natural Hazard Mitigation Plan*
- Illinois Environmental Protection Agency
 - 2014 303d Listed Waters and Watershed Maps*
- Illinois State Water Survey
 - Climate Data*
- Illinois Department of Commerce and Economic Opportunity
 - Community Profiles*
- Greater Egypt Regional Planning and Development Commission
 - Comprehensive Economic Development Strategy 2010-2014*
- Jackson County
 - 2013 Assessment Records*
 - 2013 Countywide GIS Parcel Database*
 - 2009 Multi-Hazard Mitigation Plan*
 - 2011 Jackson County LEPC HAZMAT Plan*
- Jackson County Health Department
 - Community Health Improvement Plan 2010-2015*
- Carbondale
 - Carbondale Comprehensive Plan 2010*

2.7 Adoption by Local Government

Upon IEMA and FEMA approval, the Planning Team presented and recommended the plan to the County Board for formal adoption. The plan was formally adopted by the Jackson County Board on **<adoption date>**. The Planning Team worked with the County and its jurisdictions to ensure all parties formally adopted the plan. Appendix C contains the Adopting Resolutions for each participating jurisdiction.

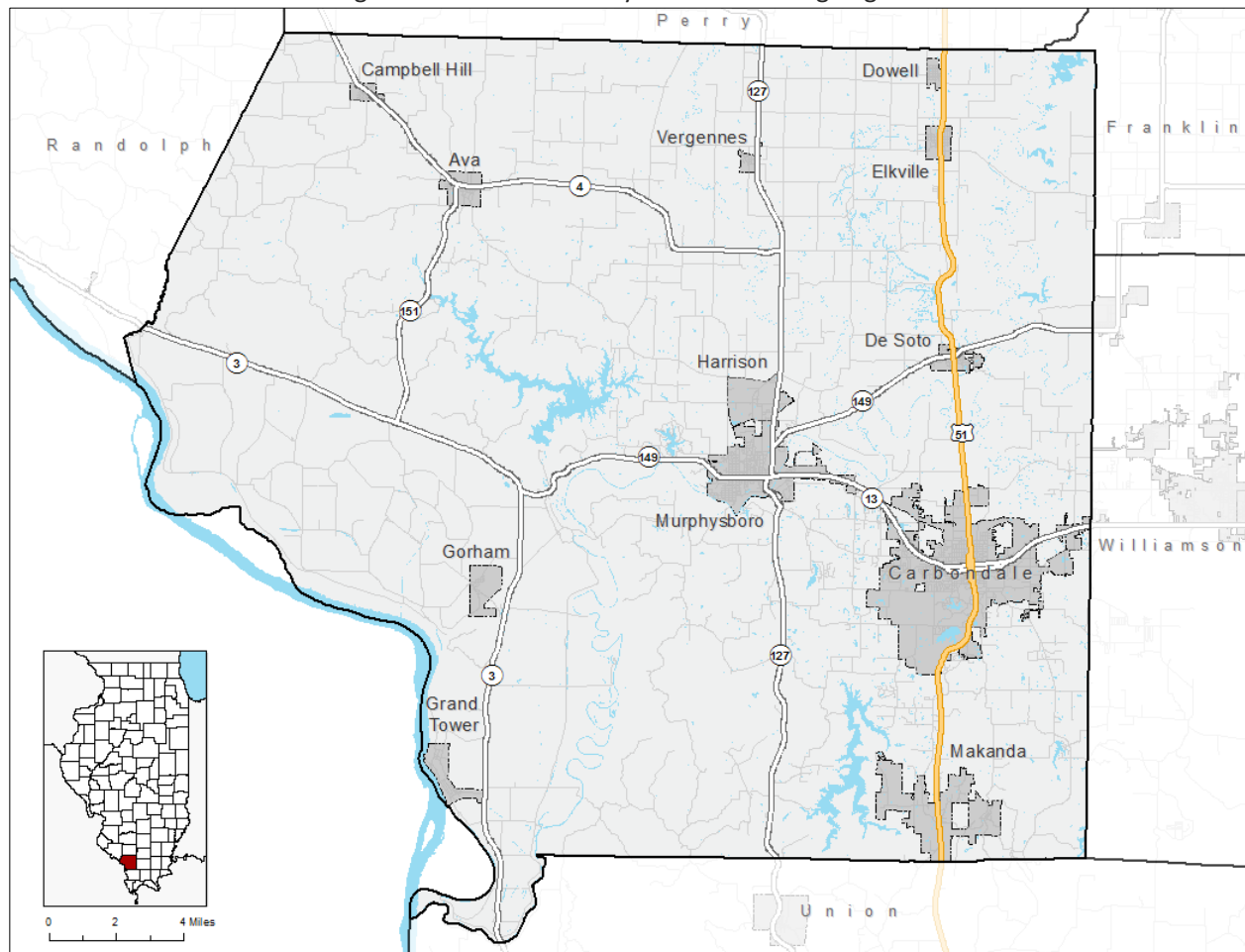
Section 3. County Profile

3.1 County Background

Jackson County organized and claimed its boundaries from the division of Randolph and Johnson Counties in 1816. In 1827, Perry County's acquisition of Jackson County's northern territory reformed the county into its current political boundaries. Jackson County was named after the seventh President of the United States, Andrew Jackson. The original county seat was located along the Big Muddy River at the House of Nathan Davis, from 1816–1817. From 1817–1843, the county seat moved to Brownsville until it burned down. Finally in 1843, the county seat moved upstream a few miles to the current location in downtown Murphysboro.

Jackson County is located in the west portion of the southern tip of Illinois (Figure 3-1). It is bounded on the north by Randolph and Perry Counties, on the south by Union County, on the west by the Missouri State Line and Mississippi River, and on the east by Williamson and Franklin Counties. It relates to major urban areas as follows: 106 miles southeast of St. Louis, Missouri; 176 miles south of Springfield, Illinois; 333 miles south-southwest of Chicago, Illinois.

Figure 3-1. Jackson County and Surrounding Region



Jackson County is an average growing county in southern Illinois. The major sources of economic activity in Jackson County include education, social services, and arts and culture. Jackson County offers a host of amenities such as shopping centers, fairs, parades, local wineries, restaurants, lodging, education, and entertainment. Crab Orchard Lake, Touch of Nature, and Giant City State Park fish and wildlife areas offer opportunities for fishing, camping, and hiking.

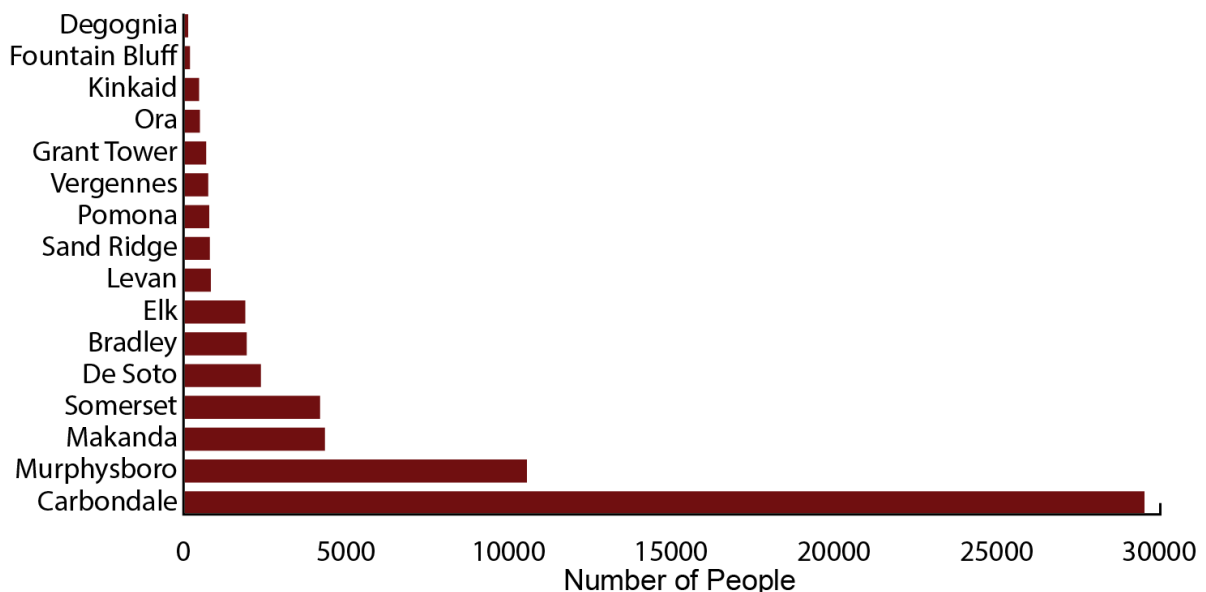
Two major Southern Illinois Healthcare (SIH) facilities serve Jackson County and surrounding region. Memorial Hospital of Carbondale is the flagship hospital for SIH and regional referral center for the 16 county southern Illinois region. Memorial Hospital of Carbondale is the only dedicated pediatric unit south of Springfield. St. Joseph Memorial Hospital has been a fixture in the Murphysboro community for over half a century and is a full-service, critical access hospital.

New development in Jackson County tends to focus in and around the city of Carbondale. The most populous city in Jackson County, Carbondale, is home to the main campus of Southern Illinois University. Founded in 1869, SIU Carbondale is categorized as an RU/H Research University in the Carnegie Classification of Institutions of Higher Education. The University offers more than 200 undergraduates majors, minors and specializations, 30 doctoral and more than 60 master's degree programs, including law and medical degrees. SIU is a cultural center that offers everything from education, art, sports, recreation, concerts, shows, speeches, a business incubator, and many other amenities.

3.2 Demographics

According to the 2010 U.S. Census, Jackson County's population is 60,218, an increase of 2.3% from 2007. As of 2013, Jackson County's population estimate is 59,814 (American Community Survey, 2013). The population is spread through 16 townships: Bradley, Carbondale, Degognia, De Soto, Elk, Fountain Bluff, Grand Tower, Kinkaid, Levan, Makanda, Murphysboro, Ora, Pomona, Sand Ridge, Somerset, and Vergennes. Figure 3-2 displays the breakdown of population by township from the 2010 Census.

Figure 3-2. Jackson County 2010 Population by Township



3.3 Economy and Industry

Jackson County is strategically located along the bustling business corridor along Route 13 and home to a public research university. Education, health, social services, and retail continue to drive the industrial sectors in Jackson County (American Community Survey 2009-2013). Education and retail trade employ 42% of the workforce. Jackson County's major employers include Southern Illinois University, Memorial Hospital of Carbondale, NeuroRestorative, and Wal-Mart. The 2012 annual per capita income in the county is \$20,527, compared to an Illinois average of \$29,666. Table 3-1 lists the major employers and the approximate number of employees in Jackson County.

Table 3-1. Jackson County's Major Employers

Employer	Industry	Approximate Number of Employees
Southern Illinois University	Education	7,100
Memorial Hospital of Carbondale	Health Care	1,116
NeuroRestorative	Health Care	510
Wal-Mart Carbondale	Retail	400
Southern Illinois Healthcare	Health Care	376
Penn Aluminum International	Manufacturing	300
Illinois Department of Transportation	Government	290
City of Carbondale	Government	270
St. Joseph Memorial Hospital	Health Care	250
Murphysboro Unit School District #186	Education	250
Brehm Preparatory School	Education	200
Com-Pac International	Manufacturing	180
Schnucks	Retail	180
Shawnee Health Services	Health Care	165
Lowe's	Retail	160
Specialized Training for Adult Rehab	Services	160
Tri-County Education Center	Education	150
Southern Illinoisan Newspaper	Publishing	140
Center for Medical Arts	Medical	121

Source: [Jackson Growth Alliance](#)

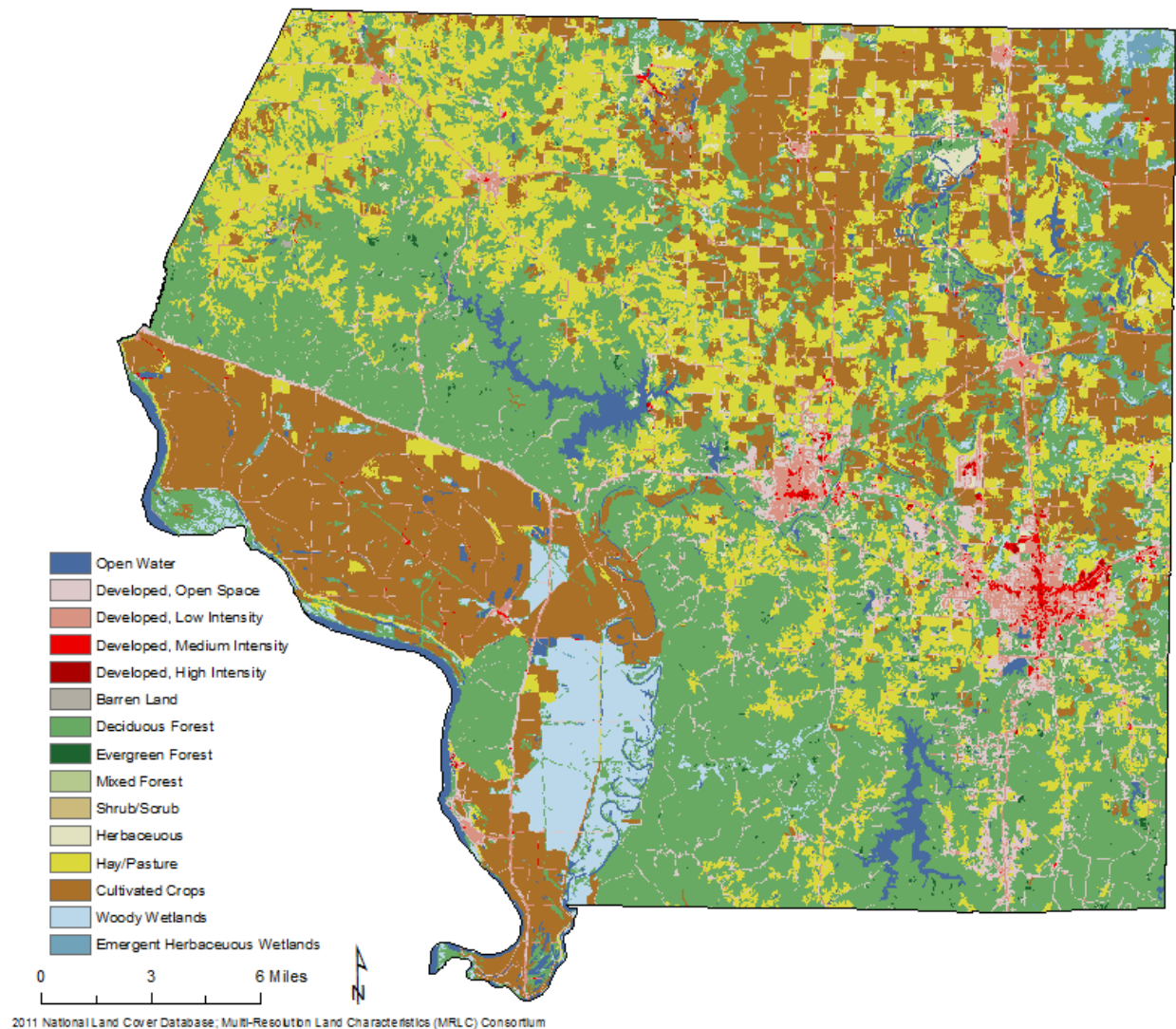
3.4 Land Use and Development Trends

Pre-European settlement, Jackson County was a land of dense forests broken by prairies. Since settlement, agriculture, coal mining, and urbanization have dramatically altered the county's land cover. Today, agriculture is the predominant land cover in the county. This fact did not result because of great agricultural capabilities of the land as a major agricultural producer; neither did it occur because of maximum economic development potential resting in agricultural pursuits. Rather it is a result of the existence of large volumes of land which cannot rationally be occupied by major urban uses within the foreseeable future. As a result many agricultural uses have only limited agricultural potential.

Coal mining was an important industry in Southern Illinois Region between the 1930s and 1980s. From 1990 through today, the importance of coal mining to the region and Jackson County has significantly lessened due to more stringent air quality regulations. Regardless, Southern Illinois's coal mining history, particularly strip mining, has left an indelible mark on Jackson County. In areas that were strip mined, particularly prior to Surface Mine Reclamation Action of 1977, the land has been left unsuitable for agriculture or significant commercial or residential development. These areas often contain large piles of mine spoil and deep pits filled with water that alter surface water drainage. In Jackson County, abandoned strip mines are generally found in the northeastern portions of the county.

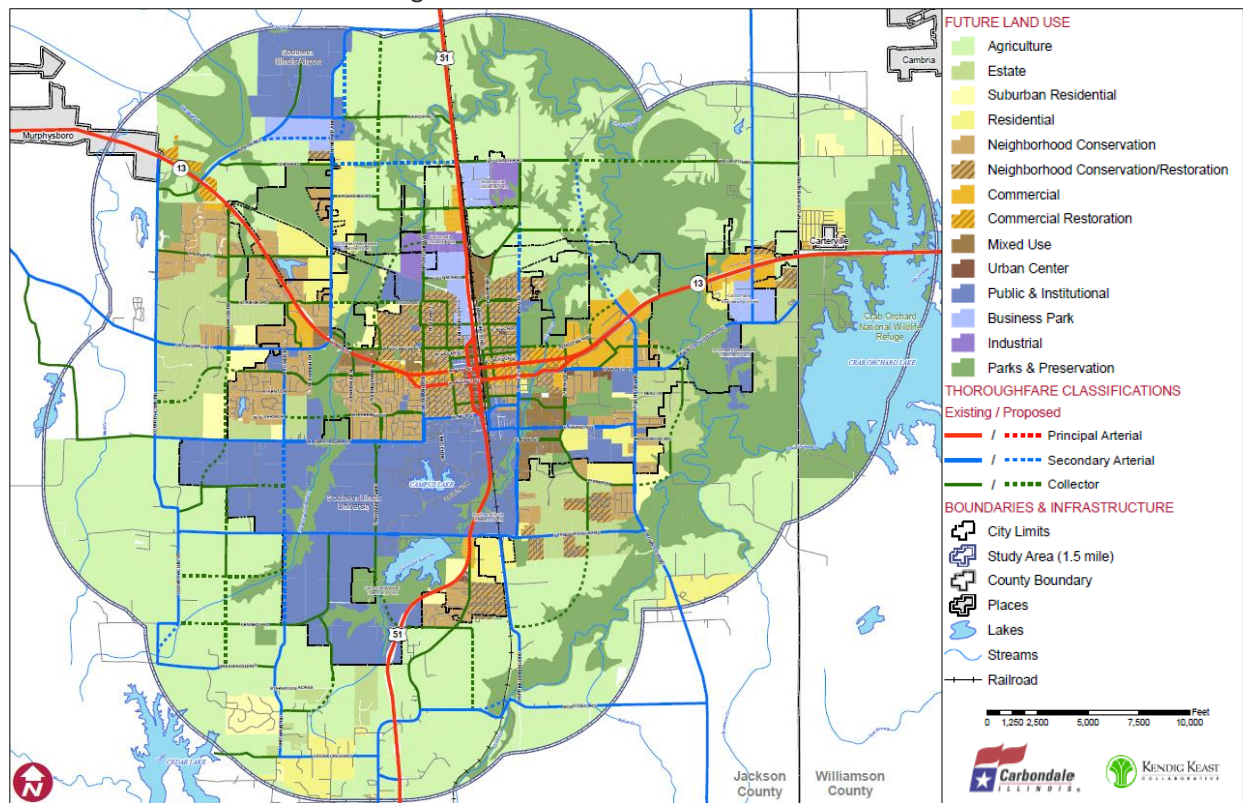
Today, Jackson County's single largest land use is cultivated crops and deciduous forest (National Land Cover Database, 2011). Figure 3-3 depicts the land use within Jackson County. The western portion of the county is the primary area of agriculture use and is also prone to flooding from the Mississippi River. This area is primarily adapted to row crops such as corn and soybeans. Further south and eastward, fruit orchards and vineyards are grown in abundance. Additional scattered areas are located within the urban core in segments which need not be utilized for urban expansion. These agricultural areas become the overflow areas of future growth. Corn is the primary crop, followed by soybeans, winter wheat, and hay.

Figure 3-3. Land Use in Jackson County



In recent years, residential and commercial developments had significant developments in the Carbondale and Murphysboro area. The current economic engines of education and health care (represented by Southern Illinois University and Memorial Hospital of Carbondale), in addition to retail, offer the ongoing catalysts for economic growth in the County. The City of Carbondale Comprehensive Plan 2011 serves as a guide for the development of Carbondale with respect to future growth and enhancement of the community. Figure 3-4 depicts the future land use in the City of Carbondale as proposed by the 2011 Comprehensive Plan.

Figure 3-4. Future Land Use in Carbondale



Public land use in Jackson County includes schools, parks, playgrounds, public utilities, and transportation facilities. The major areas of public land use are located in the southeastern parts of the county. These areas encompass the Carbondale Super Block, Touch of Nature, Southern Illinois University Carbondale, Giant City State Park, Cedar Lake, and Crab Orchard National Wildlife Refuge. Other major areas include the Lake Kinkaid, Southern Illinois Airport, Riverside City Park, Lake Murphysboro State Park, and Shawnee National Forest.

3.5 Climate

The climate in Jackson County is generally characterized by hot dry summers and cool wet winters. The variables of temperature, precipitation, and snowfall can vary greatly from one year to the next. In summer, the average low is 63.1°F and the average high is 86.8°F. However, daily maximum temperatures often exceed 90°F for the period of time (several weeks) between June and September. Also during these months, it is not uncommon for daily maximum temperatures to exceed 103°F for a few to several days.

During the fall through the spring, freezing temperatures can occur any time between October and April. The average low and high temperatures in January are 20.8°F and 39.3°F, respectively. Average annual precipitation is 45.85 inches (NCDC data from 1971 to 2000). While the winters are generally cool, i.e. temperatures are above freezing most days, extended periods (days to a couple of weeks) of sub-freezing high temperatures often occur and are sometimes accompanied by significant amounts of ice and snow.

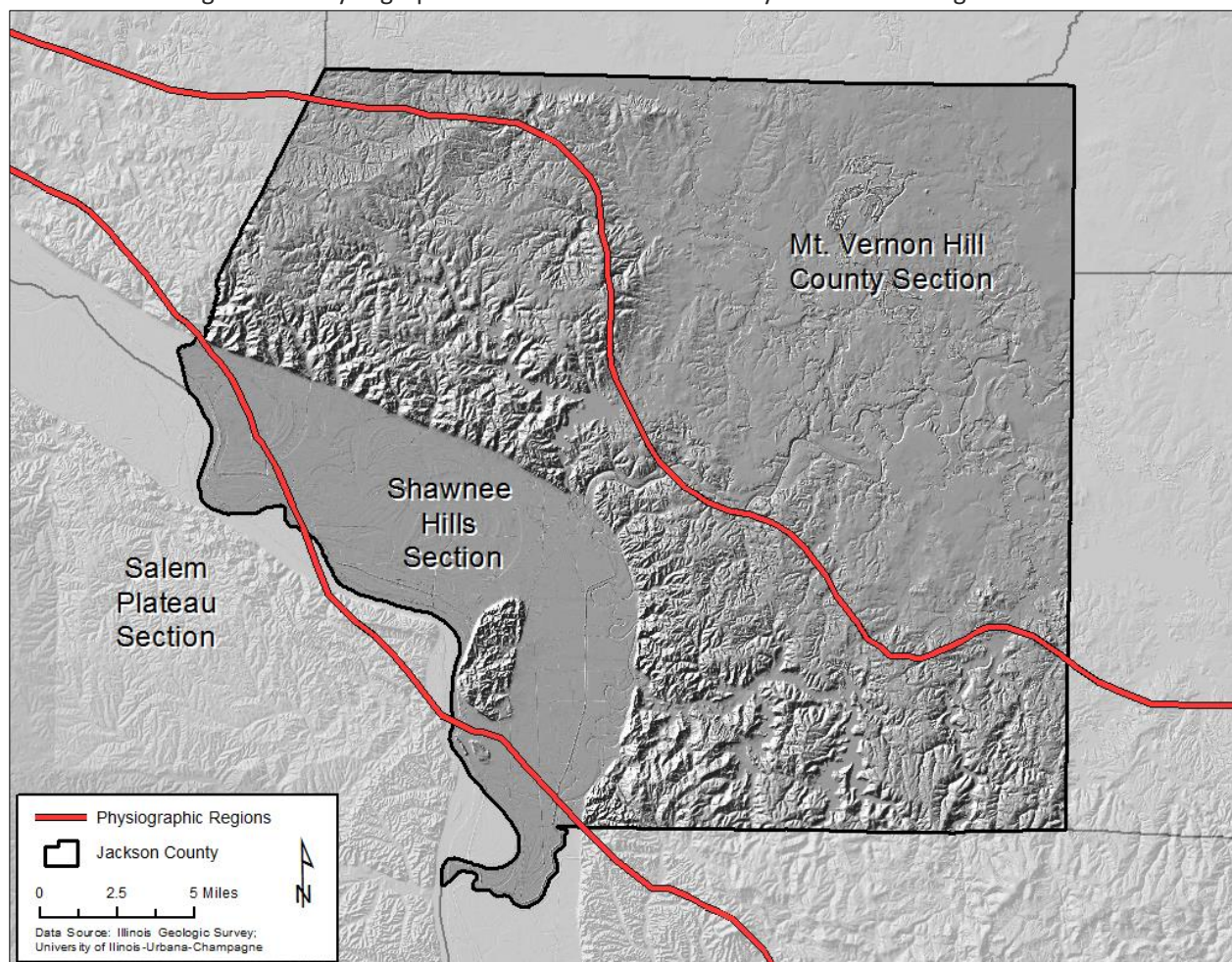
3.6 Topography

Jackson County is located within the Mt Vernon Hill Country of the Till Plain section, Shawnee Hill Section and Salem Plateau Section of Illinois. Figure 3-5 depicts the physiographic divisions within Jackson County. The highest elevation(s) (>3440 feet above sea level) in Jackson County is found in Grassy Knob in Pomona Township. The lowest elevation(s) (<811 feet above sea level) is found along the Big Muddy and Mississippi Rivers south of Grand Tower.

The Mt. Vernon Hill Country Section is the most southern sub-section of the Till Plain Section and is characterized by low rolling hills and broad alluvial valleys along the major streams. The relief in this region is not pronounced. The southern boundary of the Mount Vernon Hill Country lies within a few miles of the limits of glaciations; moraine ridges are essentially absent in the area.

The Shawnee Hills Section can be described by the Greater and Lesser sub-sections. The Greater Shawnee Hills Section consists of sandstone bluffs, steep sided ridges and hills with broad valleys. The Lesser Shawnee Hills Section, similar to the Greater Shawnee Hills Section, is characterized by limestone bedrock, sinkholes, and caves carved in limestone bluffs.

Figure 3-5. Physiographic Divisions of Jackson County and Surrounding Terrain



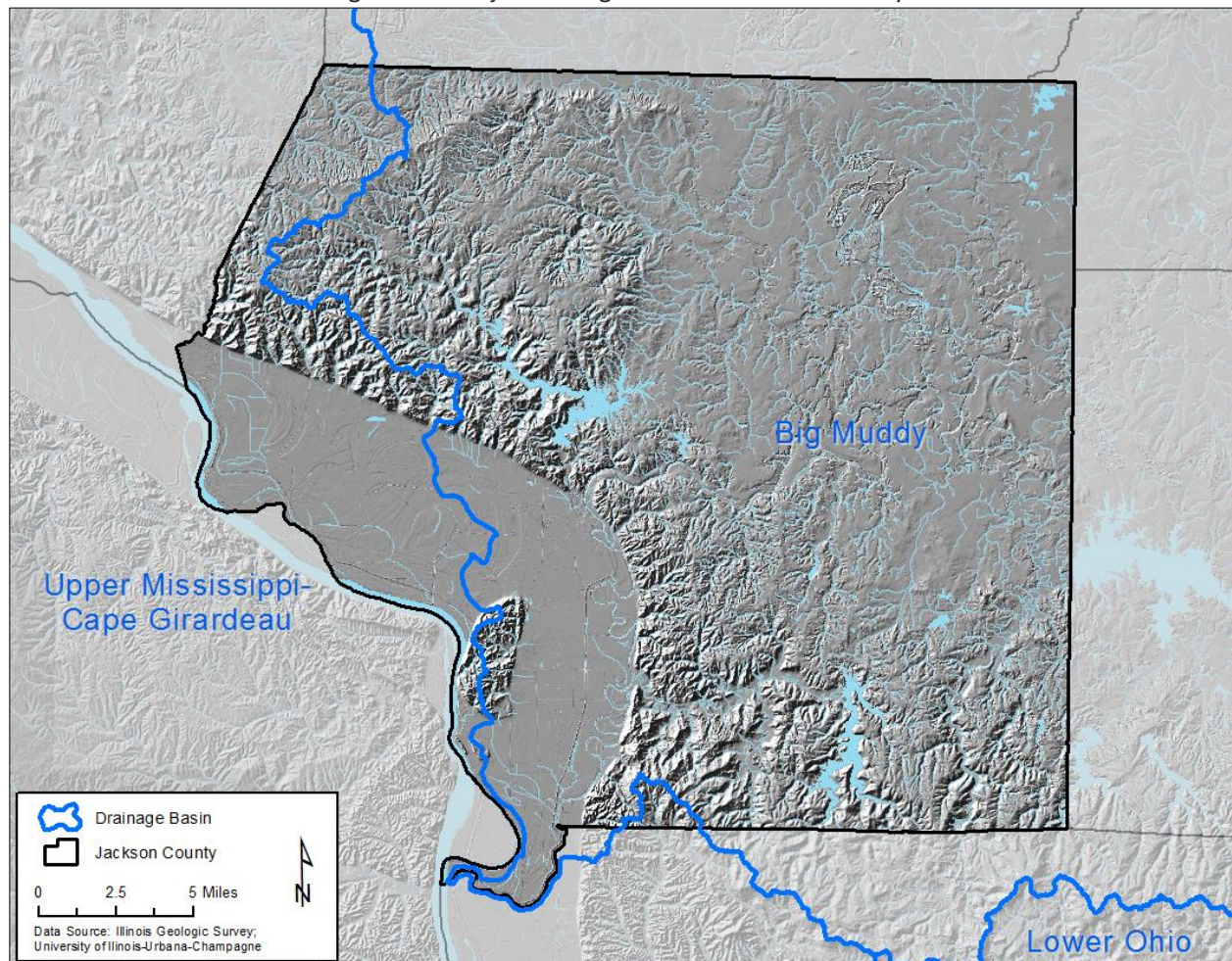
3.7 Major Lakes, Rivers, and Watersheds

Of the 102 Illinois counties, Jackson County ranks ninth in most lakes and rivers acreage in Illinois. Jackson County has twelve significant water bodies: Campbell Lake, Holliday Lake, Lake Kinkaid, New Thompson Lake, Lake Chautauqua, Lake Murphysboro, Campus Lake, Carbondale City Lake, Cedar Lake, Grand Tower Chute, Midland Hills Lake, and Spring Arbor Lake.

Geographically Jackson County bounded by the Mississippi River to the west. A large portion of the county drains westward into the Mississippi River through Carb Orchard Creek and Big Muddy River. The two major watersheds that drain the county are the Big Muddy and Upper Mississippi-Cape Girardeau. Figure 3-6 depicts the hydrologic units within Jackson County.

The Big Muddy River Watershed enters into the county from the north and east and covers the majority of the county. Approximately four-fifths of the area of the county lies within this watershed, which has a general slope toward the southwest and is drained by the Big Muddy River, the water of which flow into the Mississippi River. The Upper Mississippi-Cape Girardeau Watershed covers approximately one-fifth of the area of the county and lies to the west of the Big Muddy River Watershed with a general slope toward the southwest; it is drained by Mississippi River.

Figure 3-6. Major drainage basins in Jackson County



Section 4. Risk Assessment

The goal of mitigation is to reduce future hazard impacts including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation requires a rigorous risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. This assessment identifies the characteristics and potential consequences of a disaster, how much the disaster could affect the community, and the impact on community assets. This risk assessment consists of three components—hazard identification, vulnerability assessment, and risk analysis.

4.1 Hazard Identification

4.1.1 Existing Plans

The Planning Team identified technical documents from key agencies to assist in the planning process and incorporated the natural hazard mitigation elements from previous 2009 Jackson County Multi-Hazard Mitigation Planning efforts. Several other documents were used to profile historical hazards and guide the Planning Team during the hazard ranking exercise. Section 2-6 contains a complete list of the technical documents utilized to develop this plan.

4.1.2 National Hazard Records

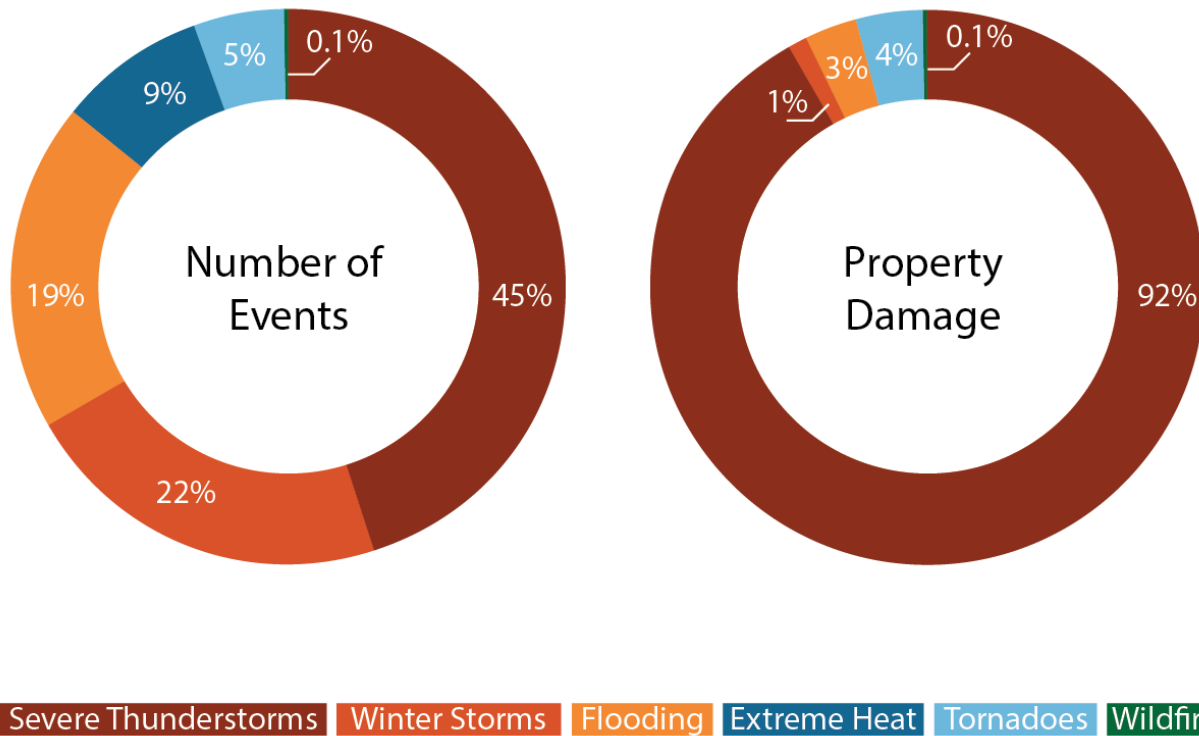
To assist the Planning Team, historical storm event data from the National Climatic Data Center (NCDC) was compiled. NCDC records are estimates of damages reported to the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses.

The NCDC database included 710 reported meteorological events in Jackson County from 1950-2014 (the most updated information as of the date of this plan). The following hazard-profile sections each include a summary table of events related to each hazard type. Table 4-1 summarizes the meteorological hazards reported for Jackson County. Figure 4-1 summarize the relative frequency of NCDC reported meteorological hazards and the percent of total damage associated with each hazard for Jackson County. Full details of individual hazard events are on the [NCDC website](#). In addition to NCDC data, Storm Prediction Center (SPC) data associated with tornadoes, strong winds, and hail was mapped using SPC-recorded latitudes and longitudes. Appendix D contains a map of these events.

Table 4-1. Summary of Meteorological Hazards Reported by the NCDC for Jackson County

Hazards	Time Period		Number of Events	Property Damage	Deaths	Injuries
	Start	End				
Severe Thunderstorm	1956	2014	321	\$106,260,500	2	9
Winter Storm	1996	2014	154	\$1,030,000	2	0
Flooding	1996	2014	135	\$3,277,000	1	0
Extreme Heat	1997	2013	61	\$0	0	37
Tornado	1951	2014	38	\$4,816,500	11	210
Wildfire	2010	2014	1	\$75,000	0	0

Figure 4-1. Distribution of NCDC Meteorological Hazards for Jackson County



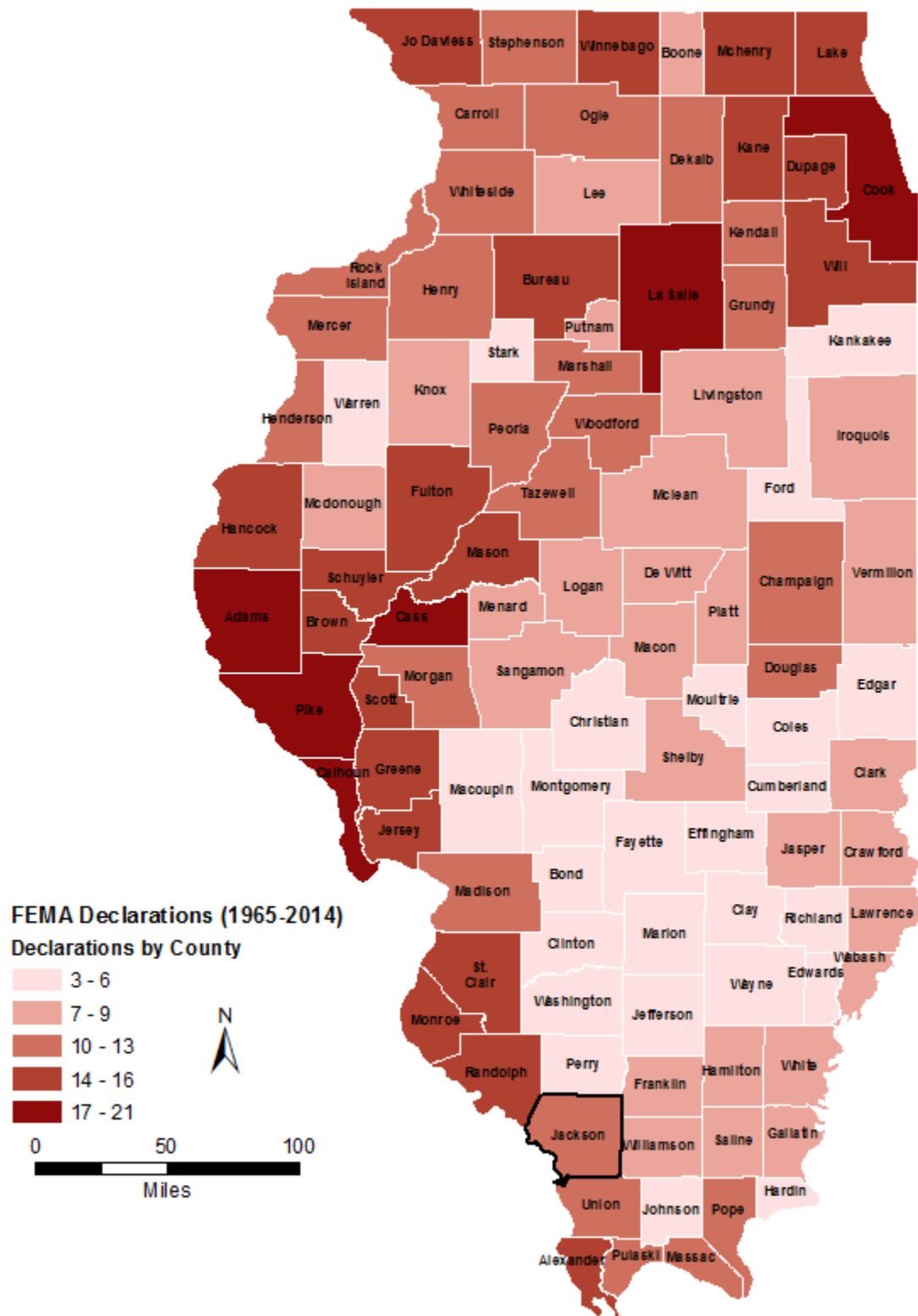
4.1.3 FEMA Disaster Information

Since 1957, FEMA has declared 53 major disasters and 7 emergencies for the State of Illinois. Emergency declarations allow states to access FEMA funds for Public Assistance (PA); disaster declarations allow for even more PA funding, including Individual Assistance (IA) and the Hazard Mitigation Grant Program (HMGP). Jackson County has received federal aid for ten declared disasters and two emergencies since 1965. Table 4-2 lists specific information for each disaster declaration in Jackson County. Figure 4-2 depicts the disasters and emergencies that have been declared for the State of Illinois and Jackson County since 1965.

Table 4-2. Details of FEMA-declared Emergencies and Disasters in Jackson County

Declaration Number	Date of Declaration	Description
276	08/30/1969	Heavy Rains and Flooding
373	04/26/1973	Severe Storms and Flooding
583	04/30/1979	Severe Storms and Flooding
684	06/06/1983	Severe Storms, Tornadoes and Flooding
997	07/09/1993	Severe Storms and Flooding
1053	05/30/1995	Severe Storms and Flooding
1112	05/06/1996	Severe Storms and Flooding
1416	05/21/2002	Severe Storms, Tornadoes, and Flooding
3199	02/01/2005	Record/Near Record Snow
3230	09/07/2005	Hurricane Katrina Evacuation
1850	07/02/2009	Severe Storms, Tornadoes and Flooding
1991	06/07/2011	Severe Storms and Flooding

Figure 4-2. FEMA-declared Emergencies and Disasters in Illinois



4.1.4 Hazard Ranking Methodology

Based on Planning Team input, national datasets, and existing plans, the Jackson County Planning Team re-ranked the list of hazards from the 2009 MHMP. These hazards ranked the highest based on the Risk Priority Index discussed in Section 4.1.5. In addition to the identified hazards, the Jackson County Planning Team identified disease epidemic / pandemic as a public health hazard. This plan includes a section devoted to disease epidemic / pandemic but it should be noted that it is not included in the ranked list of hazards.

<u>Jackson County Hazard List</u>
EARTHQUAKES
TORNADOES
DAM / LEVEE FAILURE
SEVERE THUNDERSTORM
FLOODING
WINTER STORMS
HAZARDOUS MATERIALS RELEASE
DROUGHT /EXTREME HEAT
GROUND FAILURE
DISEASE EPIDEMICS / PANDEMICS

4.1.5 Risk Priority Index

The Risk Priority Index (RPI) quantifies risk as the product of hazard probability and magnitude so Planning Team members can prioritize mitigation strategies for high-risk-priority hazards. Planning Team members use historical hazard data to determine the probability, combined with knowledge of local conditions to determine the possible severity of a hazard. Tables 4-3 and 4-4 display the criteria the Planning Team used to quantify hazard probability and magnitude.

Table 4-3. Hazard Probability Ranking

Probability	Characteristics
4 – Highly Likely	Event is probable within the next calendar year This event has occurred, on average, once every 1-2 years in the past
3 – Likely	Event is probable within the next 10 years Event has a 10-50% chance of occurring in any given year This event has occurred, on average, once every 3-10 years in the past
2 – Possible	Event is probable within the next 50 years Event has a 2-10% chance of occurring in any given year This event has occurred, on average, once every 10-50 years in the past
1 – Unlikely	Event is probable within the next 200 years Event has a 0.5-2% chance of occurring in any given year This event has occurred, on average, once every 50-200 years in the past

Table 4-4. Hazard Severity Ranking

Magnitude/Severity	Characteristics
8 – Catastrophic	Multiple deaths Complete shutdown of facilities for 30 or more days More than 50% of property is severely damaged
4 – Critical	Injuries and/or illnesses result in permanent disability Complete shutdown of critical facilities for at least 14 days More than 25% of property is severely damaged
2 – Limited	Injuries and/or illnesses do not result in permanent disability Complete shutdown of critical facilities for more than seven days More than 10% of property is severely damaged
1 – Negligible	Injuries and/or illnesses are treatable with first aid Minor quality of life lost Shutdown of critical facilities and services for 24 hours or less Less than 10% of property is severely damaged

The product of hazard probability and magnitude is the RPI (Risk Priority Index). The Planning Team members ranked specified hazards based on the RPI, with larger numbers corresponding to greater risk. After evaluating the calculated RPI, the Planning Team adjusted the ranking to better suit the County. Table 4-5 identifies the RPI and adjusted ranking for each hazard specified by the Planning Team.

Table 4-5. Jackson County Hazard Priority Index and Ranking

Hazard	Probability	Magnitude/Severity	Risk Priority Index	Rank
Earthquakes	2	8	16	1
Tornadoes	3	4	12	2
Dam / Levee Failure	4	3	12	3
Severe Thunderstorms	4	2	8	4
Flooding	4	2	8	5
Winter Storms	3	2	6	6
Hazardous Materials Release	2	2	4	7
Drought/ Extreme Heat	3	1	3	8
Ground Failure	2	1	2	9

4.1.6 Jurisdictional Hazard Ranking

Each jurisdiction created its own RPI because hazard susceptibility may differ by jurisdiction. During the five-year review of the plan, the Planning Team will update this table to ensure these jurisdictional rankings accurately reflect each community's assessment of these hazards. Table 4-6 lists the jurisdictions and their respective hazard rankings (Ranking 1 being the highest concern). The individual jurisdictions made these rankings at Meeting 1.

Table 4-6. Hazard Ranking by Jurisdiction

Jurisdiction	Earthquakes	Tornadoes	Dam / Levee Failure	Severe Storms	Flooding	Winter Storms	Hazmat	Heat / Drought	Ground Failure
Ava	4	5	-	2	-	1	-	3	6
Campbell Hill	1	2	3	4	5	6	7	8	9
Carbondale	1	2	7	5	3	6	4	-	8
De Soto	3	1	-	2	4	6	-	5	-
Dowell	2	3	-	6	4	8	1	7	5

Jurisdiction	Earthquakes	Tornadoes	Dam / Levee Failure	Severe Storms	Flooding	Winter Storms	Hazmat	Heat / Drought	Ground Failure
Elkville	1	2	3	4	5	6	7	8	9
Gorham	1	2	3	4	5	6	7	8	9
Grand Tower	1	2	3	4	5	6	7	8	9
Makanda	2	1	-	3	5	4	8	7	6
Murphysboro	1	2	3	4	5	6	7	8	9
Vergennes	1	2	3	4	5	6	7	8	9
Kinkaid-Reed's Creek Conservancy District	4	6	2	3	7	5	8	1	9
Southern Illinois Health Care	2	1	8	4	5	3	6	7	9
Southern Illinois Airport	1	2	-	3	4	5	7	6	8
Southern Illinois University Carbondale	1	2	3	4	5	6	7	8	9
Carbondale CHSD #165	1	2	3	4	5	6	7	8	9
Carbondale Elementary School District #95	3	1	-	3	-	2	-	4	-
Desoto CCSD #86	1	2	3	4	5	6	7	8	9
Elverado CUSD #196	1	2	3	4	5	6	7	8	9
Giant City CCSD #130	6	2	-	3	-	1	5	4	-
Murphysboro CUSD #186	2	1	4	3	6	5	7	-	-
Tricounty CUSD #176	1	2	3	4	5	6	7	8	9
Unity Point CUSD #140	4	2	9	1	8	3	6	7	5

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

Processes and Sources for Identifying Assets

Before meeting one, the Planning Team used their resources to update the list of critical facilities from the 2009 MHMP. Local GIS data was used to verify the locations of all critical facilities. SIU GIS analysts incorporated these updates and corrections to the Hazus-MH data tables prior to performing the risk assessment. The updated Hazus-MH inventory contributed to a Level 2 analysis, which improved the accuracy of the risk assessment. Jackson County also provided local assessment and parcel data to estimate the actual number of buildings susceptible to damage for the risk assessment.

Essential Facilities List

Table 4-7 identifies the number of essential facilities identified in Jackson County. Essential facilities are a subset of critical facilities. Appendix E include a comprehensive list of the essential facilities in Jackson County and Appendix F displays a large format map of the locations of the critical facilities within the county.

Table 4-7. Jackson County's Essential Facilities

Facility	Number of Facilities
Care Facilities	8
Emergency Operations Centers	4
Fire Stations	17
Police Stations	9
Schools	27

Facility Replacement Costs

Table 4-8 identifies facility replacement costs and total building exposure. Jackson County provided local assessment data for updates to replacement costs. Tax-exempt properties such as government buildings, schools, religious and non-profit structures were excluded from this study because they do not have an assessed value. Table 4-8 also includes the estimated number of buildings within each occupancy class.

Table 4-8. Jackson County's Building Exposure

General Occupancy	Estimated Total Buildings	Total Building Exposure
Residential	17,112	\$2,083,367,205
Commercial	1,440	\$1,059,237,234
Industrial	107	\$313,483,695
Education	304	\$10,403,250,000
Total:	18,963	\$13,859,338,134

Future Development

Jackson County is expected to see a modest increase in population due to the expansion of existing distribution centers, light industry, and the creation of new opportunities in the service industry such as retail stores, restaurants, and hotels. Most of this expansion is expected to take place within the city of Carbondale and along the Route 13 business corridor.

4.3 Risk Analysis

4.3.1 GIS and Hazus-MH

The third step in the risk assessment is the risk analysis, which quantifies the risk to the population, infrastructure, and economy of the community. The hazards were quantified using GIS analyses and Hazus-MH where possible. This process reflects a Level 2 Hazus-MH analysis. A level 2 Hazus-MH analysis involves substituting selected Hazus-MH default data with local data and improving the accuracy of model predictions.

Updates to the default Hazus-MH data include:

- Updating the Hazus-MH defaults, critical facilities, and essential facilities based on the most recent available data sources.

- Reviewing, revising, and verifying locations of critical and essential point facilities with local input.
- Applying the essential facility updates (schools, medical care facilities, fire stations, police stations, and EOCs) to the Hazus-MH model data.
- Updating Hazus-MH reports of essential facility losses.

The following assumptions were made during analysis:

- Hazus-MH aggregate data was used to model the building exposure for all earthquake analyses. It is assumed that the aggregate data is an accurate representation of Jackson County.
- The analyses were restricted to the county boundaries. Events that occur near the county boundaries do not contain damage assessments from adjacent counties.
- For each tax-assessment parcel, it is assumed there is only one building that bares all the associated values (both structure and content).
- For each parcel, it is assumed that all structures are wood-framed, one-story, slab-on-grade structures, unless otherwise stated in assessment records. These assumptions are based on sensitivity analyses of Hazus and regional knowledge.

Depending upon the analysis options and the quality of data the user inputs, Hazus-MH generates a combination of site-specific and aggregated loss estimates. Hazus-MH is not intended as a substitute for detailed engineering studies; it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This plan does not fully document the processes and procedures completed in its development, but this documentation is available upon request. Table 4-9 indicates the analysis type (i.e. GIS, Hazus-MH, or historical records) used for each hazard assessment.

Table 4-9. Risk Assessment Tool Used for Each Hazard

Hazard	Risk Assessment Tool(s)
Tornadoes	GIS-based
Earthquakes	Hazus-MH
Severe Thunderstorm	Historical Records
Winter Storms	Historical Records
Flooding	Hazus-MH
Hazmat Release	GIS-based
Levee / Dam Failure	Historical Records
Drought / Extreme Heat	Historical Records
Ground Failure	GIS-based

4.3.2 Earthquake Hazard

Hazard Definition

An earthquake is the shaking of the earth caused by the energy released when large blocks of rock slip past each other in the earth's crust. Most earthquakes occur at tectonic plate boundaries; however, some earthquakes occur in the middle of plates, for example the New Madrid Seismic Zone or the Wabash Valley Fault System. Both of these seismic areas have a geologic history of strong quakes, and an earthquake from either seismic area could possibly affect Illinois counties. There may be other, currently unidentified faults in the Midwest also capable of producing strong earthquakes.

Strong earthquakes can collapse buildings and infrastructure, disrupt utilities, and trigger landslides, avalanches, flash floods, fires, and tsunamis. When an earthquake occurs in a populated area, it may cause death, injury, and extensive property damage. An earthquake might damage essential facilities, such as fire departments, police departments, and hospitals, disrupting emergency response services in the affected area. Strong earthquakes may also require mass relocation; however, relocation may be impossible in the short-term aftermath of a significant event due to damaged transportation infrastructure and public communication systems.

Earthquakes are usually measured by two criteria: intensity and magnitude (M). Earthquake intensity qualitatively measures the strength of shaking produced by an earthquake at a certain location and is determined from effects on people, structures, and the natural environment. Earthquake magnitude quantitatively measures the energy released at the earthquake's subsurface source in the crust, or epicenter. Magnitude in the earthquake hazard analysis. Table 4-10 provides a comparison of magnitude and intensity, and Table 4-11 provides qualitative descriptions of intensity, for a sense of what a given magnitude might feel like.

Table 4-10. Comparison of Earthquake Magnitude and Intensity

Magnitude (M)	Typical Maximum Modified Mercalli Intensity
1.0 – 3.0	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 and higher	VIII or higher

Table 4-11. Abbreviated Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

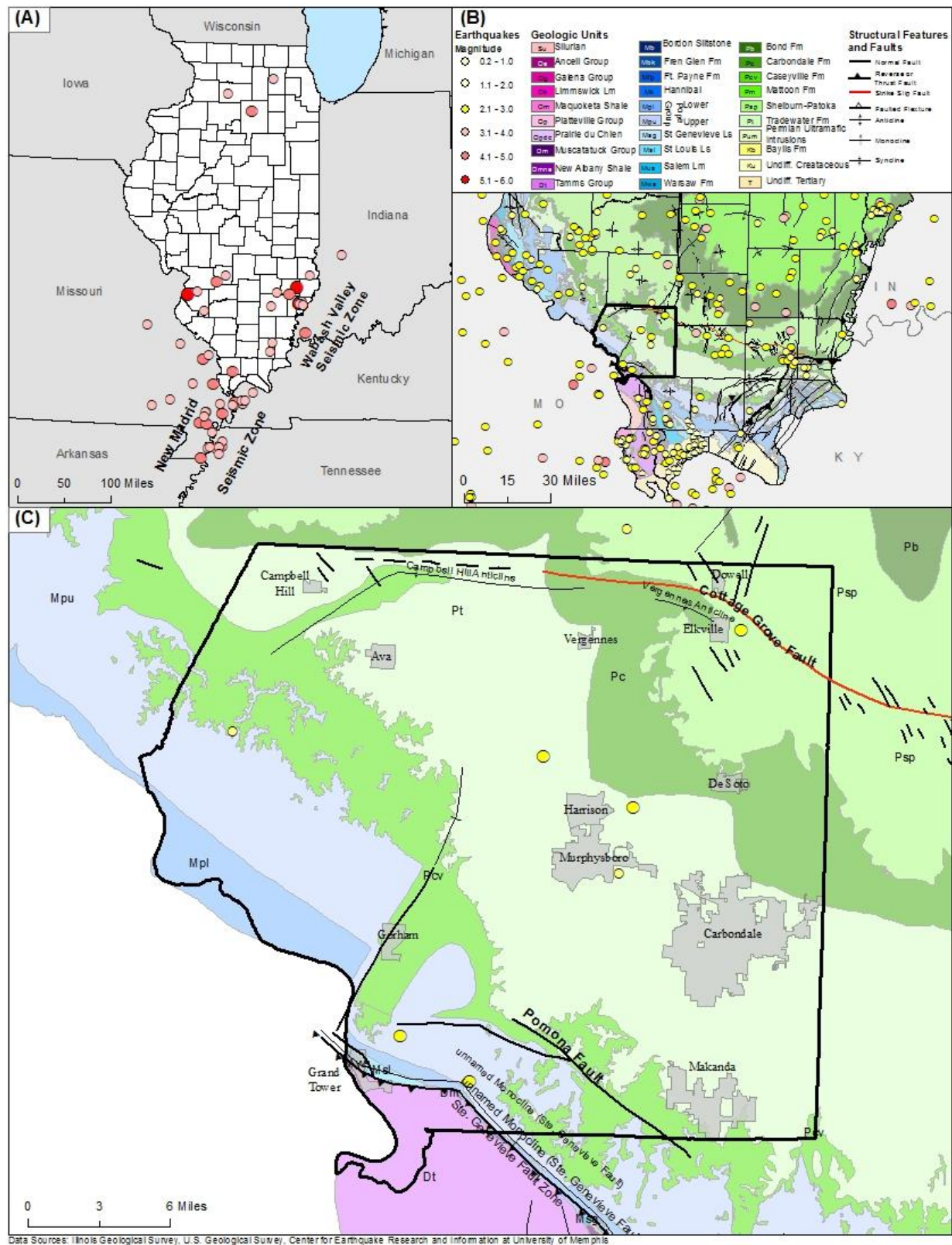
Mercalli Intensity	Description
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Previous Occurrences for Earthquakes

Historically, the most significant seismic activity in Illinois is associated with New Madrid Seismic Zone. The New Madrid Seismic Zone produced three large earthquakes in the central U.S. with magnitudes estimated between 7.0 and 7.7 on December 16, 1811, January 23, 1812, and February 7, 1812. These earthquakes caused violent ground cracking and volcano-like eruptions of sediment (sand blows) over an area >10,500 km², and uplifted a 50 km by 23 km zone (the Lake County uplift). The shaking was felt over a total area of over 10 million km² (the largest felt area of any historic earthquake). The United States Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) at the University of Memphis estimate the probability of a repeat of the 1811-1812 type earthquakes (M7.5-8.0) is 7%-10% over the next 50 years (USGS Fact Sheet 2006-3125).

Earthquakes measured in Illinois typically vary in magnitude from very low microseismic events of M=1-3 to larger events up to M=5.4. Figure 4-3 depicts the following: (A) location of notable earthquakes in Illinois region; (B) generalized geologic bedrock map with earthquake epicenters and geologic structures; (C) geologic and earthquake epicenter map of Jackson County. The most recent earthquake in Illinois—as of the date of this report—was a M2.3 event in February 2014, approximately 6 miles NNW of Mound City in Pulaski County. The last earthquake in Illinois to cause minor damage occurred on April 18, 2008 near Mt. Carmel, IL and measured 5.2 in magnitude. Earthquakes resulting in more serious damage have occurred about every 70 to 90 years and are historically concentrated in southern Illinois.

Figure 4-3. Notable Earthquakes in Illinois with Geologic and Earthquake Epicenters in Jackson County

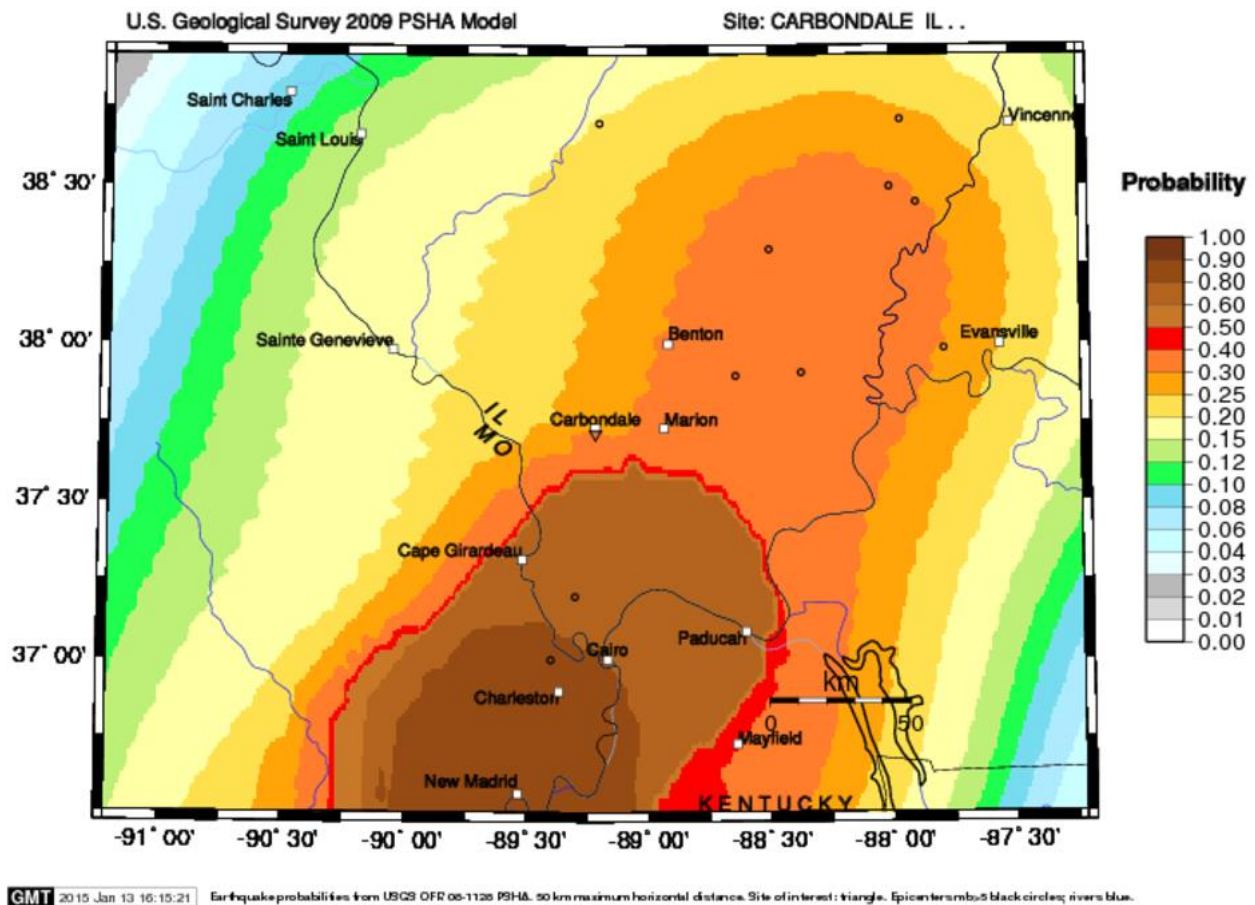


Geographic Location for Earthquake Hazard

Jackson County is situated in a region susceptible to earthquakes. Since 1974, the epicenters of seven small earthquakes (M1.6-M3.0) have been recorded in Jackson County (see Figure 4-3(C)). Some of this local seismic activity has been focused along and near the large fault zones such as the Cottage Grove Fault System and other smaller faults such as St. Genevieve Fault Zone, Pomona Fault and Dowel Fault. The seismogenic potential of these structures is unknown, and the geologic mechanism related to the minor earthquakes is poorly understood.

The two most significant zones of seismic activity in Illinois are the New Madrid Seismic Zone and the Wabash Valley Fault System. Return periods for large earthquakes within the New Madrid System are estimated to be ~500–1000 years; moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System extends nearly the entire length of southern Illinois and has the potential to generate an earthquake of sufficient strength to cause damage between St. Louis, MO and Indianapolis, IN. While large earthquakes (>M7.0) experienced during the New Madrid Events of 1811 and 1812 are unlikely in Jackson County, moderate earthquakes ($\leq 6.0M$) in or in the vicinity of Jackson County are probable. The USGS estimates the probability of a moderate M5.5 earthquake occurring in Jackson County within the next 500-years at approximately 25-40% (see Figure 4-4).

Figure 4-4. Probability of M5.5 Earthquake occurring in Jackson County within the next 500 years



Hazard Extent for Earthquake Hazard

Earthquake effects are possible anywhere in Jackson County. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. The National Earthquake Hazards Reduction Program (NEHRP) compliant soils map was provided by FEMA for the analysis. This map identifies the soils most susceptible to failure.

Risk Identification for Earthquake Hazard

Based on historical information and current USGS and SIU research and studies, future earthquakes in Jackson County are possible, but large (>M7.0) earthquakes that cause catastrophic damage are unlikely. According to the Jackson County Planning Team's assessment, earthquakes are ranked as the number one hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
2	x	8	=	16

Vulnerability Analysis for Earthquake Hazard

Earthquakes could impact the entire county equally; therefore, the entire county's population and all buildings are vulnerable to an earthquake. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County.

Critical Facilities

All critical facilities are vulnerable to earthquakes. Critical facilities are susceptible to many of the same impacts as any other building within the jurisdiction. These impacts include structural failure and loss of facility functionality (e.g., a damaged police station will no longer be able to serve the community). Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The buildings within the county can expect similar impacts to those discussed for critical facilities. These impacts include structural failure and loss of building function which could result in indirect impacts (e.g., damaged homes will no longer be habitable causing residents to seek shelter).

Infrastructure

During an earthquake, the types of infrastructure that shaking could impact include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure was not available for use in the earthquake models, it is important to emphasize that any number of these items could become damaged in the event of an earthquake. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g., loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could also fail or become impassable, causing risk to motorists.

Hazus-MH Earthquake Analyses

Existing geological information was reviewed prior to the Planning Team selection of earthquake scenarios. A Magnitude 5.5 arbitrary earthquake scenario was performed to provide a reasonable basis for earthquake planning in Jackson County. The other two scenarios included a Magnitude of 7.7 with the epicenter located on the New Madrid Fault Zone and a Magnitude 7.1 with the epicenter located on the Wabash Fault Zone.

The earthquake-loss analysis for the probabilistic scenario was based on ground-shaking parameters derived from U.S. Geological Survey probabilistic seismic hazard curves for the earthquake with the 500-year return period. This scenario evaluates the average impacts of a multitude of possible earthquake epicenters with a magnitude typical of that expected for a 500-year return period. The New Madrid Fault Zone runs along the Mississippi River through Arkansas, Tennessee, Missouri, Kentucky and Southern Illinois. The Wabash Valley Fault Zone runs through Southeastern Illinois, Western Kentucky and Southwest Indiana. This represents a realistic scenario for planning purposes.

The earthquake hazard modeling scenarios performed:

- Magnitude 5.5 arbitrary earthquake epicenter in Jackson County
- Magnitude 7.7 event along the New Madrid Fault Zone
- Magnitude 7.1 event along the Wabash Valley Fault Zone

This report presents two types of building losses: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Results for M5.5 Earthquake Scenario

The results of the M5.5 arbitrary earthquake scenario are depicted in Tables 4-12, 4-13, and Figure 4-5. Hazus-MH estimates that approximately 708 buildings will be at least moderately damaged. This is 4% of the total number of buildings in the Jackson County. It is estimated that 7 buildings would be damaged beyond repair.

The building related economic losses are approximately \$77 million dollars. It is estimated that 4% of the losses are related to the business interruption of the region. By far, the largest loss is sustained by the residential occupancies which make up over 31% of the total loss.

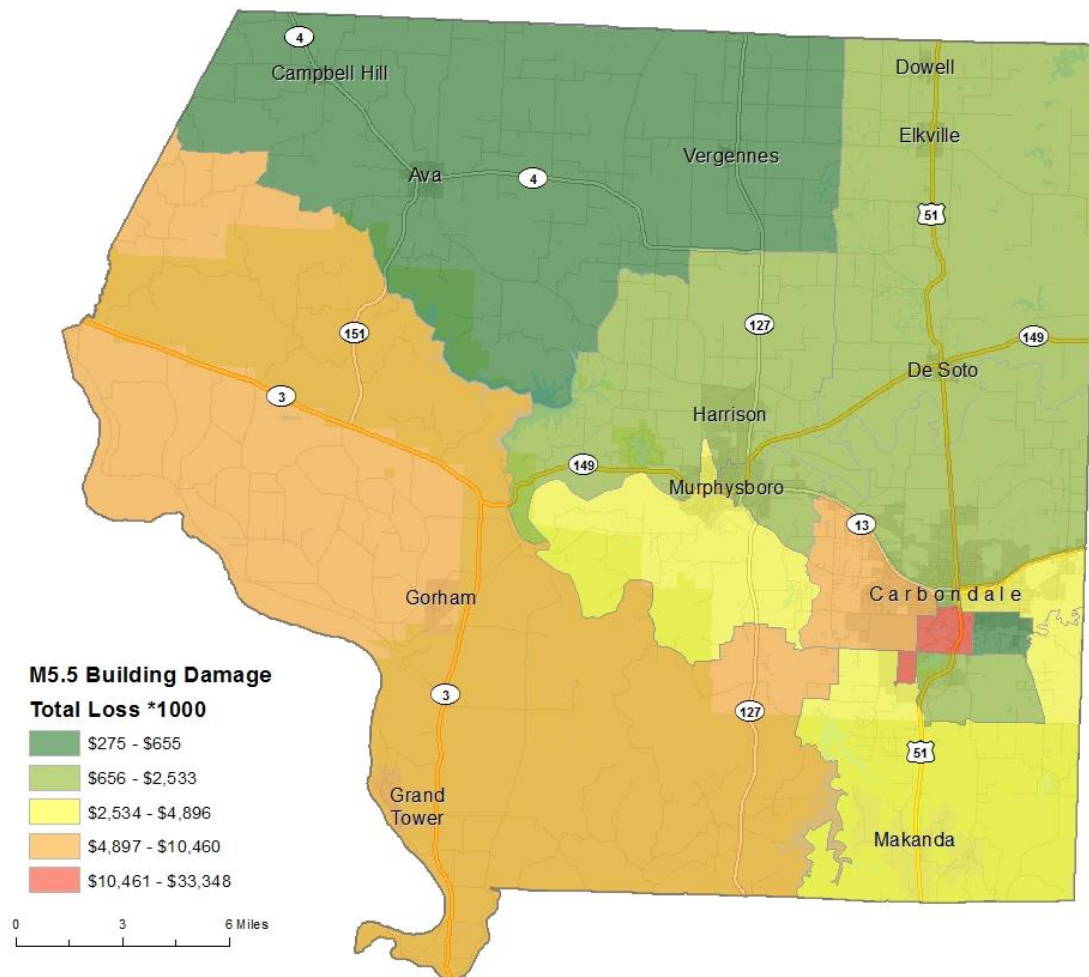
Table 4-12. M5.5 Earthquake Damage Estimates by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1283	8.53	196	8.30	56	8.94	7	9.44	1	9.96
Commercial	1033	6.87	137	5.82	28	4.48	2	2.82	0	1.23
Educational	245	1.63	39	1.67	16	2.57	3	3.26	0	2.97
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	92	0.61	13	0.57	3	0.47	0	0.31	0	0.12
Other Residential	215	1.43	28	1.18	6	1.00	1	0.88	0	0.76
Religion	4	0.03	1	0.03	0	0.04	0	0.06	0	0.11
Single Family	12156	80.89	1,944	82.44	515	82.50	64	83.23	6	84.86
Total:	15028		2,358		624		77		7	

Table 4-13. M5.5 Earthquake Estimates of Building Economic Losses (in Thousands of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Other	Total
Income Losses	Wage	\$0.00	\$0.00	\$0.01	\$0.00	\$0.93	\$0.94
	Capital-Related	\$0.00	\$0.00	\$0.02	\$0.00	\$0.41	\$0.43
	Rental	\$0.59	\$0.01	\$0.03	\$0.00	\$0.47	\$1.10
	Relocation	\$0.07	\$0.00	\$0.00	\$0.00	\$0.17	\$0.24
	Subtotal:	\$0.66	\$0.01	\$0.06	\$0.00	\$1.98	\$2.71
Capital Stock Losses	Structural	\$2.35	\$0.06	\$0.49	\$0.35	\$2.39	\$5.64
	Non-Structural	\$13.39	\$0.96	\$3.31	\$5.20	\$17.38	\$40.24
	Content	\$6.02	\$0.34	\$1.34	\$1.50	\$18.95	\$28.15
	Inventory	\$0.00	\$0.00	\$0.00	\$0.00	\$0.23	\$0.23
	Subtotal:	\$21.76	\$1.36	\$5.14	\$7.05	\$38.95	\$74.26
	Total:	\$22.42	\$1.37	\$5.20	\$7.05	\$40.93	\$76.97

Figure 4-5. Jackson County M5.5 Earthquake Building Economic Losses



Results for M7.7 New Madrid Earthquake

The results of the M7.7 New Madrid earthquake scenario are depicted in Tables 4-14, 4-15, and Figure 4-6. Hazus-MH estimates that approximately 1,414 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the Jackson County. It is estimated that 62 buildings would be damaged beyond repair.

The building related economic are approximately \$133 million dollars. It is estimated that 10% of the losses are related to the business interruption of the region. By far, the largest loss is sustained by the residential occupancies which make up over 62% of the total loss.

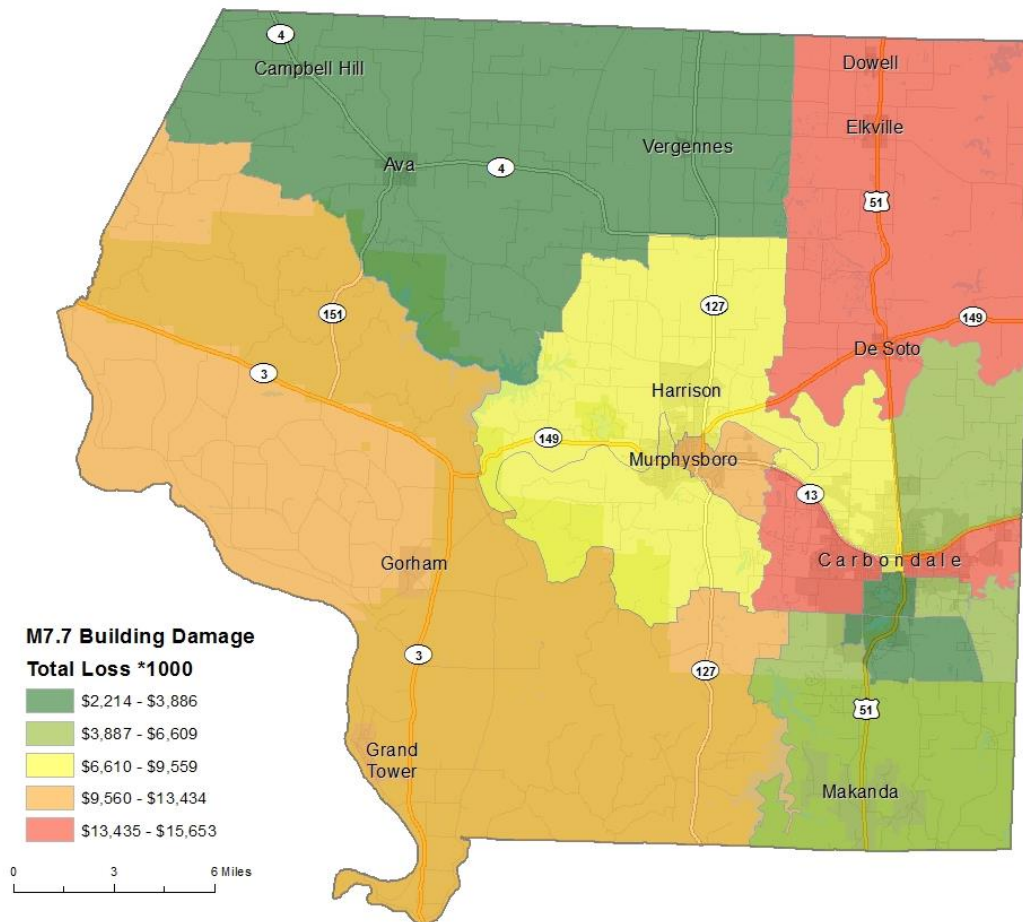
Table 4-14. New Madrid M7.7 Earthquake Damage Estimates by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	98	0.46	29	0.68	12	1.07	3	1.09	1	0.98
Commercial	906	4.30	248	5.75	79	7.29	10	3.71	2	2.51
Educational	48	0.23	12	0.28	3	0.28	1	0.22	0	0.21
Government	52	0.25	12	0.27	3	0.29	1	0.30	0	0.30
Industrial	180	0.86	51	1.19	18	1.69	3	1.01	0	0.74
Other Residential	7,174	34.04	2,167	50.31	713	66.24	115	41.92	25	40.17
Religion	111	0.52	26	0.60	7	0.68	1	0.39	0	0.30
Single Family	12,506	59.34	1,763	40.92	242	22.45	141	51.36	34	54.81
Total:	21,075		4,308		1,077		275		62	

Table 4-15. New Madrid M7.7 Earthquake Estimates of Building Economic Losses (in Millions of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Other	Total
Income Losses	Wage	\$0.00	\$0.06	\$2.07	\$0.07	\$0.29	\$2.49
	Capital-Related	\$0.00	\$0.03	\$1.79	\$0.04	\$0.07	\$1.93
	Rental	\$0.74	\$0.82	\$1.18	\$0.03	\$0.10	\$2.87
	Relocation	\$2.50	\$1.36	\$1.49	\$0.16	\$0.75	\$6.26
	Subtotal:	\$3.24	\$2.27	\$6.53	\$0.30	\$1.21	\$13.55
Capital Stock Losses	Structural	\$4.18	\$2.44	\$1.75	\$0.38	\$0.87	\$9.62
	Non-Structural	\$24.31	\$23.17	\$12.62	\$2.90	\$5.67	\$68.67
	Content	\$13.08	\$9.61	\$9.88	\$2.17	\$5.37	\$40.11
	Inventory	\$0.00	\$0.00	\$0.29	\$0.43	\$0.07	\$0.79
	Subtotal:	\$41.57	\$35.22	\$24.54	\$5.88	\$11.98	\$119.19
	Total:	\$44.81	\$37.49	\$31.07	\$6.18	\$13.19	\$132.74

Figure 4-6. New Madrid M7.7 Earthquake Building Economic Losses



Results M7.1 Magnitude Wabash Valley Earthquake – General Building Stock

The results of the Wabash Valley M7.1 earthquake scenario are depicted in Tables 4-16, 4-17, and Figure 4-7. Hazus-MH estimates that approximately 26 buildings will be at least moderately damaged. Three buildings would be damaged beyond repair.

The building related economic are approximately \$4 million dollars. It is estimated that 9% of the losses are related to the business interruption of the region. By far, the largest loss is sustained by the residential occupancies which make up over 64% of the total loss.

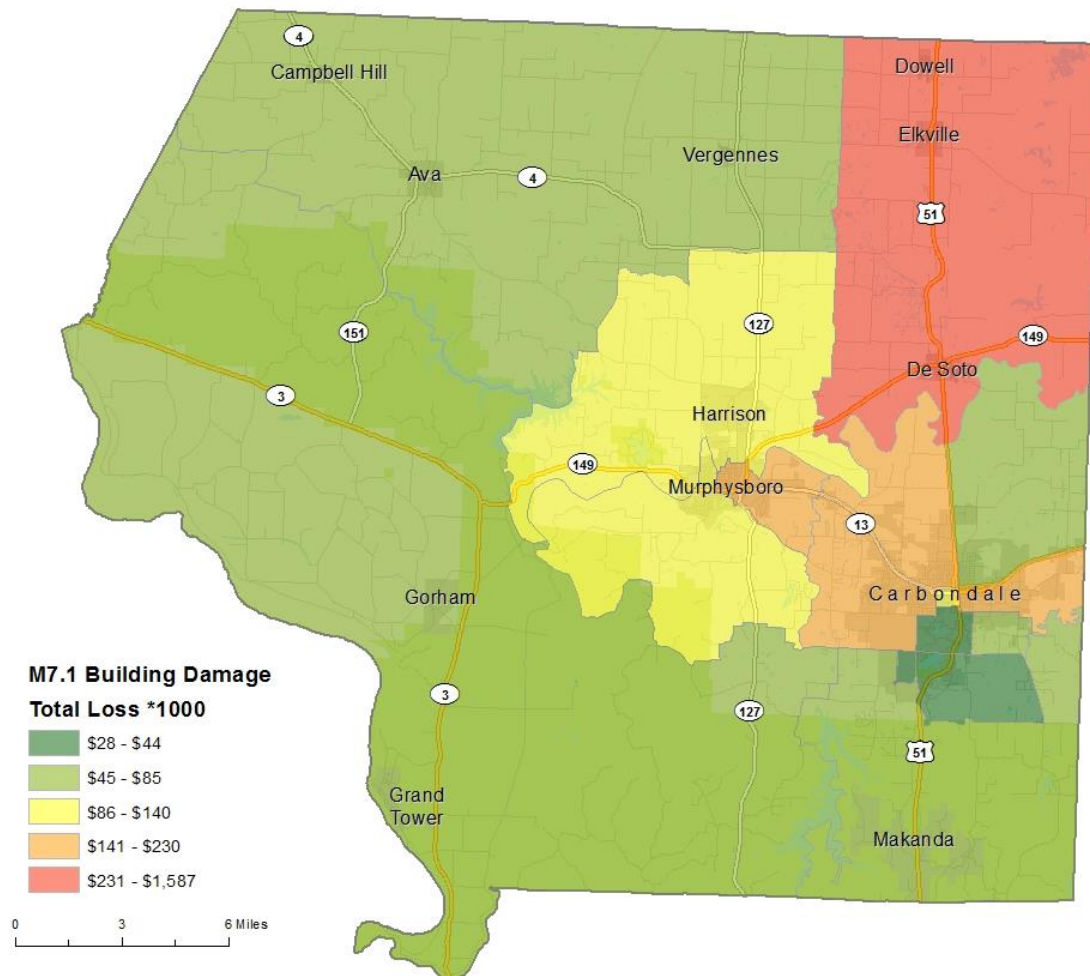
Table 4-16. Wabash Valley 7.1 Magnitude Earthquake Damage Estimates by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	141	0.53	1	0.63	0	0.86	0	0.50	0	0.50
Commercial	1,237	4.64	6	5.07	1	5.95	0	2.25	0	2.25
Educational	64	0.24	0	0.27	0	0.24	0	0.08	0	0.08
Government	68	0.25	0	0.22	0	0.25	0	0.23	0	0.23
Industrial	251	0.94	1	1.05	0	1.31	0	0.50	0	0.50
Other Residential	10,110	37.94	72	57.50	5	52.15	6	43.32	1	43.32
Religion	144	0.54	1	0.64	0	0.69	0	0.35	0	0.35
Single Family	14,629	54.91	43	34.63	4	38.56	7	52.76	2	52.76
Total:	26,644		124		10		13		3	

Table 4-17. Wabash 7.1 Magnitude Earthquake Estimates of Building Economic Losses (in Millions of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Other	Total
Income Losses	Wage	0.00	0.00	0.02	0.00	0.01	\$0.03
	Capital-Related	0.00	0.00	0.02	0.00	0.00	\$0.02
	Rental	0.03	0.02	0.02	0.00	0.00	\$0.07
	Relocation	0.10	0.02	0.02	0.00	0.01	\$0.15
	Subtotal:	\$0.13	\$0.04	\$0.08	\$0.00	\$0.02	\$0.27
Capital Stock Losses	Structural	0.16	0.05	0.03	0.00	0.02	\$0.26
	Non-Structural	0.74	0.42	0.30	0.08	0.16	\$1.70
	Content	0.33	0.15	0.22	0.05	0.13	\$0.88
	Inventory	0.00	0.00	0.01	0.01	0.00	\$0.02
	Subtotal:	\$1.23	\$0.62	\$0.56	\$0.14	\$0.31	\$2.86
	Total:	\$1.36	\$0.66	\$0.64	\$0.14	\$0.33	\$3.13

Figure 4-7. Wabash Valley M7.1 Scenario Building Economic Losses



Vulnerability to Future Assets/Infrastructure for Earthquake Hazard

New construction, especially critical facilities, should accommodate earthquake mitigation design standards.

Suggestions for Community Development Trends

Community development should occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction. It is important to harden and protect future and existing structures against the possible termination of public services and systems including power lines, water and sanitary lines, and public communication.

4.3.3 Tornado Hazard

Hazard Definition

Tornadoes are violently rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground; however, the violently rotating column of air can reach the ground quickly and become a tornado. If the funnel cloud picks up and blows debris, it has reached the ground and is a tornado.

Tornadoes are a significant risk to Illinois and its citizens. Tornadoes can occur at any time on any day. The unpredictability of tornadoes makes them one of Illinois' most dangerous hazards. Tornado winds are violently destructive in developed and populated areas. Current estimates place maximum wind velocity at about 300 miles per hour, but higher values can occur. A wind velocity of 200 miles per hour results in a pressure of 102.4 pounds per square foot—a load that exceeds the tolerance limits of most buildings. Thus, it is easy to understand why tornadoes can devastate the communities they hit.

Tornadoes are classified according to the Enhanced Fujita tornado intensity scale. The Enhanced Fujita scale ranges from intensity EF0, with effective wind speeds of 40 to 70 miles per hour, to EF5 tornadoes, with effective wind speeds of over 260 miles per hour. Table 4-18 outlines the Enhanced Fujita intensity scale.

Table 4-18. Enhanced Fujita Tornado Rating

Enhanced Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
0 Gale	40-72 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, branches broken, signboards damaged, shallow-rooted trees blown over.
1 Moderate	73-112 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 Significant	113-157 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 Severe	158-206 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.

Enhanced Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
4 Devastating	207-260 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 Incredible	261-318 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Previous Occurrences of Tornadoes

There have been several occurrences of tornadoes in Jackson County during recent decades. The National Climatic Data Center (NCDC) database reported 38 tornadoes/funnel clouds in Jackson County since 1950. Table 4-19 identifies NCDC-recorded tornadoes that caused damage, death, or injury in Jackson County. Additional details of individual hazard events are on the NCDC website.

Although not recorded in the NCDC data, the Tri-State Tornado remains the most memorable tornado in Jackson County's history. The tornado tore across Southeast Missouri, Southern Illinois, and Southwest Indiana. The Tri-State Tornado was a rare event – spanning 219 miles long with an average width of $\frac{3}{4}$ mile; affected 3 states, 13 counties, over 19 communities. The entire town of Gorham was demolished and 34 people lost their lives. 541 people were killed and 1,423 were seriously injured as the tornado tore a path of destruction nearly one mile wide through the towns of Murphysboro, De Soto, Hurst-Bush, and West Frankfort.

The most devastating recorded event in the NDCD occurred during the December 18 - 19, 1957 tornado outbreak when a low pressure area approached the southern portions of Missouri and Illinois. This tornado track closely followed the Tri-State Tornado path. The deadliest outbreak of this sequence occurred on Dec 18th, 1957 in Gorham, Murphysboro and De Soto. The tornado was rated an EF4 and killed 11 people in Murphysboro. The tornado injured 200 people along its path.

Table 4-19. NCDC-Recorded Tornadoes That Caused Damage, Death, or Injury in Jackson County

Location or County*	Date	Scale	Deaths	Injuries	Property Damage
Jackson County	12/18/1957	F2	0	0	\$25,000
Jackson County	8/21/1971	F1	0	0	\$25,000
Jackson County	6/14/1990	F1	0	0	\$25,000
Jackson County	5/8/2009	EF1	0	0	\$90,000
Jackson County	4/19/2011	EF0	0	0	\$70,000
Jackson County	2/29/2012	EF2	0	0	\$100,000
Jackson County	3/23/2012	EF1	0	0	\$75,000
Jackson County	4/24/2014	EF1	0	0	\$35,000
Jackson County	3/25/1970	F2	0	1	\$250,000
Jackson County	9/22/2006	F2	0	1	\$800,000
Jackson County	12/18/1957	F2	0	5	\$25,000
Jackson County	4/5/1958	F3	0	5	\$250,000
Jackson County	6/1/1970	F2	0	5	\$25,000
Jackson County	4/5/1958	F3	0	6	\$250,000
Jackson County	11/13/1951	F2	0	7	\$250,000

Location or County*	Date	Scale	Deaths	Injuries	Property Damage
Jackson County	12/18/1957	F2	0	0	\$25,000
Jackson County	12/18/1957	F4	11	180	\$2,500
Total:			11	210	\$2,319,000

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Tornado Hazard

The entire county has the same risk of tornado occurrence. Tornadoes can occur at any location within the county.

Hazard Extent for Tornado Hazard

Historical tornadoes generally moved from southwest to northeast across the county, although many other tracks are possible, from more southerly to northerly directions. The extent of the hazard varies in terms of the size of the tornado, its path, and its wind speed.

Risk Identification for Tornado Hazard

Based on historical information, the probability of future tornadoes in Jackson County is likely. The County should expect tornadoes with varying magnitudes to occur in the future. Tornadoes ranked as the number two hazard according to the Jackson County Planning Team's risk assessment.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
3	x	4	=	12

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area in the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County.

Critical Facilities

All critical facilities are vulnerable to tornadoes. Critical facilities are susceptible to many of the same impacts as any other building within the jurisdiction. These impacts vary based on the magnitude of the tornado but can include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g., a damaged police station will no longer be able to serve the community). Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows

broken by hail or high winds, and loss of building function (e.g., damaged home will no longer be habitable, causing residents to seek shelter).

Infrastructure

The types of infrastructure that could be impacted during a tornado include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is vulnerable, it is important to emphasize that any number of these structures could become damaged during a tornado. The impacts to these structures include broken, failed, or impassable roadways, broken or failed utility lines (e.g., loss of power or gas to community), and railway failure from broken or impassable rail lines. Bridges could fail or become impassable, causing risk to motorists.

GIS-based Tornado Analysis

One tornado scenario was conducted for Jackson County through the Villages of Campbell Hill and Ava, and the Cities of Murphysboro and Carbondale. The following analysis quantifies the anticipated impacts of tornadoes in the county in terms of numbers and types of buildings and infrastructure damaged.

GIS-overlay modeling was used to determine the potential impacts of an EF4 tornado. The analysis used a hypothetical path based upon the F4 tornado event that runs for 42 miles through the Villages of Campbell Hill and Ava and the Cities of Murphysboro and Carbondale. Table 4-20 depicts tornado damage curves and path widths utilized for the modeled scenario. The damage curve is based on conceptual wind speeds, path winds, and path lengths from the Enhanced-Fujita Scale guidelines.

Table 4-20. Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
5	2,400	100%
4	1,800	100%
3	1,200	80%
2	600	50%
1	300	10%
0	150	0%

Degrees of damage depend on proximity to the path centerline within a given tornado path. The most intense damage occurs within the center of the damage path, with decreasing amounts of damage away from the center. To model the EF4 tornado, a hypothetical tornado path was used in GIS with buffers added (damage zones) around the tornado path. Table 4-21 and Figure 4-8 illustrate the zone analysis. Figure 4-9 depicts the selected hypothetical tornado path.

Table 4-21. EF4 Tornado Zones and Damage Curves

Zone	Buffer (feet)	Damage Curve
1	0-150	100%
2	150-300	80%
3	300-600	50%
4	600-900	10%

Figure 4-8. Tornado Analysis (Damage Curves) Using GIS Buffers

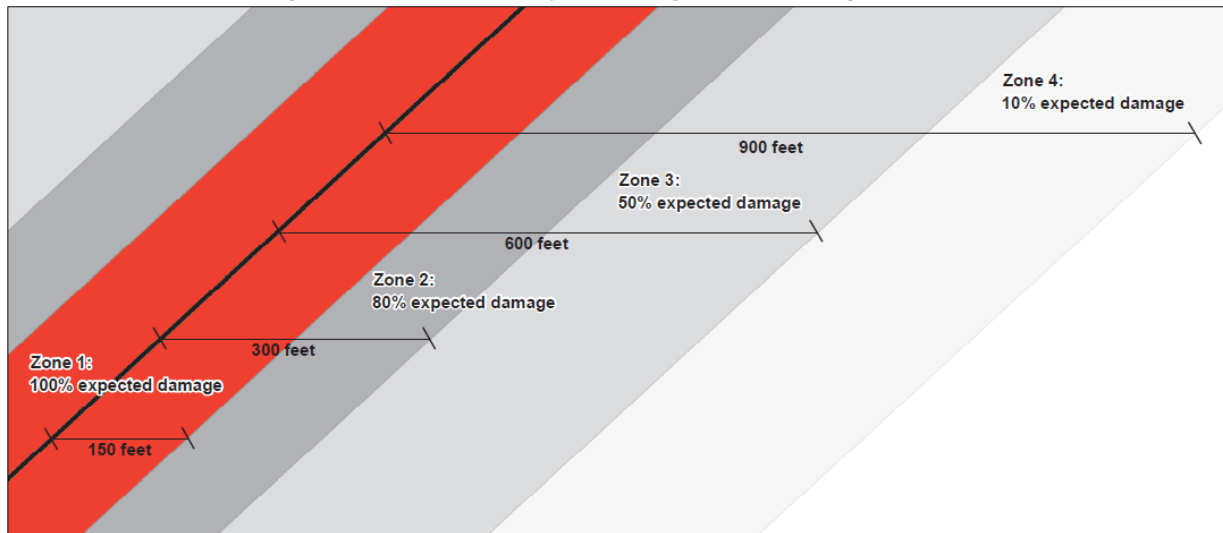
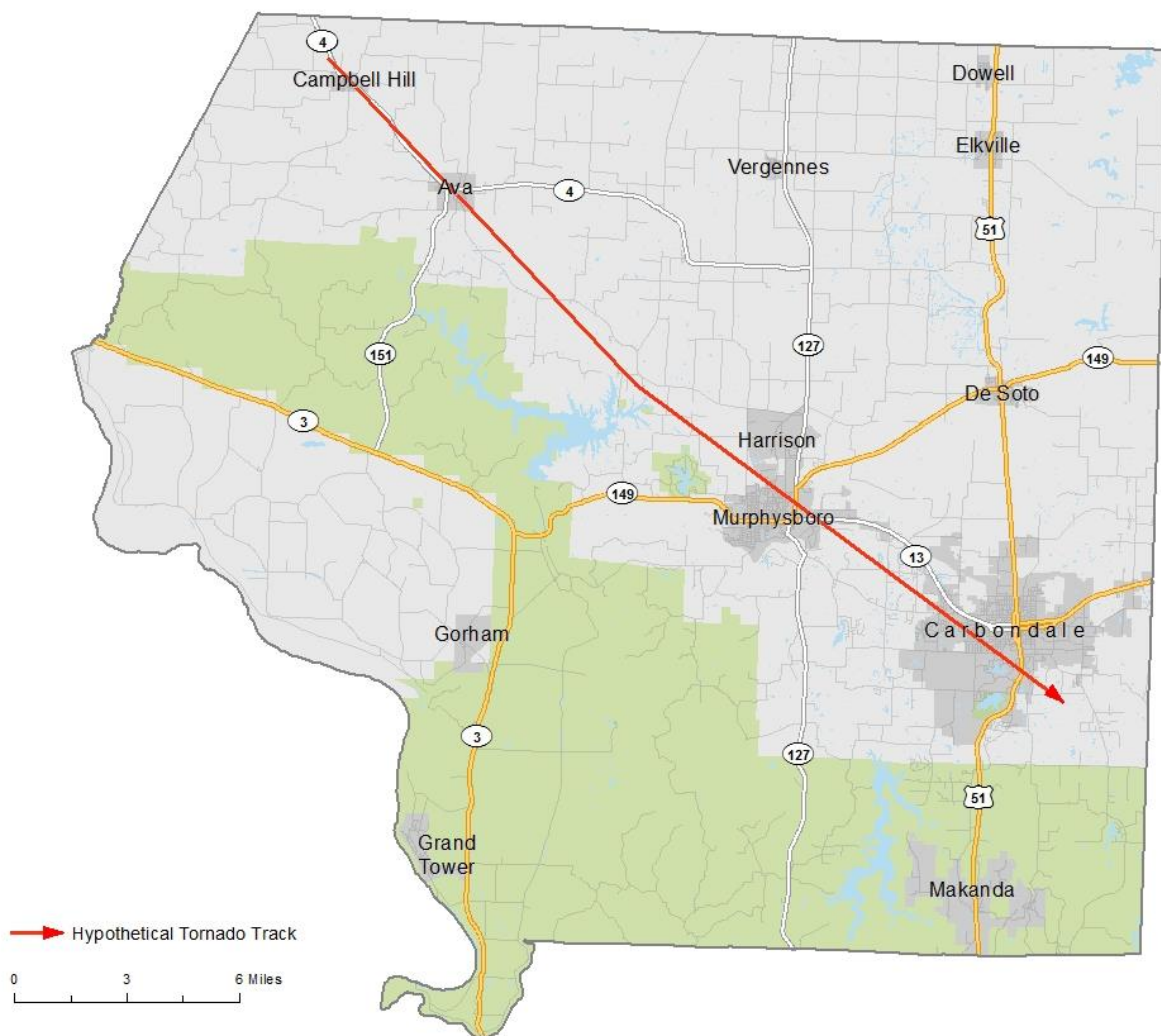


Figure 4-9. Modeled Hypothetical EF4 Tornado Track for Jackson County



Modeled Impacts of the EF4 Tornado

The GIS analysis estimates that the modeled EF4 tornado would damage 1,444 buildings. The estimated building losses are over \$43,678,413. The building losses are an estimate of building replacement costs multiplied by the damage percent. Table 4-22 and Figures 4-10 and 4-11 show the results of the EF4 tornado analysis.

Table 4-22. Estimated Building Loss by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	\$36,039,000	\$30,947,000	\$34,532,000	\$6,182,000
Commercial	\$11,359,000	\$4,252,000	\$4,401	\$1,571,000
Industrial	\$30,000	\$8,000	\$59,000	\$6,000
Educational	\$795,000,000	\$227,400,000	\$819,750,000	\$126,150,000
Total:	\$842,427,000	\$262,606,000	\$858,742,000	\$133,908,000

Figure 4-10. Building Inventory Affected by the EF4 Tornadoes Modeled for Murphysboro and Carbondale

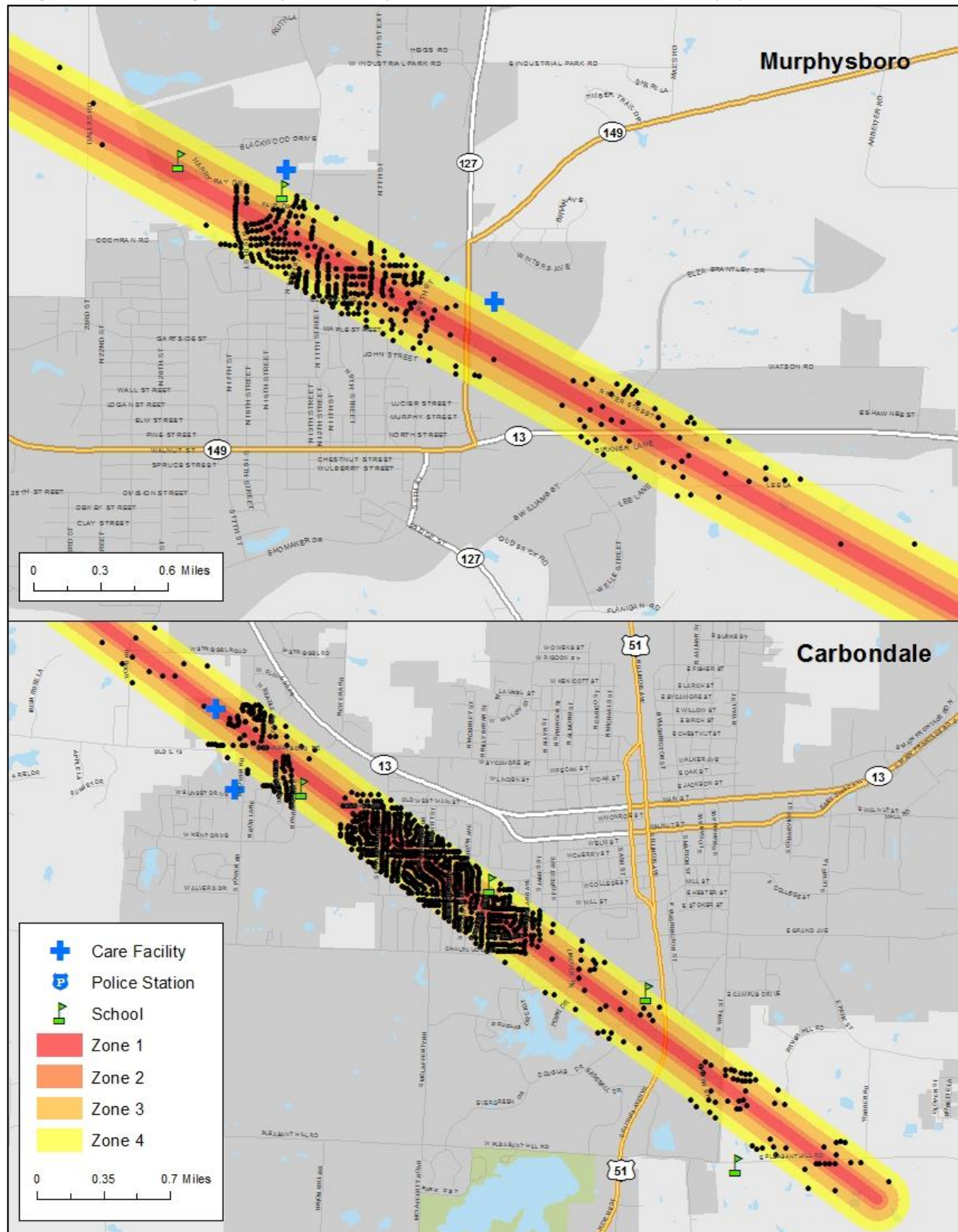
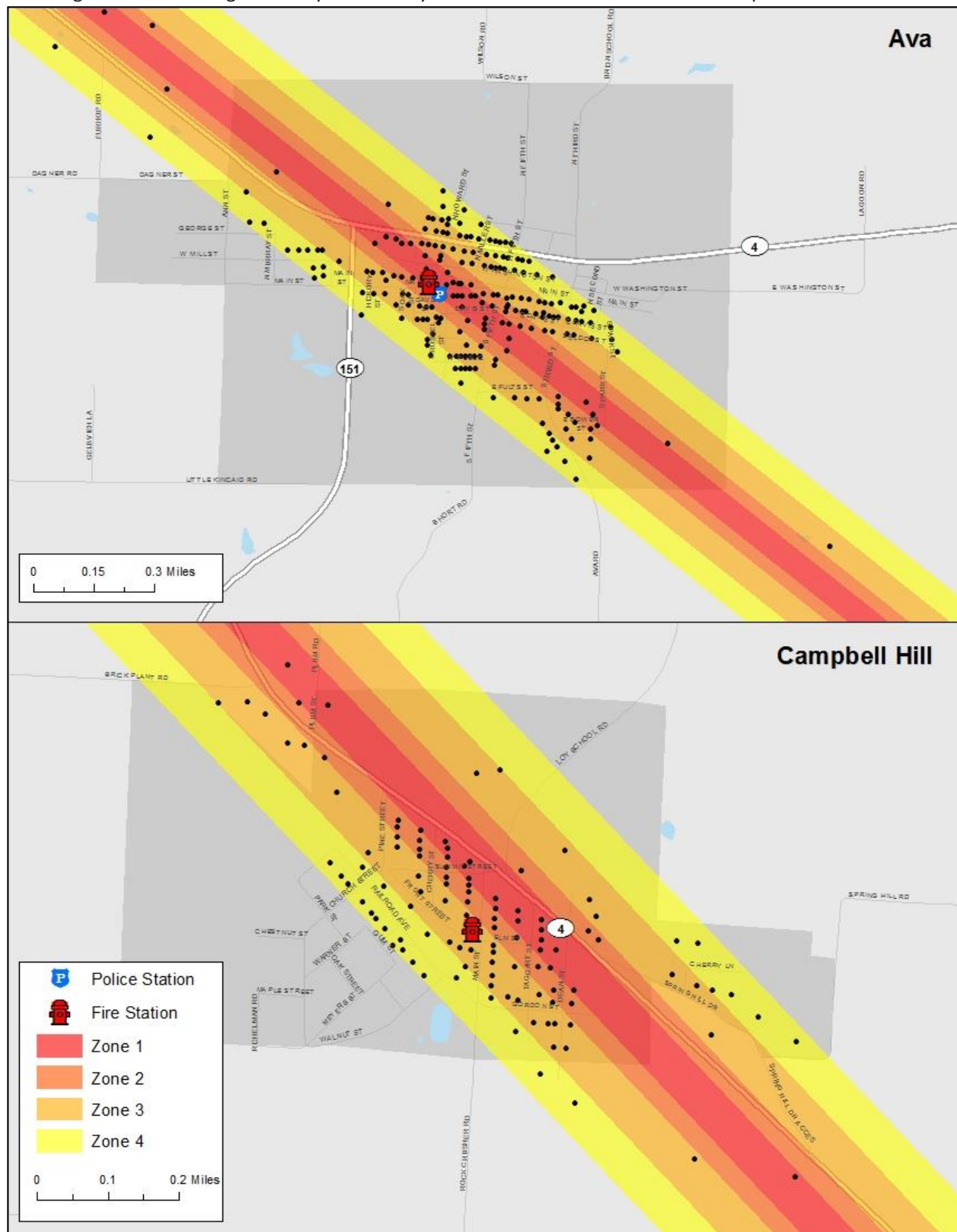


Figure 4-11. Building Inventory Affected by the EF4 Tornadoes Modeled for Campbell Hill and Ava



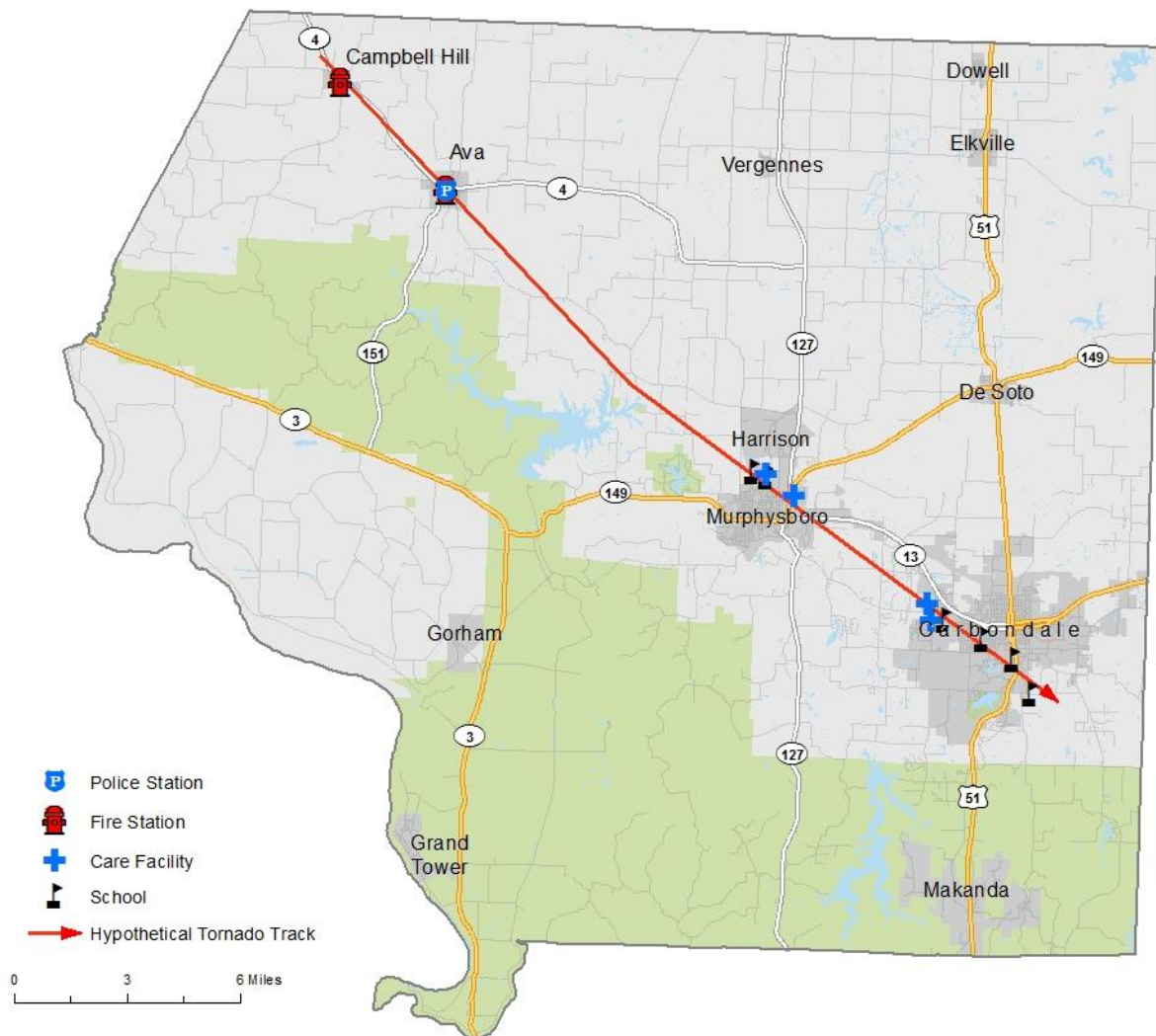
Essential Facilities Damage

There are thirteen essential facility located within 900 feet of the EF4 tornado path. The model predicts that four care facilities, six schools, two fire stations and one police station would experience damage across Jackson County. The affected facilities are identified in Table 4-23, and their geographic locations are shown in Figure 4-12.

Table 4-23. Essential Facilities Affected by the EF4 Tornadoes Modeled for Jackson County

Essential Facility	Facility Name
Care Facilities	St. Joseph Memorial Hospital
	Oak Grove Rehab & Skilled Care
	Liberty Village
Schools	Carbondale New School
	Trinity Christian School
	Parrish Elementary School
	Murphysboro High School
	Southern Illinois University
	Carruthers Elementary School
Fire Departments	Ava Volunteer Fire Department
	Campbell Hill Rural Fire District 162
Police Station	Ava Police Department

Figure 4-12. Essential Facilities Affected by the EF4 Tornadoes Modeled for Jackson County



Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and all buildings are at risk because tornadoes can occur anywhere within the state, at any time. Furthermore, any future development in terms of new construction within the county is at risk. Table 4-8 includes the building exposure for Jackson County. All essential facilities in the county are at risk. Appendix E include a list of the essential facilities in Jackson County and Appendix F displays a large format map of the locations of all critical facilities within the county.

Suggestions for Community Development Trends

Preparing for severe storms will be enhanced if local officials sponsor a wide range of programs and initiative to address severe storm preparedness. It is suggested that the county should build new structures with more sturdy construction, and harden existing structures to lessen the potential impacts of severe weather. This is particularly import where the future economic expansion is expected to take place within the City of Carbondale and along the Route 13 business corridor. Additional warning sirens can warn the community of approaching storms to ensure the safety of Jackson County residents and minimizing property damage.

4.3.4 Dam and Levee Failure

Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either: 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added infrastructure, and increased population over time. Levees in particular are built to hold back flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, then the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee-failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been under-funded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Previous Occurrences of Dam and Levee Failure

Prior to the 1950s, large flood events along the Mississippi River within Jackson County often overwhelmed local/private levees inundating the floodplain and its communities. Since the completion of the larger levees constructed by the Federal Government in the 1950s, no levee failures have occurred along the Mississippi River within Jackson County. Along the other streams and rivers in Jackson County there are no records or local knowledge of any dam or any other certified levee failure in the county.

In recent years, there have been issues with Grand Tower / Degognia Levee System in Jackson County. The U.S. Army Corps of Engineers 2010 Executive Summary for the levee system identified twenty-one slides on the Grand Tower levees and ten slides along the Degognia and Fountain Bluff levees during a field inspection. Historically, there has been shallow landslides occurring along this system due to design flaw, particularly along the Big Muddy River within the Grand Tower Drainage and Levee District. Figure 4-13 illustrates the shallow landslide observed along the Big Muddy Levee near Grand Tower, IL in 2008. In addition to issues with levee slides, the Grand Tower Levee faces necessary repairs to a drain valve that collapsed in 2013.

Figure 4-13. 2008 Slides along the Big Muddy Levee east of Grand Tower, IL



Geographic Location of Dams and Levees in Jackson County

The U.S. Army Corps of Engineers maintains the National Inventory of Dams (NID) which identified 20 dams in Jackson County. According to NID records, five dams in Jackson County are classified as high hazard and eight dams have Emergency Action Plans (EAP). Table 4-24 list of the dams located in Jackson County and their respective classification level.

Table 4-24. Jackson County Dam Inventory

Dam Name	Stream/River	Hazard Rating	EAP
Chautauqua Lake Dam	Tributary to Mud Creek	High	Yes
Campus Lake Dam	Tributary to Piles Fork	Significant	Yes
Cedar Lake Dam	Cedar Creek	High	Yes
Kinkaid Lake Dam	Kinkaid Lake	High	No
Lake Murphysboro Dam	Tributary to Big Muddy River	Significant	Yes
Carbondale Reservoir Dam	Piles Fork	High	Yes
Lake Henry Dam	Tributary to Big Muddy River	Significant	No
Spring Arbor Lake Dam	Sycamore Creek	High	Yes
Lake Indian Hills Dam	Indiana Creek	Low	No
Little Lake Dam	Big Muddy River	Low	No
Jackson Country Club Reservoir	Tributary to Big Muddy River	Low	No
New Thompson Lake Dam	Tributary to Big Muddy River	Low	No
Consol/Burning Star/Slurry-Wetlands Dam	Tributary to Little Muddy River	Low	No
Aquaculture Lake Dam	Tributary to Sycamore Creek	Low	Yes
Carbondale Park District Golf Course Dam	Tributary to Big Muddy River	Low	No
Deer Lake Dam	Tributary to Muddy Creek	Significant	Yes
Little Cedar Dam	Cedar Creek	Low	No
Borgsmiller Pond Dam	Tributary to Big Muddy River	Low	No
Carbon lake	Big Muddy River	Low	No
Midland Hills Dam	Tributary to Cedar Lake	Low	No

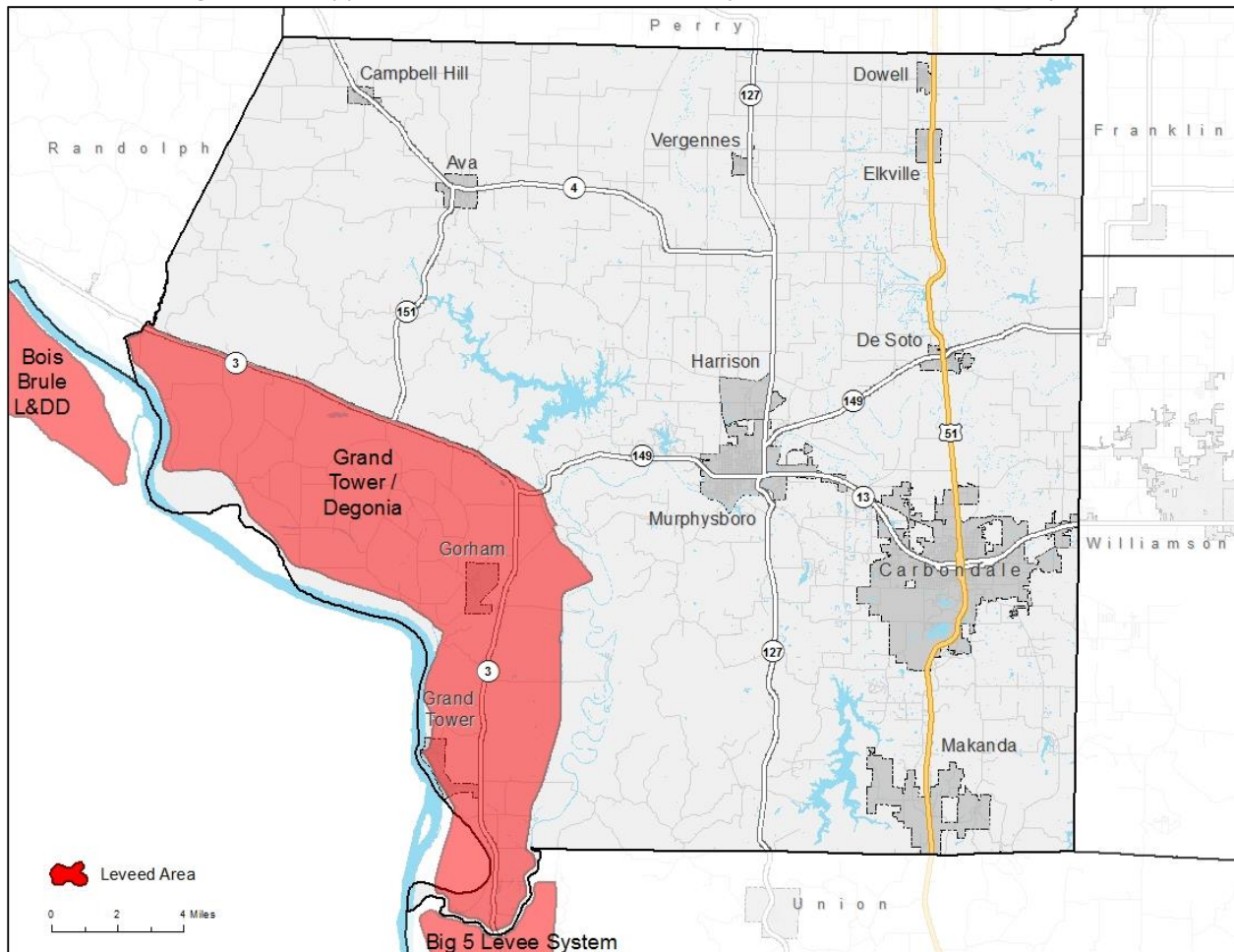
A review of the US Army Corps of Engineers National Levee Database and IDNR records revealed one levee system and three levees within Jackson County. Table 4-25 list of the levees located in Jackson County and their respective U.S. Army Corps of Engineers (USACE) levee system inspection rating. The approximate location of the levee system is shown in Figure 4-14.

Table 4-25. Jackson County Levee Inventory

Levee System	Levees District	Length (miles)	Protection Levee	USACE Levee System Inspection Rating*
Grand Tower / Degonia Levee System	Degonia and Fountain Bluff Levees	19.4	50-year	Unacceptable
	Grand Tower Levee	17.2	50-year	

*Each levee segment receives an overall segment inspection rating of Acceptable, Minimally Acceptable, or Unacceptable. If a levee system comprises one or more levee segments (if there are different levee sponsors for different parts of the levee) then the overall levee system rating is the lowest of the segment ratings.

Figure 4-14. Approximate Location of the Levee Systems within Jackson County



Hazard Extent for Dam and Levee Failure

Dams are assigned a low hazard potential classification means that failure or incorrect operation of the dam will result in no human life losses and no economic or environmental losses. Losses are principally limited to the owner's property. A significant hazard classification means that failure or incorrect

operation results in no probable loss of human life; however, dam or levee failure can cause economic loss, environmental damage, and disruption of lifeline facilities. Significant hazard potential dams are often located in predominantly rural or agricultural areas, but could be located in populated areas with a significant amount of infrastructure. A high hazard potential classification means that failure or incorrect operation has the highest risk to cause loss of human life and to significantly damage buildings and infrastructure.

According to NID records, five dams in Jackson County are classified as high hazard and eight dams have Emergency Action Plans (EAP). An EAP is not required by the State of Illinois but is recommended in the 2003 Illinois Dam Safety & Inspection Manual.

The U.S. Army Corps of Engineers conducts two types of levee inspections: routine and periodic. Both Routine and Periodic Inspections result in a final inspection rating for operation and maintenance. The rating is based on the levee inspection checklist, which includes 125 specific items dealing with operation and maintenance of levee embankments, floodwalls, interior drainage, pump stations, and channels. Each levee segment receives an overall segment inspection rating of Acceptable, Minimally Acceptable, or Unacceptable. If a levee system comprises one or more levee segments (if there are different levee sponsors for different parts of the levee) then the overall levee system rating is the lowest of the segment ratings.

According to USACE records, the Grand Tower / Degognia Levee System in Jackson County was last inspected in July 14th, 2010. The levee system received an unacceptable levee inspection rating. According to the USACE Executive Summary Report, in its current condition the Grand Tower / Degognia Levee System will likely not operate safely in the next high water event. Proper repair of the observed 32 slides is needed. Repairs are also needed to the drainage structure culverts, along with proper videotape documentation of their interior condition. Tree encroachment needs to be addressed to allow for improved flood fighting access and to reduce the potential for seepage into/through the levees from the tree roots. In addition, other deferred maintenance, modifications, and repairs (and the possibility of the existence of hidden or undetected critical flaws) could result in system failure, especially during prolonged high river stage.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees actually provide. FEMA and the U.S. Army Corps of Engineers are working together to make sure that flood hazard maps better reflect the flood protection capabilities of levees and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or private individuals or organizations such as local levee districts—are responsible for ensuring that the levees they own are maintained to their original design level and condition. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove that the levee meets design, operation, and maintenance standards for protection against the 1% annual probability (100-year) flood. Both of the levee districts are designed for 50-year events with 2 feet of freeboard. Thus they do not meet the NFIP criteria.

Risk Identification for Dam and Levee Failure

Based on operation and maintenance requirements and local knowledge of the dams and levees in Jackson County, the probability of failure is possible. However, if a high-hazard dam failed, the magnitude and severity of the damage could be great. The warning time and duration of the dam failure event would

be very short. Based on input from the Planning Team, future occurrence of dam or levee failure in Jackson County is likely. According to the Risk Priority Index (RPI) and County input, flooding is ranked as the number three hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
4	x	3	=	12

Vulnerability Analysis for Dam and Levee Failure

An Emergency Action Plan (EAP) is required to assess the effect of dam failure on these communities. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the 1% annual probability flood.

Because all floodplains are susceptible to flooding in Jackson County; therefore, the population and all buildings located within the floodplain are vulnerable to dam and levee failure. To accommodate this risk, this plan considers all buildings located within 100-year flood plain as vulnerable.

Critical Facilities

All critical facilities within the floodplain are vulnerable to dam and levee failure. An essential facility will encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility, and loss of facility functionality (e.g., a damaged police station cannot serve the community). Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

All buildings within the floodplain are vulnerable to floods as a result of dam and/or levee failure. These impacts can include structural failure, extensive water damage to the facility, and loss of facility functionality (e.g., damaged home will no longer be habitable, causing residents to seek shelter). This plan considers all buildings located within 100-year flood plain as vulnerable.

Infrastructure

The types of infrastructure potentially impacted by a flood include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available for this plan, it is important to emphasize that a flood could damage any number of these items. The impacts to these items include: broken, failed, or impassable roadways; broken or failed utility lines (e.g., loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could also fail or become impassable, causing risk to motorists.

Hazus-MH Flood Analysis

See section 4.3.6 Flooding Hazard for the results of the Hazus-MH Flood Analysis.

Vulnerability to Future Assets/Infrastructure for Dam and Levee Failure

Flooding as a result of dam or levee failure may affect nearly any location within the county; therefore all buildings and infrastructure are vulnerable. Table 4-8 includes the building exposure for Jackson County.

All essential facilities in the county are at risk. Appendix E include a list of the essential facilities in Jackson County and Appendix F displays a large format map of the locations of all critical facilities within the county. Currently, the municipal planning commission reviews new developments for compliance with the local flood zoning ordinance. At this time no new construction is planned with the 100-year floodplain.

Suggestions for Community Development Trends

Reducing floodplain development is crucial to reducing flood-related damages. Areas with recent development may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible to drainage issues. Damage to these can cause back-up of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

4.3.5 Thunderstorm Hazard

Hazard Definition

Severe thunderstorms are weather events with one or more of the following characteristics: strong winds, large and damaging hail, and frequent lightning. Severe thunderstorms most frequently occur in Illinois during the spring and summer months, but can occur at any time. A severe thunderstorm's impacts can be localized or can be widespread in nature. A thunderstorm is classified as severe when it meets one or more of the following criteria:

- Hail 0.75 inches or greater in diameter

- Hail is a possible product of a strong thunderstorm. Hail usually falls near the center of a storm, but strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, resulting in damage in other areas near the storm. Hailstones range from pea-sized to baseball-sized, and some reports note hailstones larger than softballs.

- Frequent and dangerous lightning

- Lightning is a discharge of electricity from a thunderstorm. Lightning is often perceived as a minor hazard, but lightning damages many structures and kills or severely injures numerous people in the United States each year.

- Wind speeds greater than or equal to 58 miles per hour

- Straight-line winds from thunderstorms are fairly common in Illinois. Straight-line winds can cause damage to homes, businesses, power lines, and agricultural areas, and may require temporary sheltering of individuals who are without power for extended periods of time.

Previous Occurrences of Thunderstorm Hazards

The National Climatic Data Center (NCDC) database reported 108 hailstorms in Jackson County since 1950. Hailstorms occur nearly every year in the late spring and early summer months. The most recent reported occurrence was in April of 2014, when storms formed near a warm front that was draped across southeast Missouri, southern Illinois, and Kentucky. The storms occurred within a moist and moderately unstable air mass along and behind the warm front. The strong moisture feed contributed to torrential downpours that produced flash flooding in a number of counties. Hail was reported in Murphysboro. Table 4-26 lists the significant hail storms (such as those that cause death, damage or injury) in Jackson County.

Table 4-26. Selected NCDC-Recorded Hail that Caused Damage, Death, or Injury in Jackson County

Location or County*	Date	Deaths	Injuries	Property Damage
Murphysboro	8/1/1993	0	0	\$500
Campbell Hill	5/25/2008	0	0	\$5,000
Carbondale	9/22/2006	0	0	\$10,000
Jackson County	6/12/1998	0	0	\$40,000
Jackson County	3/28/1997	0	0	\$50,000
Murphysboro	5/20/2012	0	0	\$100,000
Jackson County	5/7/2009	0	0	\$120,000
Jackson County	5/2/2002	0	0	\$1,000,000
Total:		0	0	\$1,325,500

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

The NCDC database reported 3 lightning events in Jackson County. The most recent reported event was in June 2010 when thunderstorms occurred along a cold front as it moved southeast across southern Illinois. A 32-year-old woman was struck by lightning in the parking lot of a Wal-Mart store. The main injury was to her leg, which may have sustained muscle damage. She was knocked to the ground when lightning struck the shopping cart she was holding. She lost some hair. Table 4-27 identifies NCDC-recorded lightning that caused damage, death, or injury in Jackson County.

Table 4-27. Selected NCDC-Recorded Lightning that Caused Damage, Death, or Injury in Jackson County

Location or County*	Date	Deaths	Injuries	Property Damage
Murphysboro	8/7/2000	0	0	\$10,000
Carbondale	3/29/2007	1	0	\$0
Carbondale	6/9/2010	0	1	\$0
Total:		1	1	\$10,000

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

The NCDC database reported 201 wind storms in Jackson County. Table 4-28 identifies selected NCDC-recorded wind storms that caused major damage (over \$100,000), death, or injury in Jackson County.

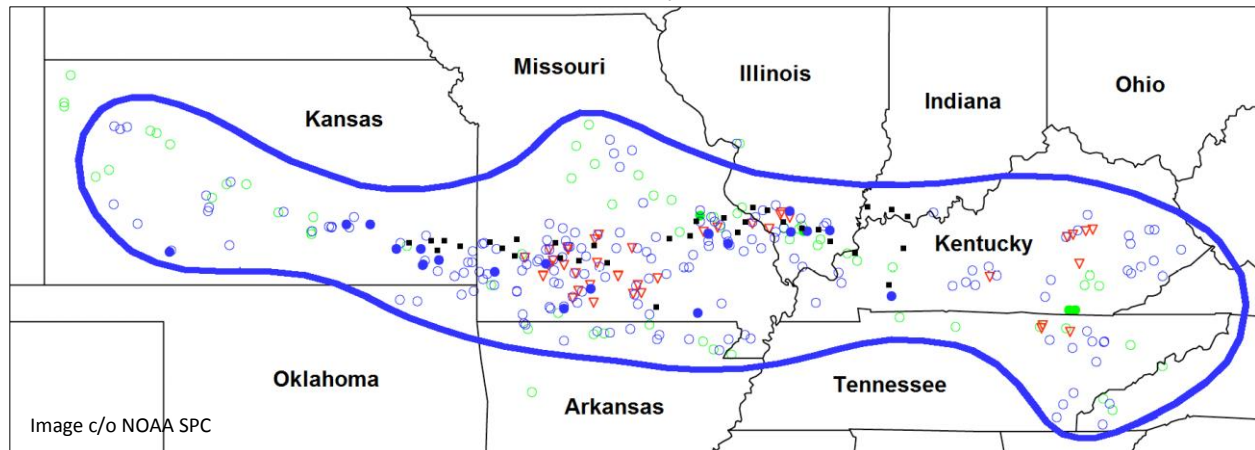
Table 4-28. Selected NCDC-Recorded Wind Storms that Caused Major Damage (over \$100,000), Death, or Injury in Jackson County

Location or County*	Date	Deaths	Injuries	Property Damage
Carbondale	1/3/2000	0	0	\$150,000
Jackson County	10/18/2007	0	0	\$100,000
Jackson County	1/29/2008	0	0	\$100,000
Murphysboro	12/27/2008	0	0	\$100,000
Jackson County	9/14/2008	0	0	\$1,500,000
Jackson County	5/8/2009	1	6	\$100,000,000
Total:		1	6	\$101,950,000

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

The most damaging wind event in southern Illinois was the May 2009 Derecho. According to NOAA, the 2009 “Super Derecho” was one of the most intense and unusual derechos ever observed. The storm produced significant and often continuous damage over a broad swath from the high plains of western Kansas to the foothills of the Appalachians in eastern Kentucky. Figure 4-15 depicts the area affected by the Super Derecho with wind damage or wind gusts ≥ 50 kts (58 mph), open blue circles; estimated or measured wind gusts ≥ 65 kts (74 mph), filled blue circles; hail ≥ 0.75 inches, open green circles; hail ≥ 2.0 inches, filled green circles; tornadoes, red triangles. Flash flooding (by county) denoted by black squares.

Figure 4-15. Area affected by and severe weather reports associated with the May 8, 2009 "Super Derecho" convective system



Winds were measured slightly over 100 mph under the comma head as it passed through the Carbondale area. The peak gust recorded by the automated system at the Carbondale airport was 81 mph before the system failed. An observer at the airport visually observed a separate anemometer located on the rooftop reach 106 mph. The automated system measured a sustained wind of 68 mph before failing.

In the city of Carbondale alone, officials reported 34 properties were deemed total losses from the storm. All but nine of those properties were mobile homes. Damage in the city alone (excluding Southern Illinois University) was estimated near 3 million dollars. The preliminary damage estimate for Southern Illinois University was 5 million dollars. Officials estimated about 3,000 trees were down or damaged in Carbondale alone, including the campus of Southern Illinois University. One fatality occurred on Old Route 13 in Murphysboro when a large tree limb fell on a home, knocking an elderly man down a flight of stairs and causing a severe head injury.

Officials in Murphysboro reported 17 dwellings in that city were total losses. One mobile home was blown over onto a car. Murphysboro officials also reported a police cruiser, a truck, and a mobile command center were destroyed. Figure 4-16 depicts one of the damaged mobile homes in Jackson County. The city's public works garage was shifted off its foundation, and the city police station was damaged.

Figure 4-16. May 2009 Derecho - Damaged Mobile Home in Jackson County



Countywide, efforts to restore power were complicated by swampy fields, mud, and downed trees. Carbondale was virtually impassable due to debris. Eighty-seven percent of the county was without power at the peak of the outages. Widespread power and telephone outages complicated recovery efforts. Most roads were blocked by debris and downed trees. Gas stations were closed in many areas, adding to problems obtaining fuel for generators. Red Cross shelters were opened in Carbondale and Murphysboro. Major grocery stores were closed for at least 12 to 24 hours, and much of their frozen food was lost. Most communication by cell phone and land line was impossible.

On July 2nd, 2009 the Federal Emergency Management Agency accounted that federal disaster aid had been made available for Illinois to supplement state and local recovery efforts in the area struck by the Derecho.

Geographic Location of Thunderstorm Hazard

The entire county has the same risk for occurrence of thunderstorms. They can occur at any location within the county.

Hazard Extent for Thunderstorm Hazard

The extent of the hypothetical thunderstorms depends upon the extent of the storm, the wind speed, and the size of hail stones. Thunderstorms can occur at any location within the county.

Risk Identification for Thunderstorm Hazard

Based on historical information, the occurrence of future high winds, hail, and lightning is highly likely. The County should expect high winds, hail, and lightning of widely varying magnitudes in the future. According to the Jackson County Planning Team's assessment, severe thunderstorms are ranked as the number four hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
4	x	2	=	8

Vulnerability Analysis for Thunderstorm Hazard

The entire county's population and all buildings are vulnerable to a severe thunderstorm and can expect the same impacts within the affected area. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County.

Critical Facilities

All critical facilities are vulnerable to severe thunderstorms. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g., a damaged police station cannot serve the community). Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The buildings within the county can expect impacts similar to those discussed for critical facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g., a person cannot inhabit a damaged home, causing residents to seek shelter).

Infrastructure

A severe thunderstorm could impact roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is vulnerable, it is important to emphasize that a severe thunderstorm could damage any number of these structures. The impacts to these structures include broken, failed, or impassable roadways; broken or failed utility lines (e.g., loss of power or gas to community); or impassable railways. Bridges could become impassable causing risk to motorists.

Potential Dollar Losses from Thunderstorm Hazard

According to the NDCD, Jackson County has incurred approximately \$106 million in damages relating to thunderstorms, including hail, lightning, and high winds since 1950. NDCD records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event. As a result, the potential dollar losses for a future event cannot be reliably constrained; however, based on average property damage in the past decade, SIU estimates that Jackson County incurs property damages of approximately \$1.7 million per year related to severe thunderstorms.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

All future development within the county and all communities will remain vulnerable to severe thunderstorm events.

Suggestions for Community Development Trends

Local officials should enhance severe storm preparedness by they sponsor a wide range of programs and initiatives to address the overall safety of county residents. It is suggested that the county should build new structures with more sturdy construction, and harden existing structures to lessen the potential

impacts of severe weather. This is particularly important where the future economic expansion is expected to take place within the city of Carbondale and along the Route 13 business corridor. Additional warning sirens can warn the community of approaching storms to ensure the safety of Jackson County residents and minimizing property damage.

4.3.6 Flooding Hazard

Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the United States. The type, magnitude, and severity of flooding are functions of the magnitude and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods are classified as one of two types in this plan: upstream floods or downstream floods. Both types of floods are common in Illinois.

Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another 18 inches might carry off a car. Generally, upstream floods cause severe damage over relatively localized areas. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can result from inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at any time of the year in Illinois, but they are most common in the spring and summer months.

Downstream floods, sometimes called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage. Riverine flooding on the large rivers of Illinois generally occurs during either the spring or summer.

Previous Occurrences of Flooding

The NCDC database reported 135 flooding events in Jackson County. The most recent recorded event was in April 2014 during a period of heavy rainfall during the first week of April caused most of the region's rivers to rise. Many rivers experienced minor to moderate flooding. Moderate flooding occurred along the Big Muddy River. At the Murphysboro river gage, the river crested at 29.20 feet on the 8th. This crest was about one-half foot above the March 2013 flood crest. Flood stage is 22 feet, and moderate flooding begins at 28 feet. Low-lying fields and woodlands were underwater, including small parts of Riverside Park. Table 4-29 identifies NCDC-recorded flooding events that caused damage, death, or injury in Jackson County.

Table 4-29. NCDC-recorded Flooding Events that caused Death, Damage (over \$100,000) or Injury in Jackson County

Location or County*	Date	Deaths	Injuries	Property Damage
Murphysboro	5/10/1996	0	0	\$200,000
Jackson County	5/1/1996	0	0	\$100,000
Murphysboro	4/28/1996	0	0	\$100,000
Carbondale	6/29/1998	0	0	\$100,000
Jackson County	1/21/1999	0	0	\$100,000
Jackson County	3/18/2008	0	0	\$1,800,000
Jackson County	5/1/2011	0	0	\$350,000
Total:		0	0	\$2,750,000

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

There are several structures in Jackson County that have experienced repetitive losses due to flooding. FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the NFIP that has suffered flood loss damage on two or more occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is $\geq 25\%$ of the market value of the structure at the time of each flood loss.

The Illinois Emergency Management Agency and Illinois Department of Natural Resources was contacted to determine the location of repetitive loss structures in Jackson County. Records indicate that there are 6 repetitive loss structures within the county. The total amount paid for building replacement and building contents for damage to these repetitive loss structures is \$139,112. Table 4-30 describes the repetitive loss structures for each jurisdiction.

Table 4-30. Repetitive Loss Structures for each Jurisdiction in Jackson County

Jurisdiction	Number of Properties	Number of Losses	Total Paid
Carbondale	2	5	\$58,757.02
Murphysboro	2	4	\$36,574.67
Makanda	1	2	\$18,899.18
Dowell	1	2	\$24,880.81
Total:	6	13	\$139,111.68

Geographic Location of Flooding

Most riverine flooding in Illinois occurs during either the spring or summer and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Flash flooding of low-lying areas in Illinois can occur during any time of the year, but tends to be less frequent and more localized between mid-summer and early winter.

The primary sources of river flooding in Jackson County are the Mississippi River, the Big Muddy River and its major tributaries. The major tributaries to the Big Muddy River include: Little Muddy River, Beaucoup Creek, Crab Orchard Creek, and Little Crab Orchard Creek. Flooding along the Big Muddy impacts the south and eastern portions of Murphysboro and often closes Town Creek Road. The Big Muddy can also impact major transportation routes such as US 51, State Routes 149 and 13. Flooding along the Little Muddy River can affect portions of Dowell and Elkhart. Flooding of Crab Orchard and Little Crab Orchard Creek can impact parts of Carbondale. Flooding along Drury Creek can impact Makanda.

Flash flooding in Jackson County typically occurs or is best documented in urban/developed areas. For example on November 11, 2005 major flash flooding was reported in Carbondale and Murphysboro. A co-operative observer measured 5.15 inches of rain in Carbondale from the overnight and early morning storms. An automated gage in Murphysboro measured 4.25 inches. Traffic was diverted from low-lying areas in Carbondale. Sewers backed up into homes and basements. On the campus of the Southern Illinois University, a couple of rooms in the Physical Plant were flooded. Major transportation routes in Jackson County affected by flash flooding include State Route 13 and US Route 51 through Carbondale, State Route 127 through Elkhaville and 149 through Murphysboro.

Hazard Extent for Flooding

All floodplains are susceptible to flooding in Jackson County. The floodplain of concern is for the 100-year flood event which is defined as areas that have a 1% chance of flooding in any given year. However, flooding is dependent on various local factors including, but not limited to, impervious surfaces, amount of precipitation, river-training structures, etc. The 100-year flood plain covers approximately 13% of Jackson County

Vulnerability Analysis for Flooding

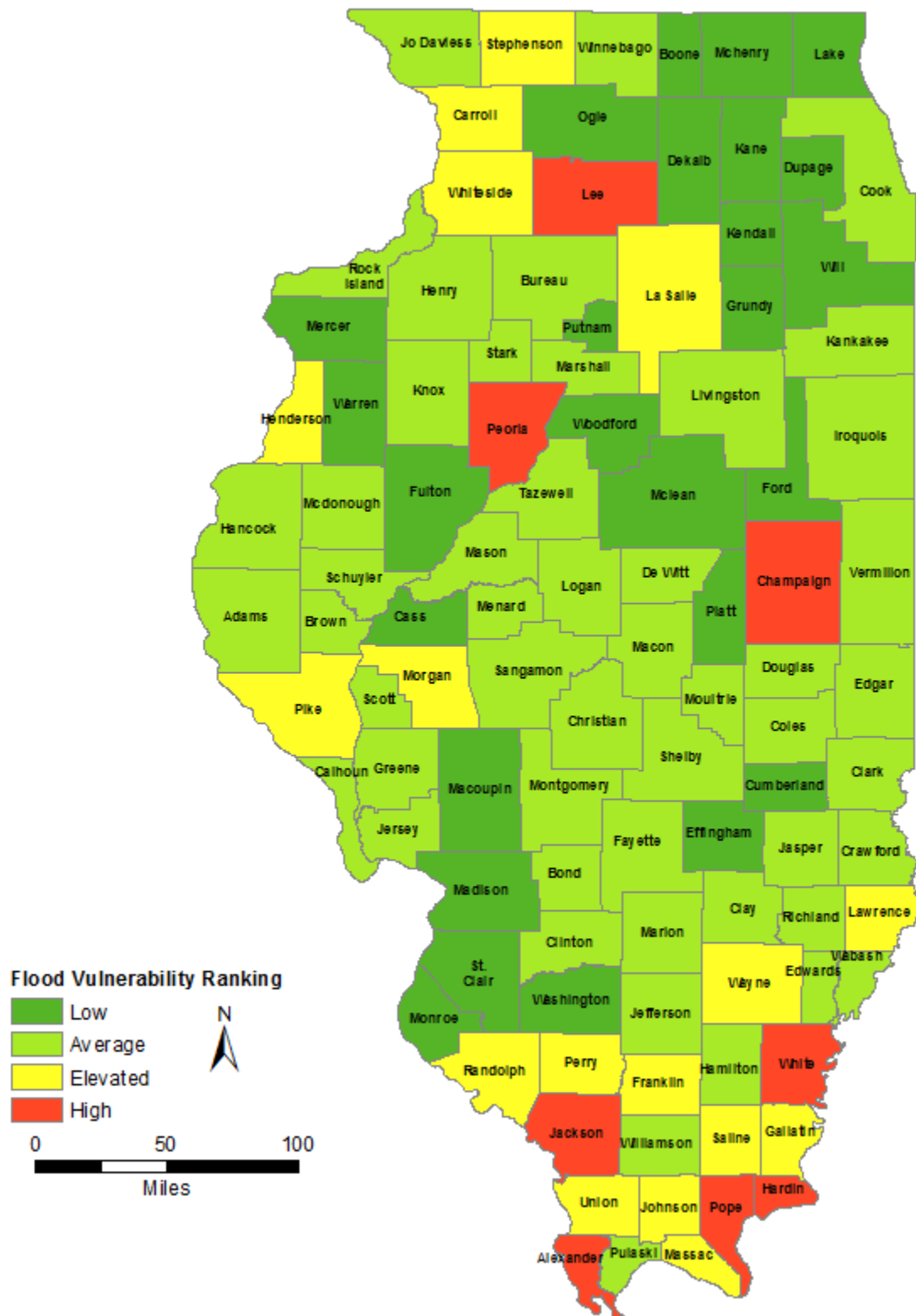
The 2013 Illinois Hazard Mitigation Plan analyzed a variety potential natural hazards including vulnerability to flooding. A Flood Vulnerability Index (FVI) was calculated for all counties and jurisdictions in Illinois. FVI combines Hazus-based estimates of flood exposure and loss with the widely utilized Social Vulnerability Index (SoVI). The highest vulnerability scores and vulnerability ratings were generally in rural counties and communities located along Illinois's large rivers (i.e., Mississippi, Green, Illinois, Kaskaskia, Rock and Ohio Rivers). Figure 4-17 displays the Flood Vulnerability Ratings for the 102 Counties in Illinois. The vulnerability ratings are categorical representations (low, average, elevated, or high) of the flood vulnerability index. Jackson County has a High Flood Vulnerability Rating and ranks 7 out of the 102 Counties in Illinois in terms of loss estimation according to Hazus-MH for floods.

Table 4-31 lists the jurisdictional Flood Vulnerability Ratings for Jackson County. The jurisdictions of Jackson County all surpass an average Flood Vulnerability Rating. Grand Tower ranks 4th in the State of Illinois.

Table 4-31. Jurisdictional Flood Vulnerability Ranking for Jackson County

Jurisdiction	State Ranking	Flood Vulnerability Rating
Grand Tower	4	High
Gorham	9	High
Dowell	21	High
Murphysboro	40	Elevated
De Soto	100	Elevated
Elkhaville	115	Elevated
Vergennes	129	Elevated
Carbondale	170	Elevated
Makanda	183	Elevated

Figure 4-17. County Flood Vulnerability Rating for Illinois



All floodplains are susceptible to flooding in Jackson County; therefore, the population and all buildings located within the floodplain are vulnerable to flooding. To accommodate this risk, this plan considers all buildings located within 100-year flood plain as vulnerable.

Risk Identification for Flood Hazard

Based on historical information and the Flood Vulnerability Rating, future occurrence of flooding in Jackson County is likely. According to the Risk Priority Index (RPI) and County input, flooding is ranked as the number five hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
4	x	2	=	8

Critical Facilities

All critical facilities within the floodplain are vulnerable to floods. An essential facility will encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility, and loss of facility functionality (e.g., a damaged police station cannot serve the community). Appendix E include a list of the critical facilities in Jackson County and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

All buildings within the floodplain are vulnerable to floods. These impacts can include structural failure, extensive water damage to the facility, and loss of facility functionality (e.g., damaged home will no longer be habitable, causing residents to seek shelter). This plan considers all buildings located within 100-year flood plain as vulnerable.

Infrastructure

The types of infrastructure potentially impacted by a flood include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available for this plan, it is important to emphasize that a flood could damage any number of these items. The impacts to these items include: broken, failed, or impassable roadways; broken or failed utility lines (e.g., loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could also fail or become impassable, causing risk to motorists.

Hazus-MH Flood Analysis

Hazus-MH was utilized to generate the flood depth grid for a 100-year return period and made calculations by clipping the USGS one-third-arc-second DEM (~10 m) to the flood boundary. Next, Hazus-MH was used to estimate the damages for Jackson County by utilizing a detailed building inventory database created from assessor and parcel data.

According to this analysis, there are 1,232 buildings located in the Jackson County 100-year floodplain. The estimated damage to these structures is \$60 million. It should be noted that the results should be interpreted as degrees of loss rather than exact number of buildings exposed to flooding. Figure 4-18 depicts the building inventory within the 100-year floodplain and Table 4-32 shows the loss estimates by occupancy class.

Figure 4-18. Building Inventory Located within the 100-year Floodplain in Jackson County

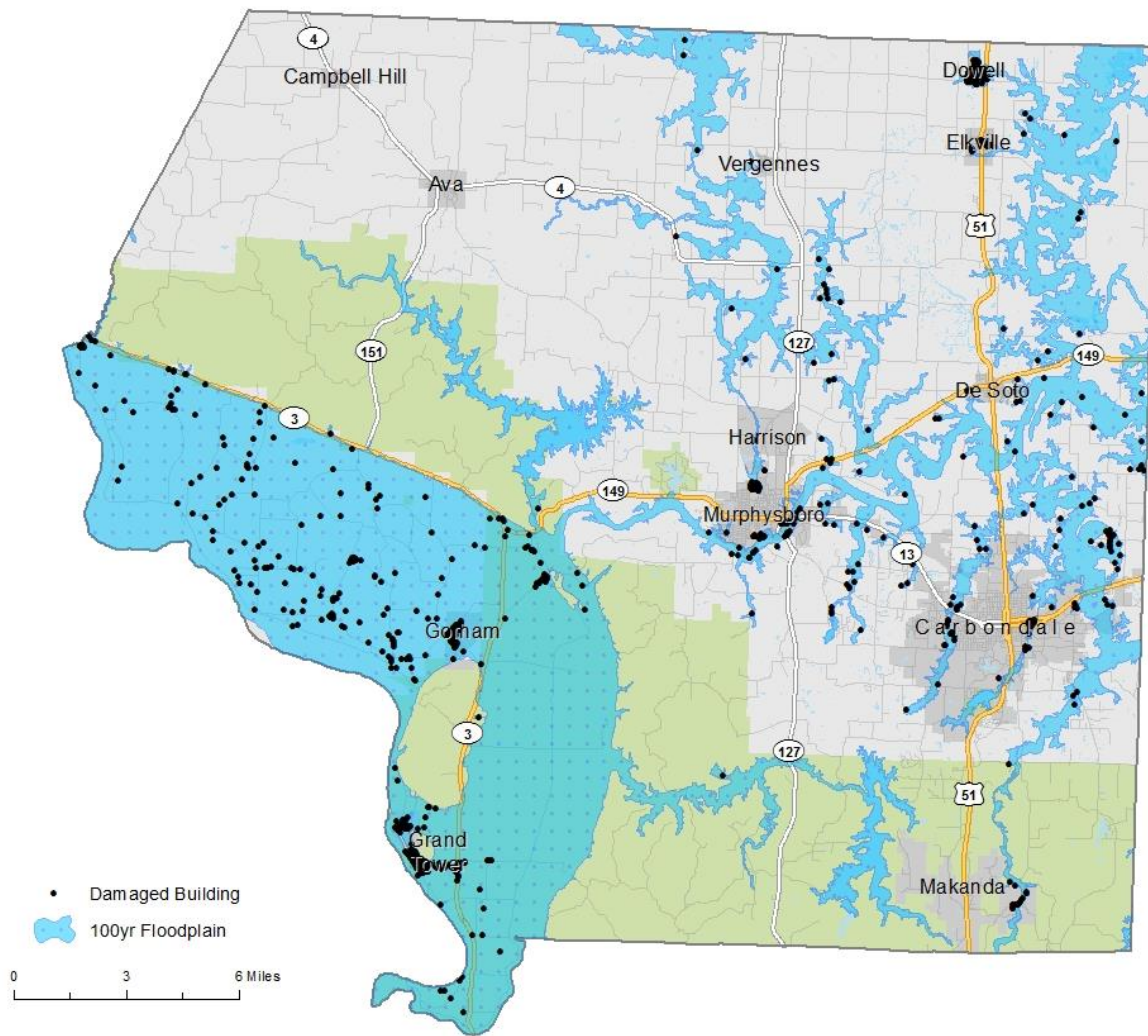


Table 4-32. Estimated Flood Losses within the 100-year Floodplain

Occupancy Class	Number of Structures	Estimated Building Related Losses
Residential	993	\$255,700
Commercial	73	\$2,204,000
Industrial	19	\$84,000
Agricultural	138	\$1,126,000
Educational	1	\$48,614,000
Government	7	\$17,000
Religious / Non-Profit	1	\$8,538,000
Total:	1,232	\$60,838,700

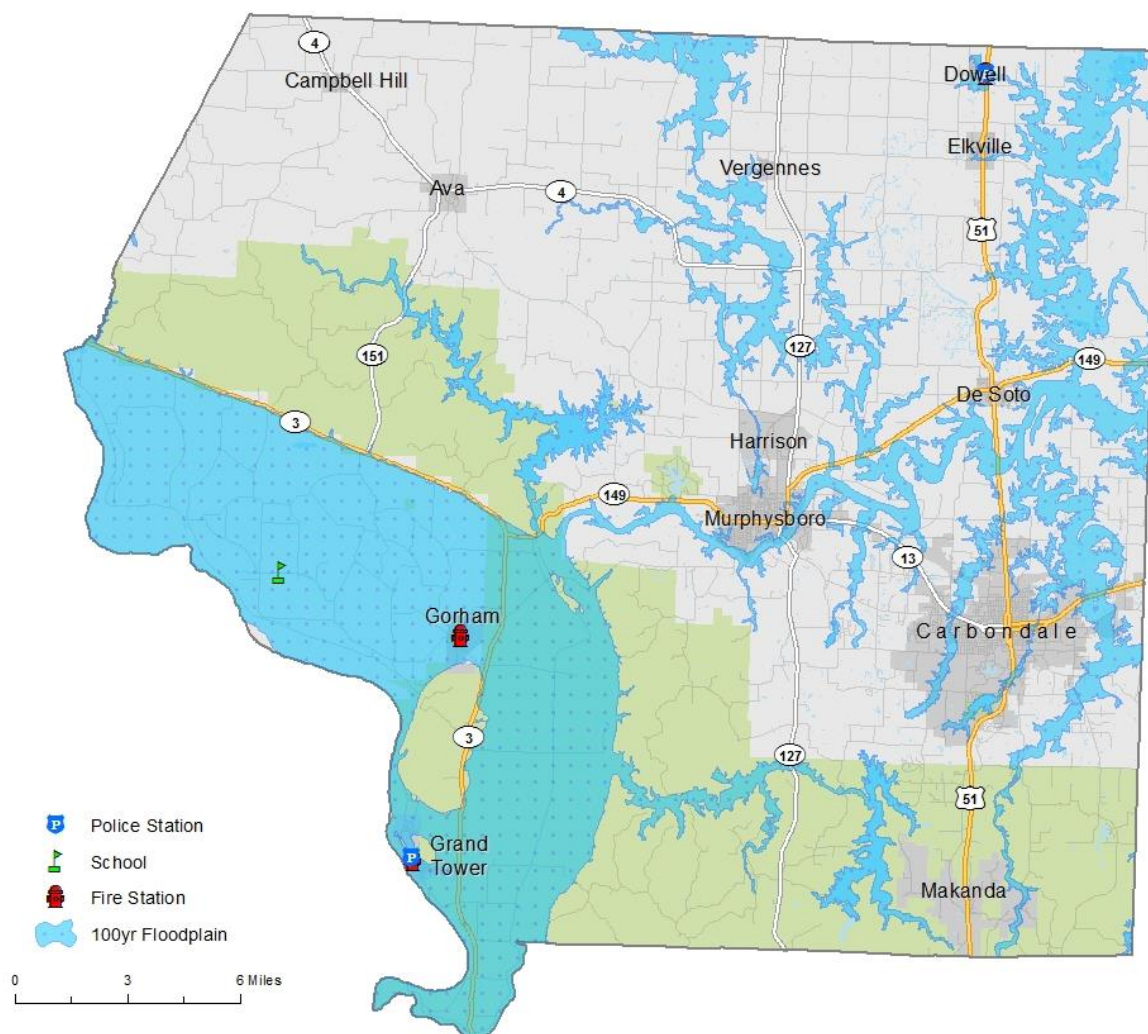
Essential Facilities Damage

The analysis identified seven essential facilities that are subject to flooding. Table 4-33 and Figure 4-19 identified the essential facilities within the 100-year floodplain.

Table 4-33. Essential Facilities within the 100-year Floodplain

Essential Facility	Facility Name
School	Christ Lutheran School
Fire Departments	Dowell Fire Department
	Gorham Fire Department
	Tower Rock Fire Department
Police Departments	Grand Tower Police Department
	Dowell Village Police Department
	Gorham Police Department

Figure 4-19. Map of Essential Facilities within the 100-year Floodplain



Vulnerability Analysis to Future Assets/Infrastructure

Flooding may affect nearly any location within the county; therefore all buildings and infrastructure are vulnerable. Table 4-8 includes the building exposure for Jackson County. All essential facilities in the county are at risk. Appendix E include a list of the essential facilities in Jackson County and Appendix F displays a large format map of the locations of all critical facilities within the county. Currently, the municipal planning commission reviews new developments for compliance with the local flood zoning ordinance. At this time no new construction is planned with the 100-year floodplain.

Suggestions for Community Development Trends

Reducing floodplain development is crucial to reducing flood-related damages. Areas with recent development may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible to drainage issues. Damage to these can cause back-up of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

4.3.7 Winter Storm Hazard

Hazard Definition of Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human health risks such as frostbite, hypothermia, or death and cause property damage and disrupt economic activity.

Ice or sleet, even in small quantities, can result in hazardous driving conditions and can cause property damage. Sleet involves raindrops that freeze completely before reaching the ground. Sleet does not stick to trees and wires. Ice storms, on the other hand, involve liquid rain that falls through subfreezing air and/or onto sub-freezing surfaces, freezing on contact with those surfaces. The ice coats trees, buildings, overhead wires, and roadways, sometimes causing extensive damage.

Ice storms are some of the most damaging winter storms in Illinois. Ice storms occur when moisture-laden Gulf air converges with the northern jet stream causing freezing rain that coats power and communication lines and trees with heavy ice. Strong winds can cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication.

Rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility, characterize significant snowstorms. A blizzard is categorized as a snow storm with winds of 35 miles per hour or greater and/or visibility of less than one-quarter mile for three or more hours. Strong winds during a blizzard blow falling and fallen snow, creating poor visibility and impassable roadways. Blizzards potentially result in property damage.

Blizzards repeatedly affect Illinois. Blizzard conditions cause power outages, loss of communication, and transportation difficulties. Blizzards can reduce visibility to less than one-quarter mile, and the resulting disorientation makes even travel by foot dangerous if not deadly.



Heavy snow fall in Carbondale, Dec 2013
(c/o The Southern Illinoisan)

Severe cold involves ambient air temperatures that drop to 0°F or below. These extreme temperatures can increase the likelihood of frostbite and hypothermia. High winds during severe cold events can enhance the air temperature's effects. Fast winds during cold weather events can lower the wind chill factor (how cold the air feels on your skin). As a result, the time it takes for frostbite and hypothermia to affect a person's body will decrease.

Previous Occurrences of Winter Storm Hazard

The NCDC database reported 154 winter storm and extreme cold events for Jackson County since 1950. The most recent reported event occurred in April 2014 when temperatures plummeted across southern Illinois with breezy conditions leading to wind chill values falling into the 28°F-32°F range following a high pressure system from the Ohio Valley. The coldest observed temperature was 28 degrees at the Mount Vernon airport. Other lows included 31 degrees at the Carbondale airport and at Metropolis, IL. Table 4-34 identifies NCDC-recorded winter storm events that caused damage, death, or injury in Jackson County.

Table 4-34. NCDC-Recorded Winter Storms that Caused Damage, Death, or Injury in Jackson County

Location or County*	Date	Deaths	Injuries	Property Damage
Jackson County	1/1/1999	0	0	\$50,000
Jackson County	3/3/2008	0	0	\$30,000
Jackson County	2/11/2008	1	0	\$500,000
Jackson County	1/26/2009	0	0	\$400,000
Jackson County	2/21/2013	0	0	\$50,000
Total:		1	0	\$1,030,000

Geographic Location of Winter Storm Hazard

Severe winter storms are regional in nature. Most of the NCDC data are calculated regionally or in some cases statewide.

Hazard Extent of Winter Storm Hazard

The extent of the historical winter storms varies in terms of storm location, temperature, and ice or snowfall. A severe winter storm can occur anywhere in the county.

Risk Identification of Winter Storm Hazard

Based on historical information, the probability of future winter storms in Jackson County is likely. The county should expect winter storms with varying magnitudes to occur in the future. Winter storms ranked as the number six hazard according to the Jackson County Planning Team's risk assessment.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
3	x	2	=	6

Vulnerability Analysis of Winter Storm Hazard

Winter storm impacts are equally likely across the entire county; therefore, the entire county is vulnerable to a winter storm and can expect impacts within the affected area. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County.

Critical Facilities

All critical facilities are vulnerable to winter storms. A critical facility will encounter many of the same impacts as other buildings within the county. These impacts include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow. Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

Infrastructure

During a winter storm, the types of potentially impacted infrastructure include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is vulnerable, it is important to emphasize that a winter storm could impact any structure. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

Potential Dollar Losses from Winter Storm Hazard

According to the NDCD, Jackson County has incurred approximately \$1 million in damages relating to winter storms since 1950. NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event. As a result, the potential dollar losses for a future event cannot be reliably constrained; however, based on average property damage in the past decade, SIU estimates that Jackson County incurs property damages of approximately \$15,625 per year related to winter storms, including sleet/ice and heavy snow.

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

Any new development within the county will remain vulnerable to these events.

Suggestions for Community Development Trends

Because winter storm events are regional in nature, future development across the county will also face winter storms.

4.3.8 Hazardous Material Storage and Transportation Hazard

Hazard Definition

Illinois has numerous active transportation lines that run through many of its counties. Active railways transport harmful and volatile substances across county and state lines every day. Transporting chemicals and substances along interstate routes is commonplace in Illinois. The rural areas of Illinois have considerable agricultural commerce, meaning transportation of fertilizers, herbicides, and pesticides is common on rural roads. These factors increase the chance of hazardous material releases and spills throughout the state of Illinois.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion can potentially cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

Previous Occurrences of Hazardous Materials Storage and Transportation Hazard

Jackson County has not experienced a significantly large-scale hazardous material incident at a fixed site or during transport resulting in multiple deaths or serious injuries. Minor releases have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents and prevent or lessen harm to Jackson County residents.

Geographic Location of Hazardous Materials Storage and Transportation Hazard

Hazardous material hazards are countywide and are primarily associated with the transport of materials via highway, railroad, and/or river barge.

Hazard Extent of Hazardous Materials Storage and Transportation Hazard

The extent of the hazardous material hazard varies both in terms of the quantity of material being transported as well as the specific content of the container.

Risk Identification of Hazardous Materials Storage and Transportation Hazard

Based on input from the Planning Team, future occurrence of hazardous materials accident in Jackson County is likely. According to the Risk Priority Index (RPI) and County input, flooding is ranked as the number seven hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
2	x	2	=	4

Vulnerability Analysis for Hazardous Materials Storage and Transportation Hazard

The entire county is vulnerable to a hazardous material release and can expect impacts within the affected area. The main concern during a release or spill is the affected population. This plan will therefore consider all buildings located within the county as vulnerable. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County.

Critical Facilities

All critical facilities and communities within the county are at risk. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g., a damaged police station can no longer serve the community). Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The buildings within the county can expect similar impacts to those discussed for critical facilities. These impacts include structural failure due to fire or explosion or debris, and loss of function of the building (e.g., a person cannot inhabit a damaged home, causing residents to seek shelter).

Infrastructure

During a hazardous material release, the types of potentially impacted infrastructure include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan, it is important to emphasize that a hazardous materials release could damage any number of these items. The impacts to these items include: broken, failed, or impassable roadways; broken or failed utility lines (e.g., loss of power or gas to community); and railway failure from broken or impassable railways. Bridges could become impassable causing risk to motorists.

ALOHA Hazardous Chemical Release Analysis

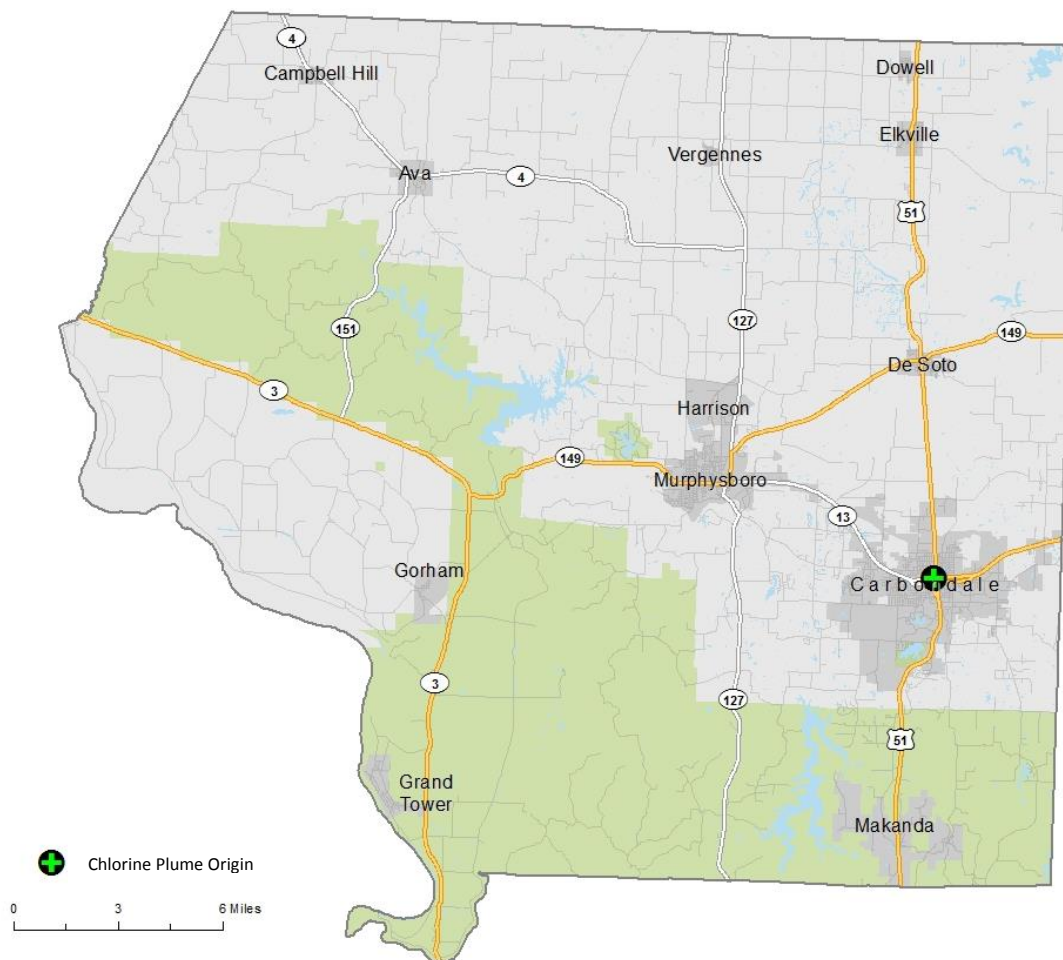
The U.S. Environmental Protection Agency's ALOHA (Areal Locations of Hazardous Atmospheres) model was used to assess the impacted area for chlorine release at intersection of Route 13 and US Highway 51 in Carbondale. The Jackson County Planning Team selected the chlorine scenario because of significant truck traffic along major transportation routes within a relatively densely populated area.

ALOHA is a computer program designed for response to chemical accidents, as well as emergency planning and training. Ammonia, chlorine, and propane are common chemicals used in industrial operations and are found in either liquid or gas form. Rail and truck tankers haul ammonia, chlorine, and propane to and from facilities.

Chlorine is a greenish yellow gas with a pungent suffocating odor. Toxic by inhalation. Slightly soluble in water. Liquefies at -35°C and room pressure. Readily liquefied by pressure applied at room temperature. Contact with unconfined liquid can cause frostbite by evaporative cooling. Does not burn but, like oxygen, supports combustion. Long-term inhalation of low concentrations or short-term inhalation of high concentrations has ill effects. Vapors are much heavier than air and tend to settle in low areas. (NOAA Reactivity, 2007).

For the chlorine scenario, SIU assumed average atmospheric and climatic conditions for the fall season with a breeze from the northeast. SIU considered the seasonal conditions upon the request of the Planning Team and obtained average monthly conditions for the City of Paducah from NOAA's Monthly Weather Summary. Figures 4-20 depicts the plume origin of the modeled hazardous chemical release in Jackson County. The ALOHA atmospheric modeling parameters for the propane release, depicted in Figure 4-21, were based upon a northeasterly speed of 10 miles per hour. The temperature was 67°F with 75% humidity and a cloud cover of five-tenths skies. SIU used average weather conditions for the month of June reported from NOAA for wind direction, wind speed, and temperature to simulate fall conditions.

Figure 4-20. ALOHA Modeled Hazardous Chemical Plume Origin in Jackson County



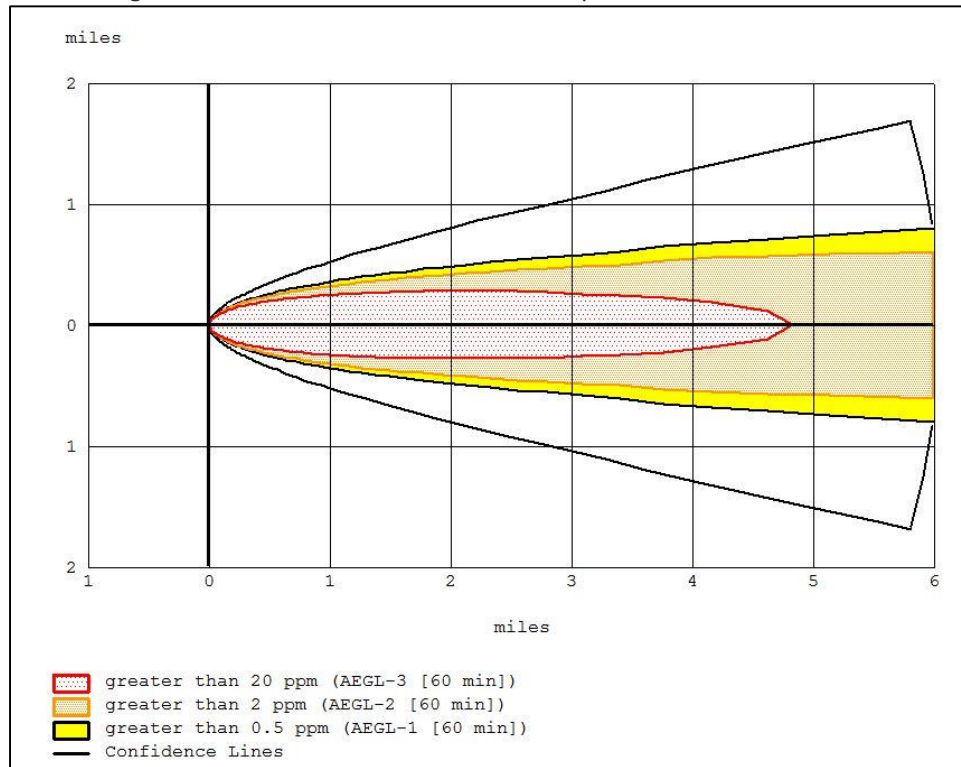
The source of the chemical spill is a horizontal, cylindrical-shaped tank. The diameter of the tank was set to 8 feet and the length set to 33 feet (12,408 gallons). At the time of its release, it was estimated that the tank was 75% full. The propane in this tank is in its liquid state. This release was based on a leak from a 2.5-inch-diameter hole, 12 inches above the bottom of the tank. According to these ALOHA parameters, this scenario would release approximately 102,119 pounds of material per minute. Figure 4-21 shows the plume modeling parameters in greater detail.

Figure 4-21. ALOHA Modeling Parameters for Chlorine Release

SITE DATA:	
Location: CARBONDALE, ILLINOIS	
Building Air Exchanges Per Hour: 0.70 (sheltered single storied)	
Time: December 10, 2014 1132 hours CST (using computer's clock)	
CHEMICAL DATA:	
Chemical Name: CHLORINE	Molecular weight: 70.91 g/mol
AEGL-1 (60 min): 0.5 ppm	AEGL-2 (60 min): 2 ppm
AEGL-3 (60 min): 20 ppm	
IDLH: 10 ppm	
Ambient Boiling Point: -29.8° F	
Vapor Pressure at Ambient Temperature: greater than 1 atm	
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%	
ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)	
Wind: 10 miles/hour from NE at 10 feet	
Ground Roughness: open country	Cloud Cover: 5 tenths
Air Temperature: 67° F	Stability Class: D
No Inversion Height	Relative Humidity: 75%
SOURCE STRENGTH:	
Leak from hole in horizontal cylindrical tank	
Non-flammable chemical is escaping from tank	
Tank Diameter: 8 feet	Tank Length: 33 feet
Tank Volume: 12,408 gallons	
Tank contains liquid	Internal Temperature: 67° F
Chemical Mass in Tank: 55.1 tons	Tank is 75% full
Circular Opening Diameter: 2.5 inches	
Opening is 12 inches from tank bottom	
Release Duration: 15 minutes	
Max Average Sustained Release Rate: 10,300 pounds/min	
(averaged over a minute or more)	
Total Amount Released: 102,119 pounds	
Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).	

Using the parameters in Figure 4-21, approximately 10,300 pounds of material would be released per minute. The image in Figure 4-22 depicts the plume footprint generated by ALOHA. As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million.

Figure 4-22. ALOHA Generate Plume Footprint of Chlorine Scenario



The red buffer (20 ppm) extends no more than 4.5 miles from the point of release after one hour. The orange buffer (2 ppm) and yellow buffer (0.5 ppm) extends no more than six miles from the point of release. The dashed line depicts the level of confidence within the confines of the entire plume footprint. The ALOHA model is 95% confident that the release will stay within this boundary.

Acute Exposure Guideline Levels (AEGL) are intended to describe the risk to humans resulting from once-in-a-lifetime, or rare exposure to airborne chemical ([U.S. EPA AEGL Program](#)). The National Advisory Committee for the Development of Acute Exposure Guideline Levels for Hazardous Substances (AEGL Committee) is involved in developing these guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills, or other catastrophic exposures. AEGLs represent threshold exposure limits for the general public and are applicable to emergency exposure periods ranging from 10 minutes to 8 hours. The three AEGLs have been defined as follows:

AEGL-1: the airborne concentration, expressed as parts per million or milligrams per cubic meter (ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL-2: the airborne concentration (expressed as ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3: the airborne concentration (expressed as ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Airborne concentrations below the AEGL-1 represent exposure levels that can produce mild and progressively increasing but transient and non-disabling odor, taste, and sensory irritation or certain asymptomatic, non-sensory effects. With increasing airborne concentrations above each AEGL, there is a progressive increase in the likelihood of occurrence and the severity of effects described for each corresponding AEGL. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma, and those with other illnesses, it is recognized that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL.

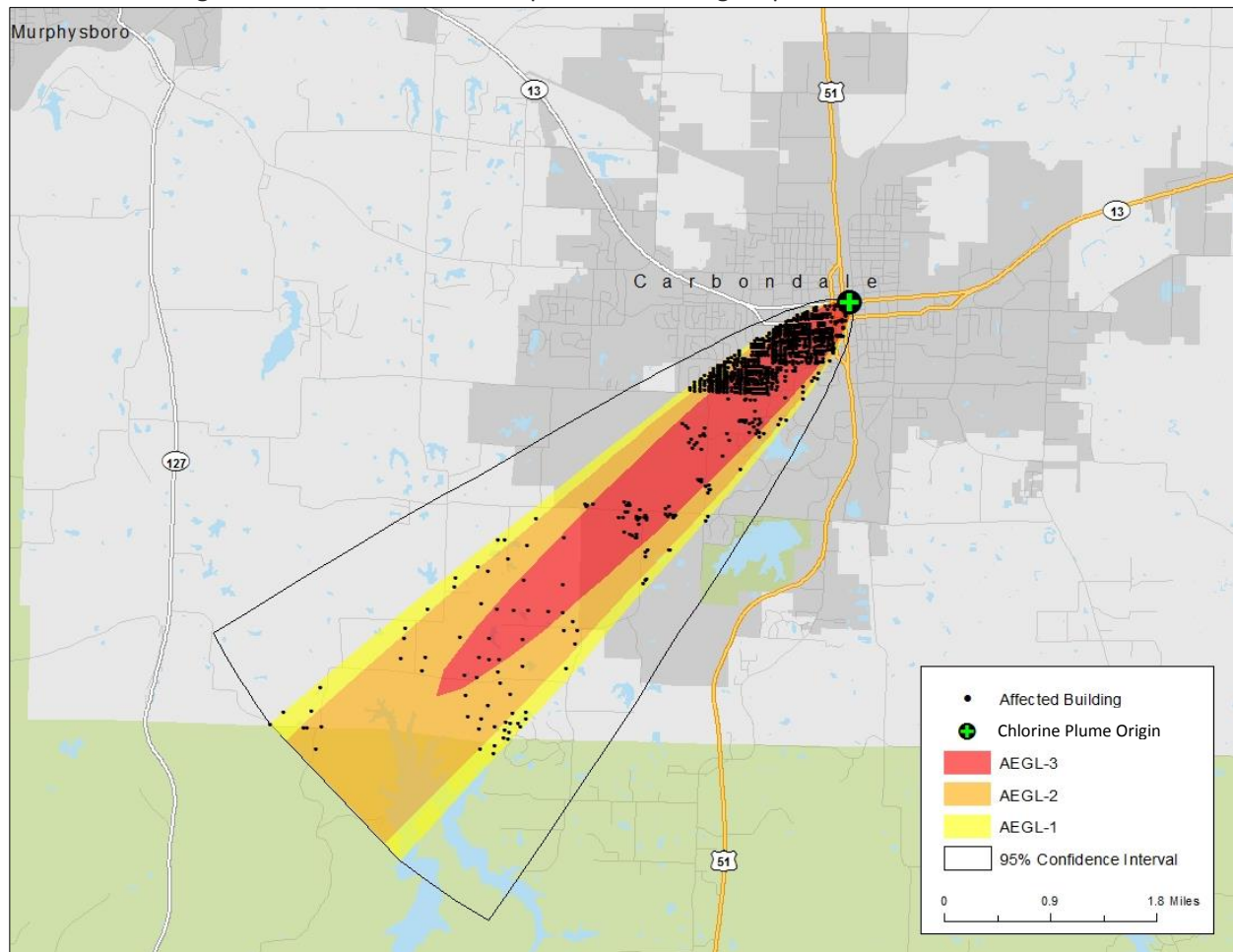
Results for Chlorine Release

An estimate of property exposed to the chlorine spill was calculated by using the building inventory and intersecting these data with each of the AEGL levels (AEGL 3: ≥ 20.0 ppm, AEGL 2: ≥ 2.0 ppm and AEGL 1: ≥ 0.5 ppm). The Jackson County assessment and parcel data was utilized for this analysis. There are 1,050 buildings within the chlorine plume. It should be noted that the results should be interpreted as potential degrees of loss rather than exact number of buildings damaged to the propane release. Table 4-35 lists the total amount of building exposure to each AEGL zone. Figure 4-23 depicts the propane spill footprint and location of the buildings exposed. The GIS overlay analysis estimates that the full replacement cost of the buildings exposed to the propane plume is approximately \$1 billion.

Table 4-35. Estimated Building Exposure as a Result of the Chlorine Release

Occupancy	Building Exposure			Number of Buildings		
	AEGL 1	AEGL 2	AEGL 3	AEGL 1	AEGL 2	AEGL3
Residential	\$9,376,626	\$16,254,330	\$46,613,169	86	170	550
Commercial	\$1,113,378	\$1,264,770	\$28,845,450	7	5	98
Educational	\$221,100,000	\$261,600,000	\$605,400,000	10	27	97
Total:	\$231,590,004	\$279,119,100	\$680,858,619.00	103	202	745

Figure 4-23. ALOHA Plume Footprint and Buildings Exposed to Chlorine Release



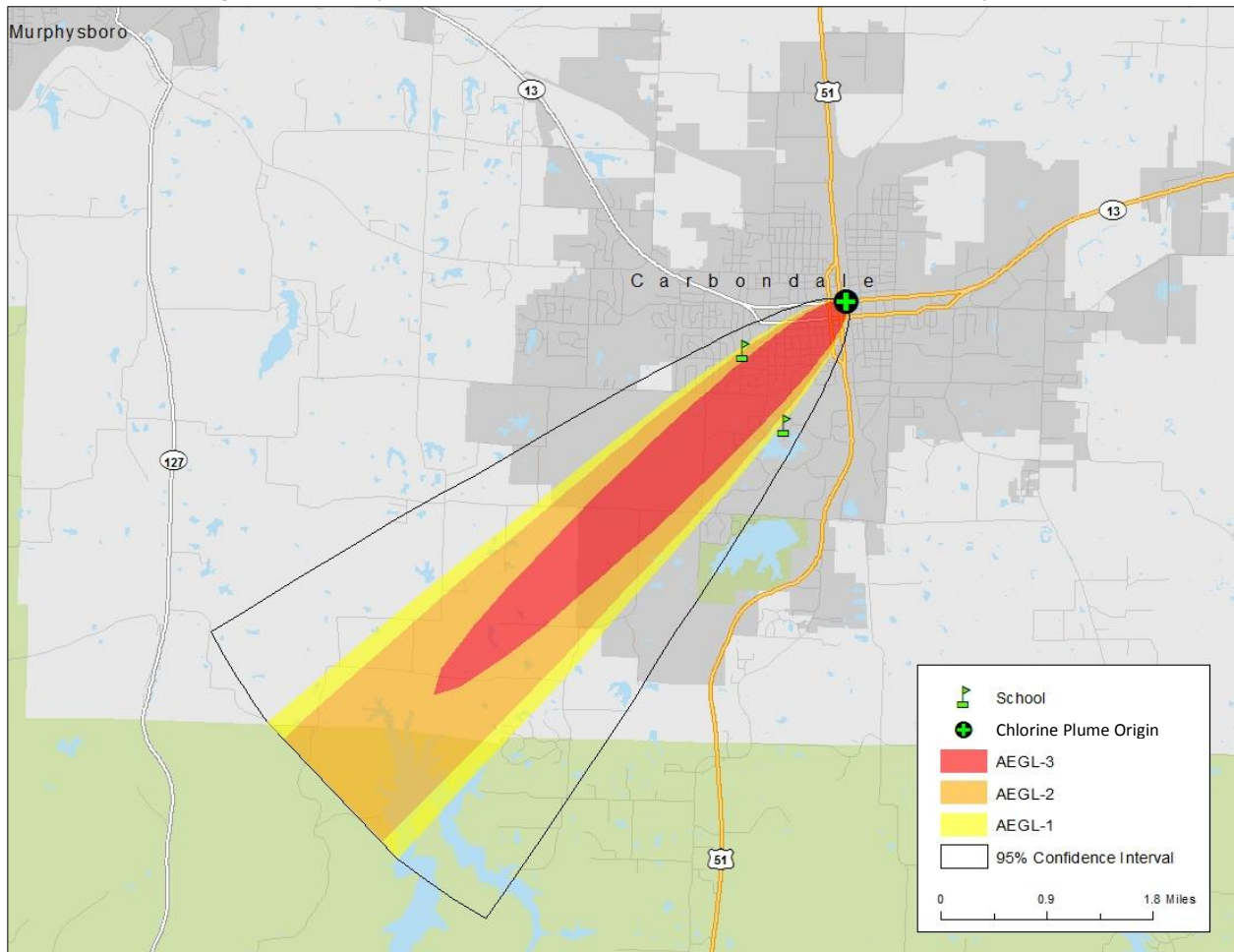
Essential Facilities Damage

There are two essential facilities within the limits of the chlorine scenario. Most are located in the confines of the >2 ppm concentration level. Table 4-36 and Figure 4-24 identifies the affected facilities.

Table 4-36. Essential Facilities within the Propane Plume Footprint

Essential Facility	Facility Name
Schools	Trinity Christian School
	Southern Illinois University

Figure 4-24. Map of Essential Facilities within the Chlorine Plume Footprint



Vulnerability to Future Assets/Infrastructure for Hazardous Materials Storage and Transportation Hazard

Jackson County is expected to see future economic expansion within the city of Carbondale and along the Route 13 business corridor. These areas are particularly vulnerable to chemical releases because of transportation of hazardous materials.

Suggestion for Community Development Trends

Because the hazardous material hazard events may occur anywhere within the county, future development is impacted. The major transportation routes and the industries located in Jackson County pose a threat of dangerous chemicals and hazardous materials release.

4.3.9 Drought and Extreme Heat Hazard

Hazard Definition for Drought Hazard

Drought is a normal climatic phenomenon that can occur across the state of Illinois and within Jackson County. The meteorological condition that creates a drought is below-normal rainfall. However, excessive heat can lead to increased evaporation, which enhances drought conditions. Droughts can occur in any month. Drought differs from normal arid conditions found in low-rainfall areas. Drought is the

consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or longer).

The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands by human activities, vegetation, and agricultural operations. Droughts will affect the quality and quantity of crops, livestock, and other agricultural assets. Droughts can adversely impact forested areas leading to an increased potential for extremely destructive forest and woodland fires that could threaten residential, commercial, and recreational structures.

Drought conditions are often accompanied by extreme heat, which is defined as temperatures that exceed the average high for the area by 10°F or more for the last for several weeks. Such extreme heat can have severe implications for humans. Below are common terms associated with extreme heat:

Heat Wave

Prolonged period of excessive heat often combined with excessive humidity.

Heat Index

A number, in degrees Fahrenheit, which estimates how hot it feels when relative humidity is added to air temperature. Exposure to full sunshine can increase the heat index by 15°F.

Heat Cramps

Muscular pains and spasms due to heavy exertion. Although heat cramps are the least severe, they are often the first signal that the body is having trouble with heat.

Heat Exhaustion

Typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs, resulting in a form of mild shock. If left untreated, the victim's condition will worsen. Body temperature will continue to rise, and the victim may suffer heat stroke.

Heat and Sun Stroke

A life-threatening condition. The victim's temperature control system, which produces sweat to cool the body, stops working. The body's temperature can rise so high that brain damage and death may result if the body is not cooled quickly.

Previous Occurrences for Drought and Extreme Heat

The NCDC database reported 31 drought/heat wave events in Jackson County since 1950. The most recent recorded event occurred one afternoon in August 2013 when a surface high pressure located over the Deep South remained nearly stationary. A persistent hot and humid southwest wind flow around this high brought an extended period of dangerously high heat indices. Heat indices topped out between 105 and 110 degrees at most airport observing sites. The heat index reached 107 at Carbondale. A number of persons were treated for heat exhaustion including 37 at a Carbondale hospital. Several counties opened a cooling shelter. Table 4-37 identifies NCDC-recorded drought/heat wave events that caused damage, death, or injury in Jackson County.

Table 4-37. NCDC-recorded Extreme Heat Events that caused Death, Damage or Injury in Jackson County

Location or County*	Date	Deaths	Injuries	Property Damage
Jackson County	8/3/2002	0	1	\$0
Jackson County	7/21/2005	0	6	\$0
Jackson County	8/6/2007	0	37	\$0
Total:				

Geographic Location for Drought and Extreme Heat

Droughts are regional in nature. Most areas of the United States are vulnerable to the risk of drought and extreme heat.

Hazard Extent for Drought and Extreme Heat

The extent of droughts or extreme heat varies both depending on the magnitude and duration of the heat and the range of precipitation.

Risk Identification for Drought and/or Extreme Heat

Based on historical information, the occurrence of future droughts and/or prolonged extreme heat is highly likely. The County should expect extreme heat and prolonged periods of less than average rainfall in the future. According to the Jackson County Planning Team's assessment, drought and/or extreme heat are ranked as the number eight hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
3	x	1	=	3

Vulnerability Analysis for Drought and Extreme Heat

Drought and extreme heat are a potential threat across the entire county; therefore, the county is vulnerable to this hazard and can expect impacts within the affected area. According to FEMA, approximately 175 Americans die each year from extreme heat. Young children, elderly, and hospitalized populations have the greatest risk. The entire population and all buildings are at risk. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County. Even though the exact areas affected are not known, a discussion of the potential impact are detailed below.

Critical Facilities

All critical facilities are vulnerable to drought. A critical facility will encounter many of the same impacts as any other building within the jurisdiction, which should involve little or no damage. Potential impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather. Table 4-7 lists the types and number of critical facilities for the entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The buildings within the county can expect similar impacts to those discussed for critical facilities. These impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather.

Infrastructure

During a drought, the types of potentially impacted infrastructure include roadways, utility lines/pipes, railroads, and bridges. The risk to these structures is primarily associated with fire, which could result from hot, dry conditions. Since the county's entire infrastructure is vulnerable, damage to any infrastructure is possible. The impacts to these items include: impassable roadways; broken or failed

utility lines (e.g., loss of power or gas to community); or impassable railways. Bridges could become impassable, causing risk to motorists.

Potential Dollar Losses from Drought and Extreme Heat

According to the NCD, Jackson County has not incurred damages relating to drought and extreme heat events storms since 1950. NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event. As a result, the potential dollar losses for a future event cannot be reliably constrained.

Vulnerability to Future Assets/Infrastructure from Drought/Extreme Heat Hazard

Future development will remain vulnerable to droughts. Typically, some urban and rural areas are more susceptible than others. For example, urban areas are subject to water shortages during periods of drought. Excessive demands of densely populated areas put a limit on water resources. In rural areas, crops and livestock may suffer from extended periods of heat and drought. Dry conditions can lead to the ignition of wildfires that could threaten residential, commercial, and recreational areas.

Suggestion of Community Development Trends

Because droughts and extreme heat are regional in nature, future development is susceptible to drought. Although urban and rural areas are equally vulnerable to this hazard, those living in urban areas may have a greater risk from the effects of a prolonged heat wave. The atmospheric conditions that create extreme heat tend to trap pollutants in urban areas, adding contaminated air to the excessively hot temperatures and creating increased health problems. Furthermore, asphalt and concrete store heat longer, gradually releasing it at night and producing high nighttime temperatures. This phenomenon is known as the “urban heat island effect.”

Local officials should address drought and extreme heat hazards by educating the public on steps to take before and during the event—for example, temporary window reflectors to direct heat back outside, staying indoors as much as possible, and avoiding strenuous work during the warmest part of the day.

4.3.10 Ground Failure

Hazard Definition

According to the USGS, the term ground failure is generally referred to landslides, liquefaction, lateral spreads, and any other consequence of shaking that affects the stability of the ground. In Illinois, ground failure is typically associated with subsidence of the land surface related to soluble rock (karst), sink holes, or underground mining.

Subsidence Related to Karst Features

Subsidence can occur on land located over soluble bedrock. The land over such bedrock often has topography characteristic of past subsidence events. This topography is termed “karst.” Karst terrain has unique landforms and hydrology found only in these areas. Bedrock in a karst areas are typically limestone, dolomite, or gypsum. In Illinois, limestone and dolomite (carbonate rocks) are the principle karst rock types. 9% of Illinois has carbonate rock types close enough to the ground surface to have a well-developed karst terrain. The area in Illinois in which the karst terrain is most developed is the southern and southwestern part of the state (Panno, et al., 1997). The karst feature most associated with subsidence is the sinkhole.

Sinkhole Formation and Collapse

A sinkhole is an area of ground that has no natural external surface drainage—when it rains, all of the water stays inside the sinkhole and typically drains into the subsurface. Sinkholes can vary from a few feet to hundreds of acres and from less than one to more than 100 feet deep. Typically, sinkholes form slowly, so that little change is seen during a lifetime, but they also can form suddenly when a collapse occurs. Such a collapse can have a dramatic effect if it occurs in a populated setting.

Sinkholes form where rainwater moves through the soil and encounters soluble bedrock. The bedrock begins to dissolve along horizontal and vertical cracks and joints in the rock. Eventually, these cracks become large enough to start transporting small soil particles. As these small particles of soil are carried off, the surface of the soil above the conduit slump down gradually, and a small depression forms on the ground surface. This depression acts like a funnel and gathers more water, which makes the conduit still larger and washes more soil into the conduit.

Sudden collapse of a sinkhole occurs where the soil close to the ground surface does not initially slump down, but instead forms a bridge. Beneath that surface cover, a void forms where the soil keeps washing into the conduit. These voids are essentially shallow caves. Over time, the void enlarges enough that the weight of the overlying bridge can no longer be supported. The surface layer then suddenly collapses into the void, forming a sinkhole.

The process of forming a conduit and a soil bridge usually takes years to decades. However this natural process can be aggravated and expedited by human activities. Since the process of forming a sinkhole depends on water to carry soil particle down into the karst bedrock, anything that increases the amount of water flowing into the subsurface can accelerate sinkhole formation process. Parking lots, streets, altered drainage from construction, and roof drainage are a few of the things that can increase runoff.

Collapses are more frequent after intense rainstorms. However, drought and altering of the water table can also contribute to sinkhole collapse. Areas where the water table fluctuates or has suddenly been lowered are more susceptible to sinkhole collapse. (White, 1988)

Underground Mining and Subsidence

Underground mines have been used extensively in Illinois to extract coal, lead, zinc, fluorites, shale, clay stones, limestone, and dolomite. When mining first began in Illinois, land over mined areas was sparsely populated. If the ground subsided, homes or other structures were seldom damaged. As towns and cities expanded over mined-out areas, subsidence damage to structures became increasingly more common. The most common underground mines in Illinois are coal mines. A recent study in Illinois has found that about 333,100 housing units were located over or adjacent to 839,000 acres mined for coal (Bauer, 2008).

Illinois has abundant coal resources. All or parts of 86 of 102 counties in the state have coal-bearing strata. As of 2007, about 1,050,400 acres (2.8% of the state) have been mined. Of that total, 836,655 acres are underground mines (Bauer, 2008). Illinois ranks first among all U.S. states for reserves of bituminous coal (Illinois Coal Association, 1992).

There are two fundamental underground mining methods used in Illinois: high-extraction methods such as long-wall and low-extraction room-and pillar mining. High-extraction

methods remove almost all of the coal in localized areas. For modern mining practices, subsidence associated with high-extraction methods is planned and regulated by state and federal authorities. The subsurface subsides above the mine within several days or weeks after the coal has been removed. Subsidence of the over-burden above the mined-out area can continue up to seven years after subsurface removal, depending on the local geologic conditions (Bauer, 2008). The initial ground movements associated with this mining, which tend to be the largest, diminish rapidly after a few months. After subsidence has decreased to a level that no longer causes damage to structures, the land may be suitable for development. The maximum amount of subsidence is proportional to the amount of material extracted and the depth between the mining and the surface. In general, over the centerline of the mine panel, subsidence can be 60 to 70% of the extracted material (e.g., 10ft of material extracted would cause a maximum subsidence of six to seven feet; Bauer, 2006).

For low-extraction techniques such as room-and-pillar mining, miners create openings (rooms) as they work. Enough of the coal layer is left behind in the pillars to support the ground surface. In Illinois this system of mining extracts 40% to 55% of the coal resources in modern mines and up to 75% in some older mines. Based on current state regulations, room-and-pillar mines in operation after 1983 that do not include planned subsidence must show that they have a stable design. Although these permitting requirements have improved overall mine stability, there are no guarantees that subsidence will not occur above a room-and-pillar mine in the future. In general, if coal or other mined resources have been removed from an area, subsidence of the overlying material is always a possibility (Bauer, 2006).

In Illinois, subsidence of the land surface related to underground mining undertakes two forms: pit subsidence or trough (sag) subsidence. Pit subsidence structures are generally six to eight feet deep and range from two to 40 feet in diameter. Pit subsidence mostly occurs over shallow mines that are <100 feet deep and where the overlying bedrock is <50 feet thick and composed of weak rock materials such as shale. The pit is produced when the mine roof collapses and the roof fall void works its way to the surface. These structures form rapidly. If the bedrock is only a few feet thick and the surface material are unconsolidated (loose), these material may fall into adjacent mine voids, producing a surface hole deeper than the height of the collapse mine void. Pit subsidence can cause damage to a structure if it develops under the corner a building or support post of a foundation or other critical location. Subsidence pits should be filled to ensure that people or animals don't fall into these structures (Bauer, 2006).

Trough (or "sag") subsidence forms a gentle depression over a broad area. Some trough subsidence may be as large as a whole mine panel (i.e. several hundred feet long and a few hundred feet wide). Several acres of land may be affected by a single trough event or feature. As discussed above, the maximum vertical settlement is 60% to 70% of the height of material removed (e.g., two to six feet). Significant troughs may develop suddenly (in a few hours or days) or gradually over a period of years. Troughs originate over places in mines where pillar has collapsed, producing downward movement at the ground surface. These failures can develop over mines of any depth. Trough subsidence produces an orderly pattern of tensile features (tension cracks) surrounding a central area of possible compression features. The type and extent of damage to surface structures relate to their orientation and position within a trough. In the tension zone, the downward-bending movements that develop in the ground may damage buildings, roads, sewer and water pipes, and other utilities. The downward bending of the ground surface causes the soil to crack, forming the tension cracks that pull

structures apart. In the relatively smaller compression zone, roads may buckle and foundation walls may be pushed inward. Buildings damaged by compressional forces typically need their foundations rebuilt and leveled (Bauer, 2006).

Previous Occurrences of Ground Failure

In Jackson County, undermined areas generally are found around the city of Murphysboro or along US 51 between De Soto and Dowell. Mine subsidence incidents that have impacted the residents of southern Illinois, and specifically Jackson County, have been documented in the local and regional press for several decades. One example was a reported sudden mine subsidence that caused a portion of U.S. Route 51 to sink up eight feet, causing an injury accident on December 24, 2001. An Illinois Department of Transportation field maintenance technician reported that similar collapses have occurred along other state roads throughout the region (Homan, 2001). In addition to mine subsidence, several sinkholes have been mapped in Jackson County by the Illinois Department of Natural Resources.

Geographic Location for Ground Failure

Illinois is usually associated with either underground mining or collapse of soil into crevice in underlying soluble bedrock. Areas at risk for subsidence can be determined from detailed mapping of geologic conditions or detailed mine maps.

Hazard Extent for Ground Failure

The extent of ground failure hazard in Jackson County is a function of where current development is located relative to (1) areas of past and present underground mining, and (2) areas of soluble bedrock.

Risk Identification for Drought and/or Extreme Heat

Based on historical information and the underlying geology of Jackson County, the occurrence of future ground failure is likely. According to the Jackson County Planning Team's assessment, ground failure is ranked as the number nine hazard.

<u>Risk Priority Index</u>				
Probability	x	Magnitude	=	RPI
2	x	1	=	2

Vulnerability Analysis for Ground Failure

The western portion of Jackson County is underlain by soluble bedrock. Within this region, several sinkholes have been mapped by the Illinois State Geological Survey. This area has the greatest potential for sinkhole subsidence. Nearly two-thirds of Jackson County is underlain by rock units which contain coal and the region has a rich history in mining. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County.

Critical Facilities

Any critical facility built above highly soluble bedrock could be vulnerable to ground failure. A critical facility will encounter the same impacts as any other building within the affected area. These impacts include damages ranging from cosmetic to structural. Buildings may sustain minor cracks in walls due to a small amount of settling, while in more severe cases, the failure of building foundations can cause cracking of critical structural elements. Table 4-7 lists the types and number of critical facilities for the

entire county and Appendix F displays a large format map of the locations of all critical facilities within the county.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The buildings within the county can expect similar impacts to those discussed for critical facilities, ranging from cosmetic to structural. Buildings may sustain minor cracks in walls due to a small amount of settling, while in more severe cases, the failure of building foundations causes cracking of critical structural elements.

Infrastructure

In the area of Jackson County potentially affected by ground failure, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. The risk to these structures is primarily associated with land collapsing directly beneath them in a way that undermines their structural integrity. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (i.e. loss of power or gas to community); and railway failure from broken or impassable railways. In addition bridges could fail or become impassable causing risk to traffic.

GIS-based Analysis of Ground Failure

This section provides an overview of the ground failure hazards in Illinois in general and a discussion of the potential subsidence risk for Jackson County. Ground failure in Illinois is usually associated with either underground mining or collapse of soil into crevice in underlying soluble bedrock. Areas at risk for ground failure can be determined from detailed mapping of geologic conditions or detailed mine maps. Figure 4-25 displays data sources compiled from the Illinois State Geologic Survey (ISGS) and Illinois Department of Natural Resources (IDNR) to assess the risk of ground failure in Jackson County.

Figure 4-25. Distribution of Bedrock with Potential Coal Bearing Strata, Karst, Sinkholes and Mining Efforts

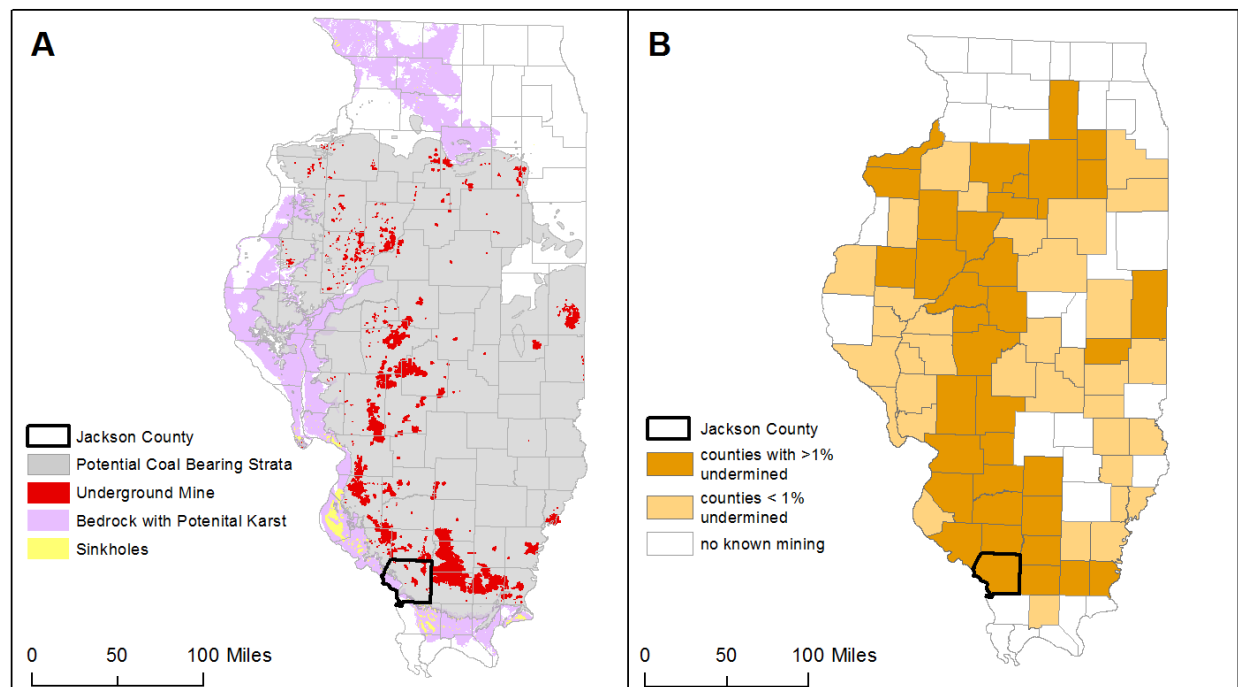
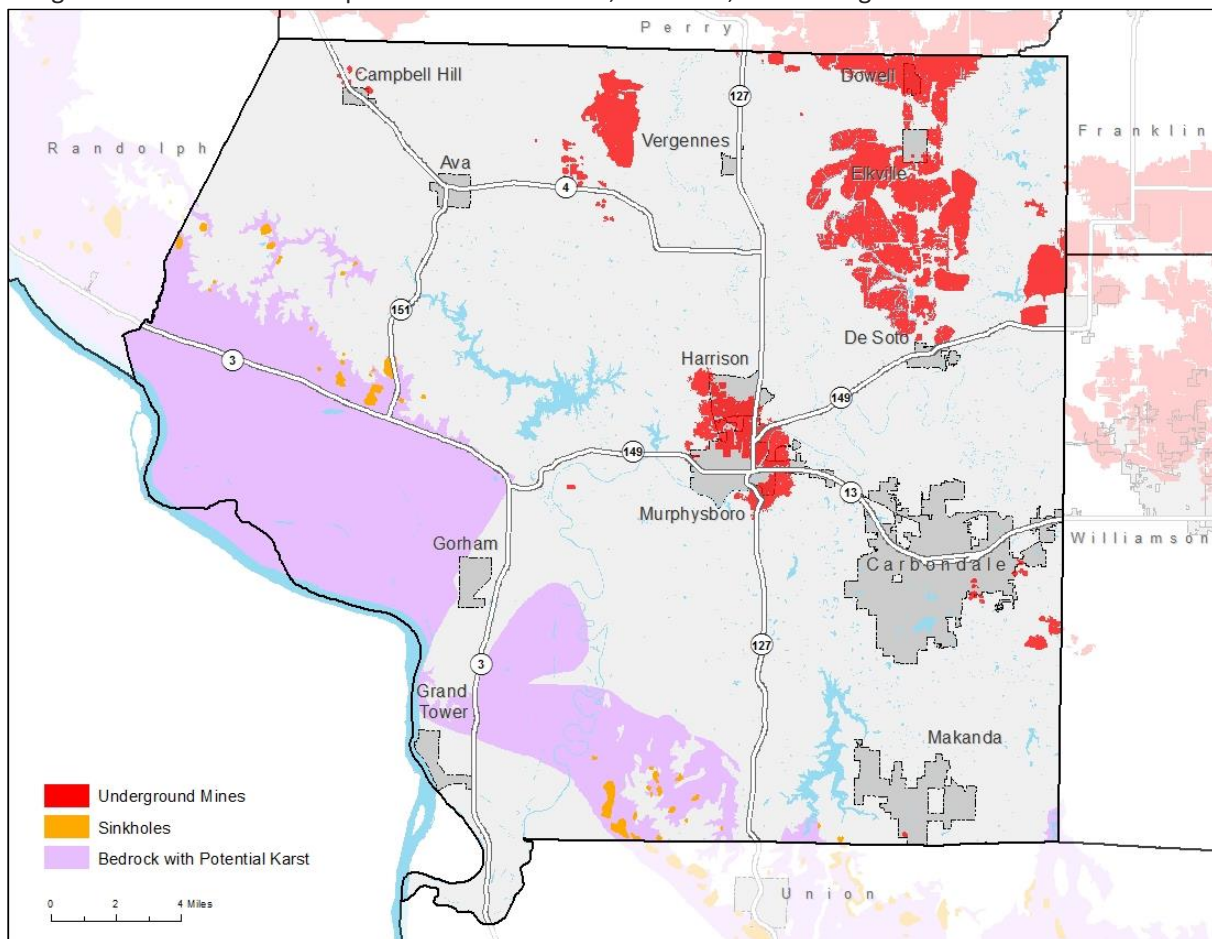


Figure 4-25(a) shows statewide distribution of bedrock with karst potential, coal bearing strata, sink holes. Figure 4-25(b) shows the counties which are 0, <1% and >1% undermined. Nearly all of Jackson County is underlain by rock units which contain coal and is >1% undermined. The Mine Subsidence Insurance Act of 1979 created subsidence insurance as part of an Illinois homeowner's policy. Homeowners in any of the Illinois counties undermined by approximately 1% or more automatically have mine subsidence insurance as a part of their policy, unless coverage is waived in writing. Mine subsidence insurance is especially important for homes located near or over mines that operated before the 1977 Surface Mine Control and Reclamation Act. The companies that operated these mines may no longer be in business (Bauer, 2006).

Figure 4-26 shows the distribution of bedrock with karst potential, coal bearing strata, sink holes, and underground mines in Jackson County. Analysis of the GIS data layer of active and abandoned coal mines in Illinois obtained from the IDNR revealed that 45.2 mi² out of Jackson County's total 1570 mi² (~3%) have been undermined. The undermined areas are generally found around the city of Murphysboro or along Highway 51 between De Soto and Dowell. Comparison of Jackson County local assessment and parcel data with IDNR GIS layer of active and abandoned underground-coal mines was performed. This analysis revealed that 1,413 out of the 17,893 or ~8% of the buildings in the county were above undermined areas. Several sinkholes have been mapped in the areas underlain with soluble bedrock. This area has the greatest potential for future sinkhole subsidence

Figure 4-26. Distribution of potential karst bedrock, sinkholes, and underground mines in Jackson County



Vulnerability to Future Assets/Infrastructure for Ground Failure

New buildings and infrastructure placed on undermined land or on highly soluble bedrock will be vulnerable to ground failure.

Suggestions of Community Development Trends

Abandoned underground mine subsidence may affect several locations within the county; therefore buildings and infrastructure are vulnerable to subsidence. Continued development will occur in many of these areas. Currently, Jackson County reviews new development for compliance with the local zoning ordinance. Newly planned construction should be reviewed with the historical mining maps to minimize potential subsidence structural damage.

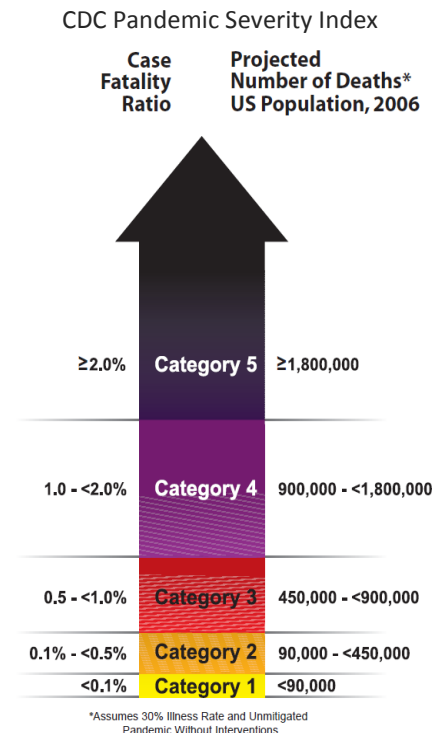
4.3.11 Disease Outbreaks, Epidemics, and Pandemics

Hazard Definition

Disease outbreaks, epidemics, and pandemics can have devastating consequences on people and the community at large. These types of hazards have the potential of affecting a large number of people and posing significant harm with their ability to seriously diminish people's health and cause death. Dependent upon the situation, these public health hazards can last from days to years. Disease Outbreaks occur when there is a sudden rise in a disease experienced by a community, region or during a season, despite measures to deter disease spread. Outbreaks could be a single case of a contagious disease, particularly if it is a novel disease or new to a community or reemerges after a long absence. An outbreak may be isolated to a single community or cover several countries.

Epidemics occur when an infectious disease spreads rapidly affecting people in several countries. Disease outbreaks have the potential of becoming epidemics. Epidemics are common occurrences in the world of the 21st century. According to the World Health Organization (WHO), every country on earth as experienced at least one epidemic since the year 2000. The 2003 Severe Acute Respiratory Syndrome (SARS) in Asia and the 2014-15 Ebola Virus Disease (EVD) both started out as outbreaks, but became epidemics. SARS ended up spreading to two dozen countries, infecting 8,098 people in which 774 people died. Some public health incidents start out as epidemics, such as Swine Flu (H1N1) and Avian Flu (H5N1) but result in global exposure (see Pandemic, below). Far more often, however, and with increasing regularity, epidemics strike at lesser geographic levels.

Pandemics are disease outbreaks/epidemics that spread worldwide. HIV/Aids is an example of one of the most destructive global pandemics in history. The number of people affected by a pandemic depends upon how severe the pandemic is. Pandemics are generally classified by severity level: mild, moderate, or severe. Pandemics can significantly impact segments of the population not usually affected by seasonal flu, for instance, healthy adults between the ages of 20 – 50, (see more information on difference between pandemic and seasonal flu later in this section). By infecting and causing death in large numbers of people, pandemics can also cause significant economic disruption and loss.



Public health experts say it's not a matter of "if" an influenza pandemic will happen, but "when."

CDC Pandemic Severity Index -The number of people affected by a pandemic depends upon the severity of the pandemic. The Centers of Disease Control and Prevention (CDC) has developed a Pandemic Severity Index, with categories of increasing severity (Category 1 to Category 5). The Pandemic Severity Index uses a ratio to estimate the number of expected deaths. This index helps communities with pandemic preparedness and planning.

Previous Occurrences of Disease Outbreaks, Epidemics, and Pandemics

Recently, the 2014 outbreak of the Ebola virus disease in several West African counties has prompted changes in the way the public health industry mitigates and responds to epidemics and pandemics. It is important to note that as of December 2014, only two imported cases, including one death, and two locally acquired cases in healthcare workers have been reported in the United States. Common epidemic and pandemic threats include (but not limited to) HIV/Aids, smallpox, tuberculosis, influenza, non-polio enteroviruses, and foodborne outbreaks. This plan will only highlight the most recent non-polio enteroviruses, influenza and foodborne illness records.

Non-Polio Enteroviruses are very common viruses that cause about 10 to 15 million infections in the United States each year. All populations are susceptible to non-polio enteroviruses, however there is an increased risk for infants, children, and teenagers due to a lack of immunity from previous exposures to the viruses. The infection is spread via close contact or touching surfaces with the infection. Those who become infected with the viruses do not get sick or come down with mild illnesses. Severe cases have the potential to infect the heart, brain or even paralyze.

One of the most recent non-polio enteroviruses cases occurred from mid-August to December 11th, 2014. The CDC confirmed a total of 1,149 people in 48 states and the District of Columbia with respiratory illness caused by Enterovirus D68 (EV-D68). This virus was first identified in California in 1962 and is one of the more than 100 non-polio enteroviruses. EV-D68 has been the most common type of enterovirus identified in 2014, leading to increases in illnesses among children and affecting those with asthma most severely.

Influenza Pandemics (pandemic flu) occurs when a new type of influenza (flu) virus emerges, affecting the health and lives of many people. As a serious respiratory illness, pandemic flu spreads quickly from person to person because people have not been exposed to the new flu strain. Once exposed, individuals may have little or no bodily resistance for fighting off the new, contagious type of flu. During the 20th century, there were three major influenza pandemics.

The 1918 Spanish flu was the deadliest flu pandemic, infecting 20% to 40% of the world's population. An estimated 50 million died from the Spanish flu, 675,000 of which were from the United States. This was a viral pandemic in which people could die quite suddenly. Instances occurred in which people reported being well in the morning, felt sick during the day and had died by evening. Many individuals fighting this virus succumbed to complications, such as pneumonia. Those most affected were adults between the ages of 20-50, healthy individuals that typically are not the hardest hit by influenza.

"Asian flu" of 1957 and "Hong Kong flu" of 1968 caused approximately 1 - 4 million deaths. The 1957 pandemic originated in China and was a category 2 on the pandemic severity index. Eventually, the Asian flu strain evolved, shifting initiating a milder 1968-69 Hong Kong flu pandemic infecting 500,000 people

The most recent pandemic was the H1N1 Flu Pandemic. On August 10th, 2010 the World Health Organization announced that the world is now in a post-pandemic period where the 2009 flu pandemic flu is expected to continue to circulate seasonally worldwide, causing variable levels of disease and outbreaks. Table 4-38 displays the influenza pandemics since 1918.

Table 4-38. Influenza Pandemics since 1918

Name	Date	Subtype	Deaths in American
1918-1919	Spanish Flu	H1N1	675,000
1957-1958	Asian Flu	H2N2	69,800
1986-1969	Hong Kong Flu	H3N2	33,800
2009-2010	2009 Flu Pandemic / Swine Flu	H1N1/09	8,870 - 18,300
Total:			787,470 – 796,900

Source: [U.S. Department of Health & Human Services](#)

Seasonal Flu and Pandemic Flu are both influenza viruses that affect the upper respiratory system of people. Seasonal flu is the more common type of flu, emerging each year during the fall, winter, and spring months. Seasonal flu continually circulates among people during each flu season, changing slightly from year to year. Because of seasonal flu's continual presence among people, individuals are more likely to have acquired some bodily resistance, allowing them to fight off this flu strain better. Despite having acquired some immunity, the CDC estimates that from the 1976-77 season to the 2006-07 flu season, flu-associated deaths ranged from a low of about 3,000 to a high of about 49,000. FWBCHD and other health organizations offer seasonal flu vaccinations annually to protect people from this changing virus. Pandemic flu is a new type of virus, which means that people have little or no immunity to it. Pandemic flu spreads quickly from person to person and can produce serious illness, usually significantly more severe than seasonal flu.

Foodborne Disease is a common public health problem. The CDC estimates that each year roughly 1 in 6 Americans get sick by consuming contaminated foods or beverages. Many different disease-causing microbes, pathogens, or harmful toxins or chemicals can contaminate foods. There are eight known pathogens that account for the vast majority of illnesses, hospitalizations, and deaths. Nontyphoidal Salmonella, Toxoplasma, Listeria, and norovirus caused the most deaths. Table 4-39 identifies CDC-recorded death related foodborne outbreaks with reported cases in Illinois. Reported hospitalizations and deaths are national statistics for a given outbreak. Additional details of individual hazard events are on the CDC website.

The most severe confirmed outbreak of foodborne disease occurred in 2011 after a multistate outbreak of *Listeria monocytogenes* food poisoning linked to whole cantaloupes from Jensen Farms of Holly, Colorado. A total of 33 deaths and 143 hospitalizations were reported to the CDC from 28 States. Additionally, one woman pregnant at the time of illness had a miscarriage. Four people were infected in the State of Illinois.

Table 4-39. Confirmed Foodborne Disease Outbreaks with reported cases in Illinois. Hospitalizations and Deaths are National Statistics for a given outbreak.

Year	Genus Species	Food Vehicle	Total Hospitalizations	Total Deaths
2011	<i>Listeria monocytogenes</i>	Cantaloupe	143	33
2008	<i>Salmonella enterica</i>	Peanut Butter; Peanut Paste	166	9
2006	<i>E.coli</i> , Shiga toxin-producing	Spinach	103	5

Year	Genus Species	Food Vehicle	Total Hospitalizations	Total Deaths
2012	Salmonella enterica; Salmonella enterica	Cantaloupe	94	3
2007	Salmonella enterica	Pot Pie	108	3
1998	Salmonella enterica	Tomato, Unspecified	16	3
2008	Salmonella enterica	Pureed Food Diet	1	2
2008	Salmonella enterica	Peppers, Jalapeno; Peppers, Serrano; Tomato, Unspecified	308	2
2003	Salmonella enterica	Honeydew Melon	13	2
2012	Salmonella enterica	Cantaloupe	11	1
2011	Salmonella enterica	Ground Turkey, Unspecified	50	1
2010	Shigella sonnei	Bread, Nine Grain; Tomatoes	13	1
2009	Salmonella enterica	Melon	4	1
2008	Norovirus Genogroup II	Lettuce Based Salads	3	1
2000	Salmonella enterica	Salmon, Unspecified; Seafood Dish, Unspecified	10	1
Total:			1,043	68

*CDC Foodborne Outbreak Online Database was last updated on 5/28/2014 to include 2012 outbreak data. Reporting agencies (state, local, territorial, and tribal health departments, and CDC) can modify their reports at any time, even months or years after an outbreak. Therefore, results from Foodborne Outbreak Online Database are subject to change.

Geographic Location for Disease Outbreak, Epidemics, and Pandemic Hazard

Because of the nature of pandemic disease, the entire country, continent, or whole world is at risk. An epidemic can occur over a short period of time and strike at lesser geographic levels. Therefore the entire county has the same risk of disease outbreak, epidemic, or pandemic hazard.

Hazard Extent for Disease Outbreak, Epidemics, and Pandemic Hazard

The extent of the hazard varies in terms of the physical characteristics of the disease outbreak, epidemic or the pandemic (e.g., the number of people infected and strength of the virus).

Risk Identification for Disease Outbreak, Epidemics, and Pandemic Hazard

Disease outbreaks, epidemics, and pandemics can occur within any area in the county; therefore, the entire county population and all critical infrastructure are vulnerable. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-7 and 4-8 display the existing buildings and critical infrastructure in Jackson County. The Jackson County Planning Team identified disease outbreak, epidemic, and pandemic as a prioritized public health hazard. This plan includes a section devoted to disease outbreak, epidemic, and pandemic but it should be noted that it is not included in the ranked list of hazards.

Vulnerability Analysis

A less severe pandemic and/or more severe epidemic would likely result in dramatic increases in the number of hospitalizations and deaths. A severe pandemic would likely overwhelm the nation's critical healthcare services and impose significant stress on our nation's critical infrastructure (including but not limited to the airline and travel industry). Epidemic and pandemics can create a shortage of staff, facilities, equipment, hospital beds, and other supplies needed to cope with the number of people who get the pandemic flu. Alternative sites, such as schools, may serve as medical facilities.

Suggestions for Community Development Trends

The U.S. Department of Health & Human Services and the State of Illinois Department of Public Health provides guidance to communities, individuals, health professionals, businesses and schools on epidemic and pandemic mitigation. Planning and preparedness information is disseminated via [Flu.gov](https://www.flu.gov). Various Fact sheets, tool kits, check lists and pre-pandemic planning guides are available. It is important that all entities in the county are prepared because the federal government cannot prepare for or respond to the challenge of a pandemic alone.

The Centers of Disease Control and Prevention (CDC) developed the 2007 Interim Pre-pandemic Planning Guide for local communities to mitigation against pandemic influenza. The goals are to limit the spread of a pandemic; mitigate disease, suffering, and death; and sustain infrastructure and lessen the impact on the economy and the functioning of society. A pandemic influenza mitigation framework was created and includes four mitigation interventions to help offset the effect on communities. Implementing these interventions require advance planning. As such, the CDC warns of second- and third-order consequence of the interventions which may require additional planning. Interventions include, but are not limited to:

1. Isolation and treatment (as appropriate) with influenza antiviral medications of all persons with confirmed or probable pandemic influenza. Isolation may occur in the home or healthcare setting, depending on the severity of an individual's illness and /or the current capacity of the healthcare infrastructure.
2. Voluntary home quarantine of members of households with confirmed or probable influenza case(s) and consideration of combining this intervention with the prophylactic use of antiviral medications, providing sufficient quantities of effective medications exist and that a feasible means of distributing them is in place.
3. Dismissal of students from school (including public and private schools as well as colleges and universities) and school-based activities and closure of childcare programs, coupled with protecting children and teenagers through social distancing in the community to achieve reductions of out-of-school social contacts and community mixing.
4. Use of social distancing measures to reduce contact between adults in the community and workplace, including, for example, cancellation of large public gatherings and alteration of workplace environments and schedules to decrease social density and preserve a healthy workplace to the greatest extent possible without disrupting essential services.
5. Additionally, one of the best and most effective mitigation strategies available to everyone is simply utilizing good hygiene practices, e.g., effectively washing hands frequently, effectively covering coughs and sneezes, and wiping down surfaces frequently shared by people, e.g., door knobs, counter surfaces, bathroom/kitchen faucet sink handles and bathroom toilet handles, etc.

Section 5. Mitigation Strategies

The goal of mitigation is to reduce the future impacts of a hazard, including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. Throughout the planning process, the Jackson County Planning Team worked to identify existing hazard mitigation policies, develop mitigation goals, and create a comprehensive range of mitigation strategies specific to each jurisdiction. This work provides a blueprint for reducing the potential losses identified in the risk assessment (section 4).

5.1 Existing Hazard Mitigation Policies, Programs and Resources

This section documents each jurisdiction's existing authorities, policies, programs and resources related to hazard mitigation and the ability to improve these existing policies and programs. It is important to highlight the work that has been completed in Jackson County that pertains to hazard mitigation. In addition, the following information also provides an evaluation of these abilities to determine whether they can be improved in order to more effectively reduce the impact of future hazards.

5.1.1 Successful Mitigation Projects

To be successful, mitigation must be a recurrent process that is continually striving to lessen the impact of natural hazards within the county. The following are projects that were successfully completed after Jackson County's 2009 Multi-Hazard Mitigation Plan was formally adopted.

Jackson County Reed Station Acquisition

Following a major flood on Crab Orchard Creek in May 2011, Jackson County received HMGP funding to acquire Reed Station Mobile Home Park. The grant will be used to purchase roughly 30 acres of land and dozens of mobile homes as part of the flood mitigation project. The park structures will be demolished and the land will be deed-restricted to remain open space in perpetuity. The total cost of the project is \$2,918,840. The Federal Emergency Management Agency provided 75% of the project cost with 25% provided by the Illinois Department of Natural Resources.

Southern Illinois Hospital Seismic Retrofit

Following a major disaster declaration in August 2010, The Southern Illinois Healthcare received HMGP funding to retrofit three hospitals with seismic-resistant materials and components. The total cost of the project is \$10,800,000. These retrofits will reduce the risk of damage and injury during major earthquakes and improve post-earthquake functionality of these healthcare facilities. Phase I of this project included seismic risk assessments of the three Southern Illinois Healthcare hospital campuses: St. Joseph Memorial Hospital (Jackson County), Memorial Hospital of Carbondale (Jackson County) and Herrin Hospital (Williamson County). Phase I deliverables included an engineering report, alternatives analysis, design engineering for selected alternatives and environmental review. Phase II will include implementation/construction of the eligible selected alternatives.

Carbondale Public Safety Center

In 2012, The City of Carbondale completed construction on the new 32,000 square foot center that houses all of the police department's services. Marion Street was extended from College Street to Mill Street to facilitate police traffic at new Public Safety Center. The total cost of the project was \$9,325,086. The new facility leaves the housed department better equipped to serve the public in the event of a hazard.

Carbondale Fire Station #2

In 2014, the City of Carbondale completed construction on a new Fire Station on North Glenview Drive to replace the existing fire station. The new facility has 4,000 square feet of living and office space for fire fighters, a four bay 3,840 square foot area for fire vehicles, and 3,000 square feet for storage. The facility includes a new Emergency Operation Center with standby generator and a training room. The total cost of the project was \$3.1 million.



Image c/o the City of Carbondale

Southern Illinois Research Park Drive

In 2014, the Southern Illinois Research Park Drive project was completed. This project included enhancements to infrastructure including road, water, sewer, and utilities for Research Park Drive which connects the research park to SIUC Campus and US Highway 51. The project was funded by Southern Illinois University and the 2005 Highway Transportation Act. Total Cost of the project was \$2,100,000.

Carbondale Water Storage Facility

In 2014, the City of Carbondale completed construction on a 3 million gallon on-ground water storage facility. This facility is located on East Park Street and replaced two below ground storage facilities with a combined 2.8 million gallon capacity. This project consisted of the construction of a new three million above ground water storage tank, and a pump station that replaces the two existing underground storage tanks and pump station located at the old water treatment plant site at the corner of Wall Street and Grand Avenue. This project was funded through a low interest loan from the Illinois Environmental Protection Agency. The total construction and engineering cost for this project was approximately \$3,800,000.



Image c/o the City of Carbondale

Dowell Elevation Mapping

With the help of the Delta Regional Authority's States Economic Development Assistance Program, the Village of Dowell mapped elevations for use in FEMA's hydraulic program to calculate the risk of flooding in the community. The result of this work will be the validation of the new drainage infrastructure installed to prevent flooding in Dowell. Once the risk of flooding is proven to be no longer present, FEMA may reissue a new flood map which will provide for greatly reduced flood insurance expenses for residents and businesses. The total cost of the project was \$28,100 with an investment of \$25,000 from the Delta Regional Authority.

Armory National Guard Readiness Center

In 2011, the Illinois National Guard completed construction on the \$11 million Carbondale Reserve Center on land donated by the Southern Illinois Airport Authority. The new armory houses both Army National Guard units and Army Reserve units and consolidates current operations in Carbondale, Cairo and Marion. The facility houses 58,353 square feet of space for operations, training and equipment storage. The facility houses 17 full time staff and accommodate 275 weekend guard and reserve members.

Regional Emergency Response Center

In September 2014, the Governor of Illinois announced a \$4.5 million investment to develop a Regional Emergency Response Center (RERC) at the Southern Illinois Airport in Carbondale. The \$4.5 million investment from Governor's *Illinois Jobs Now!* Capital construction program will develop the Regional Emergency Response Center at Southern Illinois Airport to consolidate much of the emergency and critical response services for the region. This will include a permanent Emergency Management Center, a field hospital, teaching center and a regional response center for large-scale natural disasters. The development of the RERC was recommended in a plan developed by the Southern Illinois Airport Authority, Jackson Growth Alliance and former SIU Chancellor Sam Goldman.

The 50,000-square-foot RERC hangar building will be located between the existing Public Works Building and the National Guard facility at the airport. Approximately 10,000 square feet of the hangar will be designated as a communications and command center for the Jackson County Emergency Management Agency, the Jackson County Ambulance Service and Memorial Hospital of Carbondale.

Southern Illinois Airport Authority Fiber Optic and Sewer Extension

In 2014, the Delta Regional Authority announced it will invest in a fiber optic and sewer extension at the Southern Illinois Airport Authority's technology park for current tenants. The new infrastructure is expected to attract agri-business opportunities. The total project costs are \$67,400 with an investment of \$50,550 from the Delta Regional Authority.

Elkville Fire Station

The Village of Elkville received \$40,000 from the USDA Direct Community Facility Grant Program to construct a new fire station. The Direct Community Facility Grant Program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. The new facility leaves the housed department better equipped to serve the public in the event of a hazard.

Community Development Assistance Program

Community Development Assistance Program (CDAP) grants are awarded to units of local government with populations of 50,000 or less that are not located within one of the six large urban counties that receive funds directly from the U.S. Department of Housing and Urban Development. The CDAP is a grant program that assists Illinois communities by providing grants to local governments to help them in financing economic development projects, public facilities and housing rehabilitation. Since 2009, Jackson County has received four CDAP grants totaling \$476,753.

A majority of the CDAP projects were to improve water, sanitary and storm-sewer systems. The village of De Soto used the CDAP grant to design the replacement of asbestos water lines, undersized water lines,

inoperable hydrants and inoperable valves. The village of Ava used CDAP grants to (1) design approximately 21,400 feet of rural water line to serve 24 households and (2) extend water service to rural residents in the area of Lone Oak Road to residents that did not have access to a public water source. The Village of Elkhville used CDAP funds to make emergency repairs to a sewer lift station

Emergency Solutions Grant

The Illinois Emergency Solutions Grant (ESG) program provides funding to: (1) engage homeless individuals and families living on the street; (2) improve the number and quality of emergency shelters for homeless individuals and families; (3) help operate these shelters; (4) provide essential services to shelter residents, (5) rapidly re-house homeless individuals and families, and (6) prevent families and individuals from becoming homeless. Since 2009, Jackson County has received six ESG grants totaling \$139,811 to aid in shelter/services in Jackson County, including essential services and operations.

Thermal Efficiency for Public Facilities

The Illinois Thermal Efficiency for Public Facilities Program provides grants to public sector entities for improving the energy efficiency of thermal equipment or processes. Measures include natural gas system efficiency improvements and geothermal systems. The incentives are available to units of local, state, and federal government, schools, community colleges and universities. In 2010, Southern Illinois University Carbondale received \$68,005 to purchase and install a geothermal system at the Stone Center and energy efficient windows for Woody Hall.

Town Creek Road Bridge

The bridge on Town Creek Road that crosses the Big Muddy River in Murphysboro had a seismic retrofit of bearings and deck rehabilitation. The project was completed in November 2011 with a cost of \$507,687 supplied by local funding sources.

Highway Department Generator

The Jackson County Highway Department in Murphysboro installed a backup generator for use during emergencies. It was installed in July of 2013 at the cost of \$52,449 supplied by the Motor Fuel Tax and local funding sources.

Grant Management Program

The Illinois Grant Management Program provides grants to specific local governments, units of government, educational facilities and not-for-profit organizations by members of the General Assembly and the Governor for specific purposes to bolster the State's economy, promote a clean environment and improve the overall quality of life throughout the State of Illinois. Since 2009, Jackson County received 15 grants under the Grant Management Program totaling \$868,000. The following communities utilized the Grant Management Program funds to complete hazard mitigation projects:

- Campbell Hill used the grant to cover the costs associated with water improvements on various properties along Church Street in the village.
- De Soto made improvements to the village's water supply system and fire station.
- Dowell used a portion of the grant funds to cover the costs associated with drainage ditch improvements.
- Elkhville used a portion of the grant to cover the costs associated with sandblasting and repainting the interior and exterior of the 125,000 gallon elevated water storage tank.

- Gorham used a portion of the grant to assist in purchasing and installing a HVAC unit in conjunction with a newly renovated community center. The balance of the Grant funds were used to purchase and install plumbing for the installation of restrooms located at the community center.
- Vergennes made improvements to the municipal sanitary sewer system and water distribution systems.

5.1.2 National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) to help provide a means for property owners to financially protect themselves. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. This section covers the County's NFIP status, flood insurance policy and claim statistics, repetitive loss structures, and Community Rating System status.

NFIP Status

In Jackson County, eight out of the nine incorporated communities participate in the NFIP. Table 5-1 includes a summary of information for Jackson County participation in the NFIP. The Village of Grand Tower was mapped with a flood risk but was sanctioned in June 17, 1991. Sanctioned communities do not qualify for flood-related Federal disaster assistance for acquisition, construction, or reconstruction purposes in Special Flood Hazard Areas. This may have serious consequences for the community's real estate market and economic viability, as each federally regulated lender must notify the purchaser or lessee that Federal disaster assistance is not available for that property in the event of a flood. Jackson County will continue to provide information to its non-participating jurisdictions regarding the benefits of the National Flood Insurance Program.

Two communities, De Soto and Vergennes, have an effective FIRM and participate in the NFIP. However, these communities are mapped as Non-Special Flood Hazard Areas (NSFHA). NSFHA areas have a moderate-to-low risk flood zone and is not in any immediate danger from flooding caused by overflowing rivers or hard rains. However, it's important to note that structures within a NSFHA are still at risk. In fact, nearly 1 in 4 NFIP flood claims occur in these moderate- to low-risk areas.

Table 5-1. Information on Jackson County's Participation in the NFIP

Community	Participate in the NFIP	Initial Flood Hazard Boundary Map Identified	Initial FIRM Identified	Current Effective FIRM Date
Jackson County	Yes	07/14/78	05/02/08	05/02/08
Carbondale	Yes	05/03/74	11/01/79	05/02/08
De Soto	Yes	04/05/74	05/02/08	05/02/08(M)
Dowell	Yes	04/18/75	12/05/89	05/02/08
Elkville	Yes	03/28/75	12/18/84	05/02/08
Gorham	Yes	01/26/79	05/02/08	05/02/08
Grand Tower	No	01/09/74	05/16/83	05/02/08
Makanda	Yes	08/23/74	03/15/82	05/02/08
Murphysboro	Yes	04/12/75	09/29/78	05/02/92
Vergennes	Yes	02/16/79	05/02/08	05/02/08(M)

NFIP status and information are documented in the Community Status Book Report updated on 04/07/2015.

(M) – No Elevation Determined – All Zone A, C and X

Flood Insurance Policy and Claim Statistics

As of January 2015, 220 households paid flood insurance, insuring \$29,168,800 in property value. The total premiums collected for the policies amounted to \$185,021. Since the establishment of the NFIP in 1978, 107 flood insurance claims were filed in Jackson County, totaling in \$1,048,627.36 in payments. Table 5-2 summarizes the claims since 1978.

Table 5-2. Flood Insurance Claim Statistics for Jackson County

Community	Total Losses	Closed Losses	Open Losses	CWOP Losses	Payments
Jackson County	64	59	0	5	\$389,909.93
Carbondale	17	11	0	6	\$507,504.14
Dowell	8	8	0	0	\$37,080.49
Gorham	4	1	0	3	\$3,744.87
Makanda	5	4	0	1	\$31,947.55
Murphysboro	9	7	0	2	\$78,440.38

NFIP policy and claim statistics since 1978 until the most recently updated date of 01/31/2015. Closed Losses refer to losses that are paid; open losses are losses that are not paid in full; CWOP losses are losses that are closed without payment; and total losses refers to all losses submitted regardless of status. Lastly, total payments refer to the total amount paid on losses.

Repetitive Lose Structures

There are several structures in Jackson County that have experienced repetitive losses due to flooding. FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the NFIP that has suffered flood loss damage on two or more occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is $\geq 25\%$ of the market value of the structure at the time of each flood loss. Currently there are over 122,000 Repetitive Loss properties nationwide.

The Illinois Emergency Management Agency and Illinois Department of Natural Resources was contacted to determine the location of repetitive loss structures in Jackson County. Records indicate that there are 6 repetitive loss structures within the county. The total amount paid for building replacement and building contents for damage to these repetitive loss structures is \$139,112. Table 5-3 describes the repetitive loss structures for each jurisdiction.

Table 5-3. Repetitive Loss Structures for each Jurisdiction in Jackson County

Jurisdiction	Number of Properties	Number of Losses	Total Paid
Carbondale	2	5	\$58,757.02
Murphysboro	2	4	\$36,574.67
Makanda	1	2	\$18,899.18
Dowell	1	2	\$24,880.81
Total:	6	13	\$139,111.68

Community Rating System Status

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance. More than 1,200 communities from all 50 states participate in the CRS. In Illinois, 51 communities participate in the CRS. Although joining the CRS is free, completing

CRS activities and maintain a CRS rating will require a degree of commitment from the community, including dedicating staff.

The CRS uses a Class rating system that is similar to fire insurance rating to determine flood insurance premium reductions for residents. CRS Classes are rated from 9 to 1. Most communities enter the program at a CRS Class 9 or Class 8 rating, which entitles residents in Special Flood Hazard Areas (SFHAs) to a 5% to 10% discount on flood insurance premiums. Each CRS Class improvement produces a 5 percent greater discount on flood insurance premiums.

Table 5-4 displays Jackson County's Community Rating System history. In October 2002, the City of Carbondale entered the CRS program as a class 10 community but did not obtain the minimum number of credit points. Currently, Jackson County and its incorporated areas do not participate in the NFIP's Community Rating System (CRS). Joining the CRS could be one way Jackson County or its incorporated communities improve their existing floodplain management policies and further reduce the flood hazard risk.

Table 5-4 Jackson County's Community Rating System History

Jurisdiction	CRS Entry Date	Current Effective Date	Class*	% Discount for SFHA	Status
Carbondale	10/01/02	10/01/08	10	0	Rescinded

5.1.3 Jurisdiction Ordinances

Hazard Mitigation related ordinances, such as zoning, burning, or building codes, have the potential to reduce the risk from known hazards. These types of regulations provide many effective ways to address resiliency to known hazards. Table 5-5 list Jackson County's current ordinances that directly pertain, or can pertain, to hazard mitigation. It is important to evaluate the local building codes and ordinances to determine if they have the ability to reduce potential damages caused by future hazards. The Jackson County Planning Team worked to identify gaps in the current list of ordinances and suggested changes/additions in Section 5.3.

Table 5-5. Jackson County's Jurisdiction Ordinances

Community	Building	Electrical	Stormwater	Flooding	Subdivision	Fire	Land Use	Zoning
Jackson County	-	-	State Standards – adopted 2005	State Model (Current)	State Standards – adopted 2005	-	Comp. Plan – adopted 1965	-
Ava	-	-	-	-	-	Municipal Code – adopted 2002	-	-
Campbell Hill	Municipal Code – adopted 1969	-	-	-	-	-	-	Municipal Code – adopted 2002
Carbondale	ICC 2003 IBC	NFPA 2008 Code	State and IDOT Standards (Current)	State Model (Current)	Municipal Code – adopted 1964	International Fire Code 2003	Comp. Plan – Adopted 2010	Municipal Code – adopted 1974
De Soto	BOCA 2009 Code	NFPA 2008 Code	State Standards – adopted 2008	State Model (Current)	State Standards – adopted 2008	State Standards – adopted 2008	Comp. Plan – adopted 2008	-
Dowell	BOCA 1999 Code	NFPA Code (Current)	-	State Model (Current)	-	State Standards (Current)	-	-
Elkville				State Model (Current)			Comp. Plan – adopted 1966	

Gorham	-	-	-	State Model (Current)	-	-	-	-
Grand Tower	-	-	-	-	-	Municipal Code – Adopted 1980	Comp. Plan – adopted 1968	-
Makanda	-	-	Municipal Code – Adopted 1987	State Model (Current)	Municipal Code – Adopted 1987	-	-	-
Murphysboro	BOCA 1999 Code	NFPA 2008 Code	-	State Model (Current)	Municipal Code – adopted 1971	Municipal Code – adopted 2012	Comp. Plan – adopted 1965	Municipal Code – adopted 1966
Vergennes	-	-	-	State Model (Current)	-	-	-	-

The adoption of new ordinances, including the adoption of new development standards or the creation of hazard-specific overlay zones tied to existing zoning regulations, present opportunities to discourage hazardous construction and manage the type and density of land uses in areas of known natural hazards. Adopting and enforcing higher regulatory standards for floodplain management (i.e., those that go beyond the minimum standards of the NFIP) is another effective method for minimizing future flood losses, particularly if a community is experiencing growth and development patterns that influence flood hazards in ways that are not accounted for on existing regulatory floodplain maps. Revisions to existing building codes also present the opportunity to address safe growth. Many state and local codes are based off national or industry standard codes which undergo routine evaluations and updates. The adoption of revised code requirements and optional hazard-specific standards may help increase community resilience.

5.1.4 Fire Insurance Ratings

By classifying communities' ability to suppress fires, the Insurance Service Office (ISO) Public Protection Classification Program helps communities evaluate their public fire-protection services. The program provides a countrywide standard that helps fire departments in planning and budgeting for facilities, equipment, and training. Information is collected on municipal fire-protection efforts in communities throughout the United States. In each of those communities, ISO analyzes the relevant data using a Fire Suppression Rating Schedule. Ratings are assigned from 1 to 10 where Class 1 generally represents superior property fire protection, and Class 10 indicates that the area's fire-suppression program doesn't meet ISO's minimum criteria. Table 5-6 displays each Fire Department's insurance rating and total number of employees.

Table 5-6. Jackson County Fire Departments, Insurance Ratings, and Number of Employees/Volunteers

Fire Department	Fire Insurance Rating	Number of Employees
Ava Volunteer Fire Dept.	5/5x	16
Campbell Hill Rural Fire Dept.	5	20
Carbondale Fire Dept.	4	29
Carbondale Township Fire Dept.	5/5x	18
De Soto Fire Protection District	6/9	12
Dowell Fire Dept.	5/5x	20
Elkville Fire Dept.	6/8	14
Gorham Fire Dept.	N/A	12
Makanda Fire Dept.	7	28
Murphysboro-Pomona-Somerset	6/9	18
Murphysboro Fire Dept.	6	11

Tower Rock Fire Dept.	6/6x	13
Vergennes	6	8

5.2 Mitigation Goals

In Section 4 of this plan, the risk assessment identified Jackson County as prone to several hazards. The Planning Team members understand that although they cannot eliminate hazards altogether, Jackson County can work towards building disaster-resistant communities. Below is a generalized list of goals, objectives, and actions. The goals represent long-term, broad visions of the overall vision the county would like to achieve for mitigation. The objectives are strategies and steps that will assist the communities in attaining the listed goals.

Goal 1: Lessen the impacts of hazards to new and existing infrastructure

Objective: Retrofit critical facilities and structures with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.

Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.

Objective: Minimize the amount of infrastructure exposed to hazards.

Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.

Objective: Improve emergency sheltering in Jackson County.

Goal 2: Create new or revise existing plans/maps for Jackson County

Objective: Support compliance with the NFIP for each jurisdiction in Jackson County.

Objective: Review and update existing, or create new, community plans and ordinances to support hazard mitigation.

Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate Jackson County residents on the hazards

Objective: Raise public awareness on hazard mitigation.

Objective: Improve education and training of emergency personnel and public officials.

5.3 Multi-Jurisdictional Mitigation Strategies

After reviewing the Risk Assessment, the Mitigation Planning Team was presented with the task of individually listing potential mitigation activities using the FEMA STAPLEE evaluation criteria (see table 5-7). FEMA uses their evaluation criteria STAPLEE (stands for social, technical, administrative, political, legal, economic and environmental) to assess the developed mitigation strategies. Evaluating possible natural hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. The Planning Team brought their mitigation ideas to Meeting 3.

Table 5-7. FEMA's STAPLEE Evaluation Criteria

S ocial	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T echnical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A dministrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P olitical	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L egal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E conomic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E nvironmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

Table 5-8 contains a comprehensive range of specific mitigation actions and projects for each jurisdiction, with an emphasis on new and existing buildings and infrastructure. At least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment. Each of the incorporated communities within and including Jackson County was invited to participate in brainstorming sessions in which goals, objectives, and strategies were discussed and prioritized. Each participant in these sessions was armed with possible mitigation goals and strategies provided by FEMA, as well as information about mitigation projects discussed in neighboring communities and counties.

All potential strategies and goals that arose through this process are included in Table 5-8. The mitigation strategies are arranged by hazard they directly address. In some cases, certain mitigation strategies can address all hazards. If provided by the jurisdiction, each mitigation strategy contains specific details pertaining to the implementation, responsible and/or organizing agency, and potential funding source. Potential funding sources are identified by Federal, State, Local, or Private. A code is assigned to each mitigations strategy for ease of reference when reviewing the prioritization of each mitigations strategies in Section 5.4.

Table 5-8. Jackson County's Multi-Jurisdictional Mitigation Strategies

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
ALL HAZARDS					
AH1	Promote Disaster Resilience Through Workshops, Education Materials, and Planning Guides <i>Various agencies have implemented forms of this strategy. Local resources have been used to target and inform the resident population. Additional funding will be sought from the Local, State and Federal sources.</i>	All	Ongoing	L, S, F	Jackson County EMA, Health Dept., Schools, SIH
AH2	Devote Section of Website to Hazard Mitigation <i>The Jackson County EMA website is used to notify the public about hazard mitigation. Southern Illinois Airport uses their website to provide hazard mitigation related information and will start providing information on social media platforms. SIH and the Shawnee Preparedness and Response Coalition would like to develop communication tools and capacities, including social and digital media, to provide critical updates and information to community. All Jackson County School Districts continue to work with local weather stations to provide up-to-date information for students and families. Unity Point CUSD #140 utilizes Alertnow Messaging Systems to send necessary information to all Unity Point families.</i>	Jackson County, Southern Illinois Airport, SIH, Jackson County School Districts	Ongoing	L, S, F, P	Jackson County EMA, Southern Illinois Airport, SIH, Jackson County School Districts
AH3	Establish Liaison/Groups that Meets Regularly to Discuss Hazard Mitigation and Disaster Risk Reduction <i>Several groups meet on a regular basis to discuss hazard mitigation including: Jackson County LEPC, Disaster Risk Reduction Group, Shawnee Preparedness and Response Coalition, Jackson Co. Public Health and Medical Preparedness Coalition, Healthy Southern Illinois Delta Network, Shawnee Alliance for Seniors, Map Your Neighborhood Program (Carbondale).</i>	All	Ongoing	L	Various Agencies
AH4	Establish Local Emergency Planning Committee <i>The Jackson County EMA heads the Local Emergency Planning Committee that complies with the Emergency Planning and Community Right to Know Act (EPCRA) and planning for hazardous materials (HAZMAT) incident response and notification.</i>	Jackson County	Ongoing	L	Jackson County EMA
AH5	Enhance Emergency Communication System Infrastructure <i>The Jackson County EMA will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from Local, State and Federal resources. The Southern Illinois Airport would like to install an all-tenant communication system. SIH and Shawnee Preparedness and Response Coalition would like to develop and implement a region-wide back-up emergency communication system. Dowell FD and MABAS Division #86 is currently applying for a federal grant to improve communication division. Carbondale CHSD #186 is investigating potential infrastructure improvements for school offices, administration, and security personnel. Unity Point CUSD #140 continues to work with local emergency agencies to enhance the emergency communication system infrastructure.</i>	Jackson County, Carbondale, Dowell, Southern Illinois Airport, SIH, SIU, Jackson County School Districts	Ongoing/Proposed	L, S, F	Jackson County EMA, Carbondale, Southern Illinois Airport, SIH, Dowell Fire Department, SIU, Jackson County School Districts
AH6	Improve Communication Between Utility Companies <i>County and Local Agencies continue to maintain contact with utility companies before during and after hazardous events. Kinkaid-Reed's Creek Conservancy District aims to provide additional information and maintain contact with the County.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkhart, Gorham, Grand Tower, Makanda, Vergennes, Kinkaid-Reed Creek Conservancy District, SIH, Southern Illinois Healthcare, Southern Illinois Airport, SIU	Ongoing	L	Various Agencies
AH7	Distribute/Program NOAA Weather Radios <i>During severe weather preparedness week, The Jackson County EMA and area fire departments help residents program their NOAA weather radios. Each jurisdiction wishes to seek additional funding to distribute NOAA weather radios. Unity Point CUSD #140 would like to seek funding to distribute more NOAA Weather Radios in the Unity Point buildings which will allow staff to know when severe weather approaches.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkhart, Gorham, Grand Tower, Makanda, Murphysboro, Vergennes, Unity Point CUSD #140	Ongoing	L, S, F	Jackson County EMA, City/Village Fire Departments

Jackson County Multi-Hazard Mitigation Plan

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
AH8	Improve EMA Training, Staff, Resources, And Equipment <i>The County EMA and the City of Carbondale oversees the implementation of this project. Funding has not been secured for future training, but additional funding will be sought from Department of Homeland Security, state and local resources.</i>	Jackson County, Carbondale	Ongoing	L, S, F	Jackson County EMA, Carbondale
AH9	Maintain Centralized Geographical Database Including Natural Hazard/Risk Assessment <i>The County EMA oversees this project with the assistance of SIU. After each mitigation plan update, the geographical database is updated to include new information about hazard events and the number of structures within the 100-year floodplain.</i>	Jackson County, SIU	Ongoing	L	Jackson County EMA, SIU
AH10	Develop/Maintain Comprehensive Plan to Incorporate Natural Hazards <i>Jackson County and its incorporated jurisdiction participate in the 5 year renewal of the Multi-Hazard Mitigation Plan. The next update process will take place in 2020 and the county will seek federal funds to update the plan.</i>	All	Ongoing / Proposed	L, S, F	Jackson County EMA
AH11	Develop a Vulnerable Population List <i>The Jackson County Health Dept. is working with Southern Illinois University, Southern Illinois Healthcare, Shawnee Preparedness and Response Coalition, and other local health departments to update and maintain a list of vulnerable populations in the county.</i>	Jackson County, SIU, SIH	Ongoing	L	Jackson County Health Department, SIU, SIH
AH12	Develop Mutual Aid Agreements <i>The Jackson County EMA oversees this mitigation strategy. The County works with local emergency agencies to maintain mutual aid agreements between local communities, MABAS and ILEAS.</i>	All	Ongoing	L	Jackson County EMA
AH13	Retrofit/Harden Critical Facilities and Utilities <i>The County EMA will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately one year. The Jackson County Health Department aims to harden their facility within the next 3-5 years with the help of federal funding, if available. Murphysboro aims to retrofit the City Hill which houses the Murphysboro Police, Fire and Emergency Management, as well as its 911 answering center and emergency operations center. SIH would like to retrofit existing facilities to serve surge healthcare needs in the event of mass casualties. If funding is available, the Village of Dowell would update the Fire Department and Village Hall.</i>	All	Proposed	L, S, F	Jackson County EMA, Murphysboro EMA, Dowell, SIH
AH14	Identify and Procure Backup Potable Water Supplies <i>The County EMA will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if funding is available, is forecasted to be initiated within approximately 3-5 years. Kinkaid-Reed's Creek Conservancy District aims to connect to possible outside water sources.</i>	Jackson County, Makanda, Carbondale, Kinkaid-Reed's Creek Conservancy District	Proposed	L, F	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District
AH15	Construct Additional Community Safe Rooms <i>The County EMA will oversee the implementation of this project. Local resources will be used to evaluate the cost benefit of the shelters and define specific locations. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately 3-5 years. The Jackson County Health Department aims to add a safe room to their facility within the next 3-5 years with the help of federal funding, if available. The City of Murphysboro will seek funding for a public shelter, currently there are no public shelters available in the city. SIH would like to retrofit existing clinics, physician offices, and other SIH facilities to serve as storm safe rooms.</i>	All	Proposed	L, F	Jackson County EMA, Murphysboro EMA, SIH
AH16	Create Additional Heating / Cooling Shelters <i>The County EMA will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if state funding is available, is forecasted to be initiated within approximately 1-3 years.</i>	All	Proposed	L, S	Jackson County EMA

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
AH17	Equip Critical Facilities with Back-Up Generators <i>The County EMA will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately 3-5 years. Kinkaid-Reed's Creek Conservancy District aims to replace old and undersized plant generators. Southern Illinois Airport would like to equip additional buildings with generators. Murphysboro aims to acquire backup generators for critical facilities and retrofit a generator transfer switch so that in times of an emergency generators can be safely and efficiently connected to supply electricity. SIH would like to acquire a generator for emergency power for the SIH Materials Management distribution center (former Vitamin World building). This building includes office space and areas that may be useful for medical purposes in a disaster.</i>	All	Proposed	L, F	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District, Southern Illinois Airport, Murphysboro EMA, SIH
AH18	Create an Alternative Emergency Operations Center <i>The Southern Illinois Airport was awarded a state grant to develop a Regional Emergency Response Center (RERC). Carbondale CHSD #165 is coordinating with the Carbondale University Mall to establish an alternative emergency operations center. Unity Point CUSD #140, with the assistance of the Jackson County Sheriff's office and Makanda Fire Dept., utilize the Vine Church on Wall St. as an alternative emergency operations center to engage in family relocation.</i>	Southern Illinois Airport, Carbondale CHSD #165, Unity Point CUSD #140	Ongoing	L, S	Southern Illinois Airport, Carbondale CHSD #165, Unity Point CUSD #140
AH19	Acquire Portable Lighting for Mass Casualty Preparation <i>SIH and the Shawnee Preparedness and Response Coalition Purchase an adequate number of light towers to use for mass casualty care.</i>	SIH	Proposed	L, S, F, P	SIH
FLOODING / DAM AND LEVEE FAILURE					
F1	Maintain Participating Status in the NFIP by Enforcing a Flood Damage Prevention Ordinance <i>The Jackson County Emergency Management Agency is responsible for the general administration of the Jackson County Flood Damage Prevention Ordinance. Each participating jurisdiction has a representative responsible for the administration of the individual Flood Damage Prevention Ordinances. The Village of Dowell is working on having their flood maps updated.</i>	Jackson County, Carbondale, De Soto, Dowell, Elkhart, Gorham, Makanda, Murphysboro, Vergennes	Ongoing	L	Jackson County EMA and City/Village Building Services
F2	Improve Public Awareness on the NFIP, Buyout Programs, and Flood Mitigation <i>The Jackson County EMA website is used to notify the public about flood mitigation. Jackson County will also continue to educate communities that do not participate in the NFIP on the benefits of joining.</i>	Jackson County	Ongoing	L	Jackson County EMA
F3	Devote Section of Library to Maintain Material to Flood Insurance, Flood Protection, and General Hazard Information <i>The Village of Makanda aims to keep flood-related material available to residents.</i>	Makanda	Proposed	L	Makanda
F4	Institute a Buyout Plan for Repetitive Loss Properties or Flood Prone Properties <i>The Jackson County EMA is working on the 2015 buyout project (Reed Station Mobile Home Park Buyout). In the future, The Jackson County EMA will oversee the implementation of buyout and relocation projects in the county. Future funding has not been secured, but additional funding will be sought from federal, state and local resources. Implementation is forecasted to begin within approximately 3-5 years.</i>	Jackson County, Carbondale, De Soto, Dowell, Elkhart, Gorham, Makanda, Murphysboro, Vergennes	Ongoing	L, S, F	Jackson County EMA
F5	Flood Proof or Elevate Critical Facilities and Utilities <i>The Jackson County EMA will oversee the implementation of this project in the county. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 3-5 years. Kinkaid-Reed's Creek Conservancy District aims to implement this project in lower elevation areas or on water plant property – which has known moisture problems.</i>	Jackson County, Carbondale, De Soto, Dowell, Elkhart, Gorham, Makanda, Murphysboro, Vergennes, SIU, SIH, Southern Illinois Airport, Kinkaid-Reed's Creek Conservancy District	Ongoing	L, S, F	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
F6	Culvert Replacement <i>The Jackson County Highway Dept. will oversee the implementation of projects on County roads and bridges. Village/Townships will be responsible for their respective projects. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkville, Gorham, Grand Tower, Makanda, Murphysboro, Vergennes	Proposed	L, S, F	Jackson County Highway Dept. or City/Village/Townships
F7	Elevate Low-Lying Roads <i>The Jackson County Highway Dept. will oversee the implementation of projects on County roads. Village/Townships will be responsible for their respective projects. Murphysboro would like to elevate Riverside Park Road which is susceptible to flooding from the Big Muddy River. Elevating the road would mitigate the need for alternative means of moving supplies when flooding prevents access to the Murphysboro Waste Water Treatment Plan. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkville, Gorham, Grand Tower, Makanda, Murphysboro, Vergennes	Proposed	L, S, F	Jackson County Highway Dept., Murphysboro EMA and/or City/Village/Townships,
F8	Repair Old or Install New Flood Gates <i>The Levee Districts will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Levee Districts	Ongoing	L, S	Levee Districts
F9	Repair Old or Install New Levee Systems <i>The Murphysboro Ritter Street sewage pump station is critical to suppling the area of Murphysboro East of the Big Muddy River with sewer service. The lift station is prone to flooding from the Big Muddy River. It is proposed to construct a concrete wall around the lift station. The wall would encompass three sides of the lift station and the third side would have a slide in gate which could be installed and sandbagged during flooding events. The Grand Tower and Degognia Levee System faces major repairs in the future. The Levee Districts will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Murphysboro, Levee Districts	Ongoing	L, S	Levee Districts, Murphysboro EMA
F10	Install Pumping Stations in Levee Systems <i>The Levee Districts will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Levee Districts	Proposed	L, S	Levee Districts
F11	Repair Old or Install New Dam <i>The dam owners will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from state and local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Dam Owners	Proposed	L, S	Dam Owners
F12	Retrofit Water Supply Systems <i>Jackson County EMA, Murphysboro WWTP and Kinkaid-Reed's Creek Conservancy District would oversee this project. Implementation, If HMA funding is available, is forecasted to be initiated within approximately one- three years.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkville, Gorham, Grand Tower, Makanda, Murphysboro, Vergennes, Kinkaid-Reed's Creek Conservancy District	Proposed	L, S, F	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District, Murphysboro Waste Water Treatment Plant

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
TORNADO / SEVERE THUNDERSTORMS					
ST1	Construct Additional Community Safe Rooms <i>The County EMA will oversee the implementation of this project. Local resources will be used to evaluate the cost benefit of the shelters and define specific locations. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately 3-5 years. The Jackson County Health Department aims to add a safe room to their facility within the next 3-5 years with the help of federal funding, if available. The City of Murphysboro will seek funding for a public shelter at each of the four public schools (CUSD #186), currently there are no public shelters available in the city. SIH would like to retrofit existing clinics, physician offices, and other SIH facilities to serve as storm safe rooms.</i>	All	Proposed	L, S, F	Jackson County EMA, Murphysboro EMA, Murphysboro CUSD #186, SIH
ST2	Anchor Manufactured Homes and Exterior Attachments <i>The County Board will review ordinances for manufactured homes. The goal is to protect homeowners against future wind and tornado damage.</i>	Jackson County	Proposed	L	Jackson County Board
ST3	Install Lightning Detection System <i>The City of Carbondale, Carbondale CHSD #165, Tricounty CSUD #176, De Soto CCSD #86, and Southern Illinois Airport will oversee the implementation of this project and include the school districts. Implementation, if HMA or state funding is available, is forecasted to be initiated within approximately 1-3 years.</i>	Carbondale, Southern Illinois Airport, Carbondale CHSD #165, De Soto CCSD #86, Tricounty CUSD #176	Proposed	L, S, F	Carbondale, Southern Illinois Airport, Carbondale CHSD #165, De Soto CCSD #86, Tricounty CUSD #176
ST4	Provide Jurisdiction-Wide Siren Warning Coverage <i>The City of Carbondale and Village of Dowell would like to fill in the siren warning coverage gaps. Implementation, if HMA or state funding is available, is forecasted to be initiated within approximately 1-3 years.</i>	Carbondale, Dowell	Proposed	L, S, F	Carbondale, Dowell
ST5	Retrofit Structures to Withstand High Winds <i>The County EMA will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately 3-5 years. The Murphysboro City Hall building is an unreinforced masonry and glass structure. Murphysboro aims to retrofit the City Hill which houses the Murphysboro Police, Fire and Emergency Management, as well as its 911 answering center and emergency operations center. SIH would like to install wind resistant (storm rated) glass and / or shutters in hospitals, clinics, and physician offices owned by SIH.</i>	All	Proposed	L, S, F	Jackson County EMA, Murphysboro EMA, SIH
ST6	Enhance Ordinances to Exceed Minimum Construction Standards / Techniques in Regards to High Winds <i>The City of Carbondale will investigate available ordinances to exceed the minimum standards in regards to high winds. The city of Murphysboro will propose an ordinance requiring that mobile home parks or owners of locations with more than 4 mobile homes adjacent to each other provide on-site shelter large enough to accommodate all residents.</i>	Carbondale, Murphysboro	Proposed	L	Carbondale Board of Commissioners, Murphysboro EMA
EARTHQUAKES					
EQ1	Map And Assess Community Vulnerability to Seismic Hazards <i>The County EMA oversees this project with the assistance of SIU. After each mitigation plan update, the geographical database is updated to include new information about earthquake hazard events. Kinkaid-Reed's Creek Conservancy District would like to assess the water plant's facilities.</i>	Jackson County, Kinkaid-Reed's Creek Conservancy District, SIU	Ongoing / Proposed	L	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District, SIU
EQ2	Retrofit Water Supply Systems <i>Jackson County EMA, Murphysboro WWTP and Kinkaid-Reed's Creek Conservancy District would oversee this project. Implementation, If HMA funding is available, is forecasted to be initiated within approximately one- three years. Kinkaid-Reed's Creek Conservancy District would like to retrofit water plant buildings, booster stations, and ground storage tanks.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkhart, Gorham, Grand Tower, Makanda, Murphysboro, Vergennes, Kinkaid-Reed's Creek Conservancy District	Proposed	L, S, F	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District, Murphysboro Waste Water Treatment Plant

Jackson County Multi-Hazard Mitigation Plan

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
EQ3	Retrofit/Harden Critical Facilities to Protect Against Damages from Earthquakes <i>The County EMA will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately 3-5 years. The Jackson County Health Department aims to harden their facility within the next 3-5 years with the help of federal funding, if available. The Murphysboro City Hall building is an unreinforced masonry and glass structure. Murphysboro aims to retrofit the City Hill which houses the Murphysboro Police, Fire and Emergency Management, as well as its 911 answering center and emergency operations center. SIH would like to continue to retrofit all SIH hospitals and clinic with stabilization and back up equipment in the event of an earthquake.</i>	All	Proposed	L, S, F	Jackson County EMA, Murphysboro EMA, SIH
EQ4	Install Automatic Shutoff Valves <i>The Jackson County Health Department and Southern Illinois Airport will seek federal funding, if HMA funding is available, to install automatic shutoff valves..</i>	Jackson County, Southern Illinois Airport, SIU	Proposed	L, F	Jackson County Health Department, SIU
EQ5	Develop Specially-Engineered Pipelines in Areas Subject to Faulting, Liquefaction, Earthquakes, or Other Ground Failure <i>Kinkaid-Reed's Creek Conservancy District is will oversee the implementation of this project. Funding has not been secured as of 2015. Implementation, if HMA funding is available, is forecasted to be initiated within approximately 3-5 years.</i>	Kinkaid-Reed's Creek Conservancy District	Proposed	L, S, F	Kinkaid-Reed's Creek Conservancy District
EQ6	Perform Detailed Engineering Studies of Bridges and Buildings	Jackson County, Kinkaid-Reed's Creek Conservancy District, Southern Illinois Airport	Proposed	L, S, F	Kinkaid-Reed's Creek Conservancy District, Southern Illinois Airport
EQ7	Develop/Update Earthquake Emergency Action Plan <i>Both Southern Illinois Airport and Giant City CCSD #130 have earthquake emergency action plans in place. In addition, Giant City CCSD #130 has a long term care plan for students in the event of a large scale earthquake. Additional planning could be done to produce a more robust plan.</i>	Jackson County, Southern Illinois Airport, Giant City CCSD#130	Ongoing	L	Southern Illinois Airport, Giant City CCSD#130
HAZARDOUS MATERIALS RELEASE					
HAZ1	Develop/Update HAZMAT Emergency Response Plan <i>The Jackson County LEPC reviews and updates the emergency action plan on an annual basis. Southern Illinois Airport and SIH have a HAZMAT emergency response plan and updates it on an as need basis. Giant City CCSD #130 has an emergency evacuation plan in place (including shut down of all air/heat units).</i>	Jackson County, Southern Illinois Airport, Giant City CCSD #130, SIH	Ongoing	L	Jackson County LEPC, Southern Illinois Airport, Giant City CCSD #130, SIH
HAZ2	Conduct a Hazardous Materials Commodity Flow Study <i>The Jackson County EMA will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from IDOT and local resources. Implementation is forecasted to begin within approximately three years.</i>	Jackson County	Proposed	L, S	Jackson County EMA
HAZ3	Update all Hazardous Facilities to Current Regulations <i>The DOT, IDOT, Jackson County EMA, Carbondale EMA, Murphysboro EMA and rail line companies will oversee this project. Implementation, if funding is available, is forecasted to be initiated within approximately three years.</i>	Jackson County, Carbondale, Murphysboro	Proposed	L, P	Jackson County EMA, Carbondale EMA, Murphysboro EMA, Private Rail Companies
HAZ4	Purchase Emergency Equipment – i.e., Chlorine Scrubbers, etc. <i>Kinkaid-Reed's Creek Conservancy District would like to purchase Chlorine Scrubbers to contain and treat accidental releases of chlorine gas. Implementation, if funding is available, is forecasted to be initiated within approximately three years. As SIH updates their hazmat response plan they will seek to purchase additional response equipment as necessary.</i>	Kinkaid-Reed's Creek Conservancy District, SIH	Proposed	L, S, F, P	Kinkaid-Reed's Creek Conservancy District
DROUGHT / EXTREME HEAT					
H1	Develop a Water Action Plan <i>Kinkaid-Reed's Creek Conservancy District would oversee this project.</i>	Jackson County, Kinkaid-Reed's Creek Conservancy District	Proposed	L	Kinkaid-Reed's Creek Conservancy District

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
H2	Retrofit Water Supply Systems <i>Jackson County EMA, Murphysboro WWTP and Kinkaid-Reed's Creek Conservancy District would oversee this project. Implementation, If HMA funding is available, is forecasted to be initiated within approximately one- three years. Kinkaid-Reed's Creek Conservancy District is interested in detouring the Village of Gorham's water line that lays on the bottom of Kinkaid Lake. Gorham's water leaves the water plant property from a booster station next to the water's edge and from there it is suspended along the bottom of Kinkaid Lake. This would be a great location for a detour line or some sort of alternate water supply.</i>	Jackson County, Ava, Campbell Hill, Carbondale, De Soto, Dowell, Elkhart, Gorham, Grand Tower, Makanda, Murphysboro, Vergennes, Kinkaid-Reed's Creek Conservancy District, Southern Illinois Healthcare, Southern Illinois Airport, SIU	Proposed	L, S, F	Jackson County EMA, Kinkaid-Reed's Creek Conservancy District, Murphysboro Waste Water Treatment Plant
H3	Retrofit At-Risk Structures with Ignition-Resistant Materials or Sprinklers and Foam Extinguisher Systems <i>Southern Illinois Airport has a select number of buildings without adequate sprinkler and or/foam extinguisher systems. Implementation, if state or federal funding is available, is forecasted to be initiated within approximately 1-3 years.</i>	Southern Illinois Airport	Proposed	L, S, F	Southern Illinois Airport
H4	Develop/enforce water use restrictions and or burn ordinances during periods of drought <i>The Village of De Soto has water use restrictions and burn ordinances enforced during periods of drought to conserve water supplies and/or limit the spread of fire.</i>	De Soto	Ongoing	L	De Soto Village Board
GROUND FAILURE					
GF1	Map and Assess Community Vulnerability to Ground Failure Hazards <i>The County EMA oversees this project with the assistance of SIU. After each mitigation plan update, the geographical database is updated to include new information about ground failure hazard events.</i>	Jackson County, SIU	Ongoing	L	Jackson County EMA, SIU
GF2	Maintain a List of Buildings Constructed Over Underground Mines <i>The County EMA oversees this project with the assistance of SIU. After each mitigation plan update, the geographical database is updated to include new information about ground failure hazard events.</i>	Jackson County, SIU	Ongoing	L	Jackson County EMA, SIU
WINTER STORMS					
WS1	Purchase Deicing Chemicals <i>The Jackson County EMA and Southern Illinois Airport will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from local resources. Implementation is forecasted to begin within approximately five years. Southern Illinois Airport has a limited quantity of deicing chemicals and is in need of a delivery vehicle.</i>	Jackson County, Southern Illinois Airport	Ongoing	L	Jackson County EMA, Southern Illinois Airport
WS2	Purchase Snow Fences <i>Southern Illinois Airport has identified a need for snow fences along airport entrance roads. Funding has not been secured, but additional funding will be sought from local resources. Implementation is forecasted to begin within approximately 1-3 years.</i>	Southern Illinois Airport	Proposed	L, S, F	Southern Illinois Airport
WS3	Establish a network of 4WD/Off-road vehicles to access stranded people <i>The Villages of Dowell and De Soto currently have 4x4 vehicles ready for use at the Fire Departments and in the Villages.</i>	Dowell, De Soto	Ongoing	L	Dowell, De Soto
DISEASE EPIDEMICS / PANDEMICS					
EP1	Educate Community on Pandemics and How to Mitigate their Impacts <i>Potential funding sources includes: Illinois Department of Public Health, U.S. Dept. of Health and Human Services, and various Private foundations</i>	Jackson County	Ongoing	S, F	Jackson County Health Department
EP2	Purchase Software/Develop Website which Allows the Public to Pre-Register to Receive Mass Prophylaxis Medications <i>Potential funding sources includes: Illinois Department of Public Health, U.S. Dept. of Health and Human Services, and various Private foundations</i>	Jackson County	Ongoing	S, F, P	Jackson County Health Department

Code	Mitigation Strategy	Jurisdictions Involved	Status	Funding Source*	Responsible Organization or Agency
EP3	Develop Technological Solutions for Schools to Report Large Numbers of School Absences <i>This strategy will limit the spread of disease, facilitate situational awareness and rapid cycle decision making for school closures, parenting messaging, etc. Potential funding sources includes: Illinois Department of Public Health, U.S. Dept. of Health and Human Services, and various Private foundations.</i>	Jackson County	Ongoing	S, F, P	Jackson County Health Department
SCHOOL SAFETY					
SS1	Retrofit the School Entrance to Make it More Difficult for an Armed Intruder to Enter the School <i>Both the Murphysboro High School and the Murphysboro Middle school are vulnerable to an armed intruder because of the way the building entrances are constructed. It is proposed to modify these entrances using techniques commonly seen in new school construction today.</i>	Jackson County School Districts	Proposed	L, F	Murphysboro EMA, Jackson County School Districts

*F – Federal, S – State, L – Local, P – Private

5.4 Prioritization of Multi-Jurisdictional Mitigation Strategies

Implementation of the mitigation strategies is critical to the overall success of the mitigation plan. It is important to decide, based upon many factors, which action will be undertaken first. In order to pursue the top priority first, an analysis and prioritization of the actions is vital. It is important to note that some actions may occur before the top priority due to financial, engineering, environmental, permitting, and site control issues. Public awareness and input of these mitigation actions can increase knowledge to capitalize on funding opportunities and monitoring the progress of an action. It is also critical to take into account the amount of time it will take the community to complete the mitigation project.

Table 5-9 displays the priority ranking for each mitigation strategy. Each code refers to a specific mitigations strategy listed in Table 5-8. For each participating jurisdiction a rating (high, medium, or low) was assessed for each mitigation item. The ranking is the result of the STAPLEE evaluation and the timeframe the community is interested in completing the strategy: H - High 1-3 years; M - Medium 3-5 years; and L - Low 5+years.

Table 5-9. Prioritization of the Jackson County's Mitigation Strategies

Code	Priority Ranking*																							
	Jackson County	Ava	Campbell Hill	Carbondale	De Soto	Dowell	Elkville	Gorham	Grand Tower	Makanda	Murphysboro	Vergennes	Kinkaid-Reed's Creek	Southern Illinois Health Care	Southern Illinois Airport	SIU Carbondale	Carbondale CHSD #165	Carbondale ESD #95	De Soto CCSD #86	Elevrado CUSD #196	Giant City CCSD #130	Murphysboro CUSD #186	Tricounty CUSD #176	Unity Point CUSD #140
AH1	H	M	M	M	M	M	M	M	M	M	M	M	M	H	H	H	M	M	M	M	M	M	M	M
AH2	H	-	-	-	-	-	-	-	-	-	-	-	-	H	H	-	H	H	H	H	H	H	H	H
AH3	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AH4	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AH5	M	-	-	M	-	H	-	-	-	-	-	-	-	H	H	H	H	H	H	H	H	H	H	H
AH6	M	M	M	M	M	M	M	M	M	M	M	M	H	M	M	M	-	-	-	-	-	-	-	-
AH7	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	H
AH8	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AH9	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-
AH10	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
AH11	H	-	-	-	-	-	-	-	-	-	-	-	-	M	-	H	-	-	-	-	-	-	-	-
AH12	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AH13	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AH14	M	-	-	M	-	-	-	-	-	H	-	-	L	-	-	-	-	-	-	-	-	-	-	-
AH15	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AH16	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
AH17	H	H	H	H	H	H	H	H	H	H	M	H	M	H	H	H	H	H	H	H	H	H	H	H
AH18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	L	-	-	-	-	-	-	M
AH19	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-	-	-
F1	H	-	-	H	H	H	H	H	-	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
F2	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3	-	-	-	-	-	-	-	-	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F4	H	-	-	M	M	M	M	M	-	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-
F5	H	-	-	H	H	H	H	H	-	H	H	H	M	H	H	H	-	-	-	-	-	-	-	-
F6	H	-	-	M	M	H	M	M	-	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-
F7	H	-	-	M	M	M	M	M	-	M	H	M	-	-	-	-	-	-	-	-	-	-	-	-
F8	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F9	H	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
F10	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F11	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F12	H	M	M	M	M	M	M	M	M	M	H	M	H	-	-	-	-	-	-	-	-	-	-	-
ST1	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Code	Priority Ranking*																							
	Jackson County	Ava	Campbell Hill	Carbondale	De Soto	Dowell	Elkville	Gorham	Grand Tower	Makanda	Murphysboro	Vergennes	Kinkaid-Reed's Creek	Southern Illinois Health Care	Southern Illinois Airport	SIU Carbondale	Carbondale CHSD #165	Carbondale ESD #95	De Soto CCSD #86	Elevrado CUSD #196	Giant City CCSD #130	Murphysboro CUSD #186	Tricounty CUSD #176	Unity Point CUSD #140
ST2	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST3	-	-	-	M	-	-	-	-	-	-	-	-	-	-	M	-	M	-	M	-	-	-	M	-
ST4	-	-	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST5	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
ST6	-	-	-	L	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
EQ1	M	-	-	-	-	-	-	-	-	-	-	-	M	-	-	H	-	-	-	-	-	-	-	-
EQ2	H	M	M	M	M	M	M	M	M	M	H	M	M	-	-	-	-	-	-	-	-	-	-	-
EQ3	H	H	H	H	H	M	H	H	H	H	H	H	M	H	H	H	H	H	H	H	H	H	H	H
EQ4	H	-	-	-	-	-	-	-	-	-	-	-	-	-	H	H	-	-	-	-	-	-	-	-
EQ5	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-
EQ6	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-
EQ7	H	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	H	-	-	-
HAZ1	H	-	-	-	-	-	-	-	-	-	-	-	-	H	H	-	-	-	-	-	H	-	-	-
HAZ2	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAZ3	M	-	-	M	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
HAZ4	-	-	-	-	-	-	-	-	-	-	-	-	H	H	-	-	-	-	-	-	-	-	-	-
H1	M	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-	-	-	-
H2	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-	-
H3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-	-
H4	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GF1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-
GF2	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-
WS1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-	-
WS2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-	-
WS3	-	-	-	-	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP1	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP2	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP3	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SS1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	H	H	H	H	H	H	H

*Ranking based on STAPLEE evaluation and estimated timeframe: H – High, M – Medium, and L – Low

Section 6. Plan Implementation and Maintenance

6.1 Implementation through Existing Programs

Throughout the planning process, the Jackson County Planning Team worked to identify existing hazard mitigation policies, develop mitigation goals, and create a comprehensive range of mitigation strategies specific to each jurisdiction. This work provides a blueprint for reducing the potential losses identified in the Risk Assessment (Section 4). The ultimate goal of this plan is to incorporate the mitigation strategies proposed into ongoing planning efforts within the County. The Jackson County Emergency Management Agency will be the local champion for the mitigation actions. The Jackson County Board and the city and village councils will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified action.

Continued public involvement is also critical to the successful implementation of the MHMP. Comments from the public on the MHMP will be received by the Jackson County Emergency Management Agency and forwarded to the Planning Team for discussion. Education efforts for hazard mitigation will be an ongoing effort of Jackson County. The public will be notified of periodic planning meetings through notices in the local newspaper. Once adopted, a copy of the MHMP will be maintained in each jurisdiction and in the Jackson County Emergency Management Agency.

6.2 Monitoring, Evaluation, and Updating the MHMP

Throughout the five-year planning cycle, the Jackson County Emergency Management Agency will reconvene the Planning Team to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held in 2020 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If the need for a special meeting, due to new developments or the occurrence of a declared disaster in the county, the team will meet to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

As part of the update process, the Planning Team will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The team will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The plan revision will also reflect changes in local development and its relation to each hazard. The parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the MHMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the Jackson County Board.

The GIS data used to prepare the plan was obtained from existing county GIS data as well as data collected as part of the planning process. This updated Hazus-MH GIS data has been returned to the county for use and maintenance in the county's system. As newer data becomes available, these updated data will be used for future risk assessments and vulnerability analyses.

Definitions

100-year Floodplain	Areas subject to inundation by the 1-percent-annual-chance flood event.
Critical Facility	A structure, because of its function, size, service area, or uniqueness, that has the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if it is destroyed or damaged or if its functionality is impaired. This includes, but are not limited to, water and wastewater treatment facilities, municipal buildings, education facilities, and non-emergency healthcare facilities.
Community Rating System (CRS)	A voluntary program for National Flood Insurance Program (NFIP) participating communities. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management.
Comprehensive Plan	A document, also known as a "general plan," covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all the physical elements that will determine the community's future developments.
Disaster Mitigation Act of 2000 (DMA 2000)	The largest legislation to improve the planning process. It was signed into law on October 30, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.
Essential Facility	A subset of critical facilities that represent a substantial hazard to human life in the event of failure. This includes (but not limited to) hospital and fire, rescue, ambulance, emergency operations centers, and police stations.
Federal Emergency Management Agency	An independent agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.
Hazard	A source of potential danger or adverse condition.
Hazard Mitigation	Any sustained action to reduce or eliminate long-term risk to human life and property from hazards.

Hazard Mitigation Grant Program (HMPG)	Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration.
Hazus-MH	A geographic information system (GIS)-based disaster risk assessment tool.
Multi-Hazard Mitigation Planning	Identify policies and actions that can be implemented over the long term to reduce risk and future losses from various hazardous events.
National Flood Insurance Program	Administered by the Federal Emergency Management Agency, which works closely with nearly 90 private insurance companies to offer flood insurance to property owners and renters. In order to qualify for flood insurance, a community must join the NFIP and agree to enforce sound floodplain management standards.
Planning Team	A group composed of government, private sector, and individuals with a variety of skills and areas of expertise, usually appointed by a city or town manager, or chief elected official. The group finds solutions to community mitigation needs and seeks community acceptance of those solutions.
Risk Priority Index	Quantifies risk as the product of hazard probability and magnitude so Planning Team members can prioritize mitigation strategies for high-risk-priority hazards.
Risk Assessment	Quantifies the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people.
Strategy	A collection of actions to achieve goals and objectives.
Vulnerability	Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions.

Acronyms

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A AEGL – Acute Exposure Guideline Levels
ALOHA – Areal Locations of Hazardous Atmospheres

C CERI – Center for Earthquake Research and Information
CRS – Community Rating System

D DEM – Digital Elevation Model
DFIRM – Digital Flood Insurance Rate Map
DMA – Disaster Mitigation Act of 2000

E EAP – Emergency Action Plan
EMA – Emergency Management Agency
EPA – Environmental Protection Agency

F FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map

G GIS – Geographic Information System

H Hazus-MH – Hazards USA Multi-Hazard
HMGP – Hazard Mitigation Grant Program
HUC – Hydrologic Unit Code

I IA – Individual Assistance
IDNR – Illinois Department of Natural Resources
IDOT – Illinois Department of Transportation
IEMA – Illinois Emergency Management Agency
ISO – Insurance Service Office
ISGS – Illinois State Geological Survey
ISWS – Illinois State Water Survey

M MHMP – Multi-Hazard Mitigation Plan

N NCDC – National Climatic Data Center
NEHRP – National Earthquake Hazards Reduction Program
NFIP – National Flood Insurance Program
NID – National Inventory of Dams
NOAA – National Oceanic and Atmospheric Administration
NSFHA – Non-Special Flood Hazard Area

P PA – Public Assistance
PHMSA – Pipeline and Hazardous Materials Safety Administration
PPM – Parts Per Million

R RPI – Risk Priority Index

S SIU – Southern Illinois University Carbondale
SPC – Storm Prediction Center
STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, and Environmental

U USGS – United States Geological Survey

Appendices

Appendix A. Meeting Minutes	Error! Bookmark not defined.
Appendix B. Local Press Release and Newspaper Articles	Error! Bookmark not defined.
Appendix C. Adopting Resolutions	Error! Bookmark not defined.
Appendix D. Historical Hazards.....	Error! Bookmark not defined.
Appendix E. List of Essential Facilities.....	Error! Bookmark not defined.
Appendix F. Critical Facilities Map	Error! Bookmark not defined.

Appendix A. Meeting Minutes

Formal Mitigation Planning Meetings

Meeting 1 – September 4th, 2014

Meeting 2 – January 15th, 2015

Meeting 3 – May 13th, 2015

Meeting 4 – August 10th, 2015

Outside Meetings

See Attached Outside Meeting Minutes and Sign-in Sheets

Meeting 1 – September 4th, 2014



IEMA Multi-Hazard Mitigation Plan

Assembly of the Jackson County Planning Team Meeting 1
Chairmen: Derek Misener and Shawn Priddy
Plan Directors: Southern Illinois University and Greater Egypt Regional Planning and Development Commission

Meeting Date: September 4th, 2014

Meeting Time: 2:00pm

Place: 109 S. Bigler Rd. Carbondale, IL 62901

Planning Team/Attendance: 19

Introduction to the Multi-Hazard Mitigation Planning Process and Risk Assessment

The meeting is called to order

Prof. Nicholas Pinter opened the meeting by explaining that the planning team is here today to update the 2009 Jackson County Multi-Hazard Mitigation Plan. He introduced the planning partners: Jackson County, Southern Illinois University and Greater Egypt Regional Planning and Development Commission.

A PowerPoint presentation was given by Prof. Nicholas Pinter and Amanda Dampitz. Prof. Pinter explained that this project is in response to the Disaster Mitigation Act of 2000. The project is funded by a grant awarded by FEMA. Once the project is completed, it opens the County and its participating jurisdictions up to additional Hazard Mitigation Assistance Funds. Prof. Pinter divided the planning process into four meetings. During Meeting 1, the focus will be on natural disasters that are relevant to the County. As a group, the planning team will complete a hazard ranking exercise. Identified hazards will be given a probability rating and ranked by their occurrence and potential level of risk. At Meeting 2, the public meeting, SIU will present historic accounts of natural disasters that have affected the area. The results from the risk assessment report will also be presented. Meeting 3 will consist of a brain storming session focused on disasters that were analyzed in the risk assessment report. FEMA requires that for every identified hazard, two strategies to mitigate the loss and damage must be in place. At Meeting 4, the planning team will review the plan prior to sending it to IEMA. IEMA will review the plan and make recommendation to it as they see fit, then it is submitted to FEMA for review and approval. Once approved by FEMA, the Planning Team will present the Mitigation Plan to the County Board for adoption. Participating Jurisdictions must either adopt the county plan or prepare its own plan, in order to access mitigation assistance from FEMA.

3000 West DeYoung Street · Suite 800B-3 · Marion, IL 62959 · Phone: 618.997.9351 · Fax: 618.997.9354 · www.greateregypt.org

SIU Staff Researcher, Amanda Dampitz, presented historic accounts of natural disasters that have affected the County. During her presentation, she fielded any questions relevant to each hazard. She stressed that this information should help guide the planning team when completing the hazard ranking exercise.

Prof. Pinter provided the planning team with a Hazard Ranking Exercise handout. The Planning Team was then asked to assess and rank the hazards that could potentially befall Jackson County using the risk priority index (RPI). The identified hazards were ranked as followed for Jackson County:

1. Earthquakes
2. Tornadoes
3. Dam / Levee Failure
4. Severe Storms (Thunder, High Winds, Hail, Lightening)
5. Flooding
6. Winter Storms
7. Hazmat
8. Drought / Extreme Heat
9. Ground Failure

Finally, representative from each jurisdiction present at the meeting completed the Hazard Ranking Exercise for their respective jurisdiction.

Meeting was adjourned

Jackson County Multi-Hazard Mitigation Planning Meeting 1 Attendance

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
Carlin, Paulette		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Board Member	Jackson County	
Dampz, Amanda	AD	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Staff Researcher & Project Manager	Natural Hazards Research and Mitigation Group- SIU	1
Grode, Christopher		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Superintendent	Murphysboro District #186	
Guthman, Grant		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Highway Engineer	Jackson County Department of Highways	
Hagston, Bart	BH	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Director	Environmental Health & Emergency Preparedness- JC Health Department	
Hertz-Mills Doug Briggs	DB	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Captain Asst Fire Chief	City of Carbondale FI/EMA	4
Larkin, Keith		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Board Member	Jackson County	

[September, 4, 2014]

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Jackson County Multi-Hazard Mitigation Planning Meeting 1 Attendance

Please print clearly

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
Bayles, Barry	BB	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	School Resource Officer	Carbondale H.S. District #165	
Bedar, Lance		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	President	Village of Elkhart	
Berkowitz, Maureen	MB	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Assessor	Jackson County	20
Bilderback, Jim		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Fire Chief	Maconda Twp. F.P.D.	
Brunley, Tim	TB	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Supervisor	Jackson County Ambulance Service	5
Burns, Robert	MB	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Sheriff	Jackson County Sheriff's Office	20
Carpenter, Tyler	YC	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Regional Planner	Greater Egypt	20

[September, 4, 2014]

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Jackson County Multi-Hazard Mitigation Planning Meeting 1 Attendance

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
Ruffing, Amy		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	EHS Technician III	Center for Environmental Health and Safety-SIU	
Schuler-Gary Patrick McDonald P.M.	PM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Airport Operations Manager Specialist	Southern Illinois Airport → SIHA	
Shingleton, Tina	TS	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	President	Village of Mahanada	SCM
Wright, Dennis		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Fire Chief	Tower Rock F.P.D.	
LENG, SEAN D	SL	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Paramedic Supervisor	Jackson County Ambulance	5
Lindsay, Jennifer	SL	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Patrol Sgt	Jackson Co Sheriff	20
Tim Krapp	TK	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	SW Land Student	SIU	0

[September 4, 2014]

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Jackson County Multi-Hazard Mitigation Planning Meeting 1 Attendance

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
Lee, Ken		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Mayor	Campbell Hill	
Maddox, Mike	MM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Regional Hospital Coordinator	Memorial Hospital of Carbonale	20
Manwaring, Ron	RM	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	EMA Director	Murphysboro, IL	25
Minnis, Cary	MM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Executive Director	Greater Egypt	26
Misener, Derek	DM	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Coordinator	Jackson County EMA	5
Printer, Nicholas (Prof.)	PS	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Project Director	Natural Hazards Research and Mitigation Group-SIU	1
Priddy, Shawn	SP	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Deputy Coordinator	Jackson County EMA	12

[September 4, 2014]

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Meeting 2 – January 15th, 2015**IEMA Multi-Hazard Mitigation Plan**

Assembly of the Jackson County Planning Team Meeting 2
 Chairman: Derek Misener
 Plan Directors: Southern Illinois University and Greater Egypt Regional Planning and Development Commission

Meeting Date: January 15th, 2015

Meeting Time: 6:00pm

Place: Carbondale Civic Center, 200 S Illinois Ave, Carbondale, IL

Planning Team/Attendance: 19

Public Meeting and County Risk Assessment

The meeting is called to order

Prof. Nicholas Pinter opened the meeting by explaining that the planning team is here today to update the 2009 Jackson County Multi-Hazard Mitigation Plan. He introduced the planning partners: Southern Illinois University and Greater Egypt Regional Planning and Development Commission. A PowerPoint presentation was present that included: historic accounts of natural disasters that have affected Jackson County and the results from the risk assessment report.

A draft of the Jackson County Mitigation Plan was also given to each planning team member for review. It was explained by Prof. Pinter that the each planning team member should review the plan and consider the risk assessment before attending the next meeting. The next meeting will take place in March/April. This meeting will involve developing mitigation strategies to address each ranked hazard.

Prof. Pinter then asked the audience for questions and comments. Changes to the plan were suggested and discussion of the future additional meeting(s) took place:

- Correct zip code on page i
- SIU will attend the next Jackson County LEPC Meeting
- Potential NWS Spotter Training Meeting in March

Project Manager Amanda Damptz noted the changed and promised to make all corrections before the next meeting. Prof. Pinter thanked those who came and closed the presentation.

Meeting was adjourned

Please print clearly

Jackson County Multi-Hazard Mitigation Planning Meeting Attendance

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
SHAWN PRIDDELL 618-713-6632	SP	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	DEPUTY COORDINATOR	JACKSON CO EMER	15
MIKE HEARTZ 618-527-7559	MH	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	EMERGENCY MANAGER CARB. OF CARBONDALE	City of Carbondale	4
Tina Shingleton 618-967-5564	T	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Mayor	Village of Carbondale	10
Scott Wilmore, smwi.com scott.wilmore@gmail.com	SW	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	~~Carbondale~~ Superintendent	Kirkland Fire water system	30
Miriam Link-Mullison miriam@icdlandline.org	MLM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	ALM Superintendent	Jackson Co Kearl's Dept.	5
Mike O'Leary		☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	SHAWN'S OFFICE	JACKSON CO	20
RUSSELL TATE	RT	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	MURPHY'S BOARD EMA	MURPHY'S BOARD 1	20

January 15, 2015

Page 1

Jackson County Multi-Hazard Mitigation Planning Meeting Attendance

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
* Tim Krupp	TK	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Student	SUC	0
Melvin D. Dineen 618 687-7220	MD	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Supervisor of Accountants	Jackson County	15
Yvonne Carpenter	YC	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Owner	Coastal Empire	
John MICHLESTO DALE FIRE DEPT. Steve D. Dineen 618 687-7220	JM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Fire Chief	City of Dale	
		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	SECT. 5500 SUC	" "	
		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen			
		☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen			

(January 15, 2015)

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Jackson County Multi-Hazard Mitigation Planning Meeting Attendance

Name and Contact Information (email or phone)	Your Initials	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
Quifstora	Q	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Graduate	SUC	6
AYLOR SPEER	TS	☐ As a Public Employee ☐ As a Private Employee ☒ As an Interested Citizen	STUDENT	SUC	3
Aminda Darrin	AD	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Recreation II	SUC	0
Susana Ruiz	SR	☐ As a Public Employee ☐ As a Private Employee ☒ As an Interested Citizen	Teacher	SUC	0
Abel Lewis	L	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Teacher	SUC	
Deek A. Merson	DM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	ADMIN	Jackson County	6
Nicholas P. Pate	NP	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Prof.	SUC	2

(January 15, 2015)

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Meeting 3 – May 13th, 2015**IEMA Multi-Hazard Mitigation Plan**

Assembly of the Jackson County Planning Team Meeting 3

Chairman: Derek Misener

Plan Directors: Southern Illinois University and Greater Egypt Regional Planning and Development Commission

Meeting Date: May 13th, 2015

Meeting Time: 10:00am

Place: 109 S. Bigler Rd., Carbondale, IL

Planning Team/Attendance: 13

Developing Mitigation Strategies

The meeting is called to order.

Amanda Damptz opened the meeting by explaining that the planning team is here today to update the 2009 Jackson County Multi-Hazard Mitigation Plan. She introduced the planning partners: Southern Illinois University and Greater Egypt Regional Planning and Development Commission. A PowerPoint presentation was present that included: the current status of the mitigation planning efforts, FEMA's Hazard Mitigation Assistance Program, Hazard Mitigation Ideas and other potential funding sources.

During the PowerPoint, Ms. Damptz explained that regionally Southern Illinois has received \$87 million in Hazard Mitigation Assistance Grants as a result of the Hazard Mitigation Planning Efforts. A few examples include: Jackson County's Reed Station Mobile Home Acquisition, SIH's Seismic Retrofit, Creal Springs School Hardening, Rend Lake Water Main Bypass, and West Frankfort Treatment Plant Relocation.

In addition to FEMA's HMA program, there are several granting agencies the County and its municipalities can investigate to help offset the cost of future hazard mitigation projects. A few examples include: USDA Rural Development Grants, Illinois Department of Commerce and Economic Opportunity, and Illinois Dept. of Natural Resources.

Finally, the County and its municipalities broke out into their respective groups to develop mitigation strategies specific to their jurisdiction. SIU will gather the information and compile it into the plan draft. At the next meeting, the planning team will be able to review and make any changes necessary to the listed mitigation strategies.

Meeting was adjourned.

Please print clearly

Jackson County Multi-Hazard Mitigation Planning Meeting 3 Attendance

Name and Contact Information (email or phone)	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Mileage to attend this meeting
Amanda Damptz	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	APR Researcher	SIU	0
Tyler Carpenter	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Log Planner	Greater Egypt	-
Muhammad B. B. B.	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Chief County Assessment Officer	Jackson County	24 mi
Tina Shingleton	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Resident	Village of Makanda	34 mi
twins@creative.com	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Engineer/Architect	City of Carbondale	4
Mike Hertz	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Deputy Coord.	Jackson Co. team	24 mi
muhammad.b. b. b.	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Dir of Emergency	Jackson Co.	15 mi
Shawn Arndt	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen			
TEOENAGMAL.COM	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen			
BART HAGSTON	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen			
bart.hagston@online.org	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen			

(May 13, 2015)

10:01 PM

Page 1

Jackson County Multi-Hazard Mitigation Planning Meeting 3 Attendance

Name and Contact Information (email or phone)	Your Reason for Attending (check only ONE box)	Job Title(s)	Employer(s)	Roundtrip Miles to attend this meeting
William Link-Mollen	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Admin.	Joe Heath	12
Mike Maddox	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Atlc coord.	Southon, IL Hospital Services	12
Corey Shifera	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Firest/Dir	Southon Township Firest Agency	12
DEREK M. SEVER	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Director	Shelton County Emergency	8
Scott Williams	☒ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Superintendent	KFW/S	1
Ryan Guthrie	☐ As a Public Employee ☐ As a Private Employee ☐ As an Interested Citizen	Manager	Kerr	

(May 13, 2015)

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Meeting 4 – August 10th, 2015

Appendix B. Local Press Release and Newspaper Articles



Appendix C. Adopting Resolutions

See Attached Adopting Resolutions

Appendix D. Historical Hazards

See Attached Newspaper Clippings and Map

Appendix E. List of Essential Facilities

Not all data is available for every facility. Other facility specifics may be available upon request.

Emergency Operations Center Facilities

Facility Name	Address	City
Carbondale Emergency Management Service	401 North Glenview	Carbondale
Jackson County EOC	1001 Walnut Street	Murphysboro
Murphysboro Emergency Management	202 North 11 th Street	Murphysboro
Southern Illinois University EOC	374 East Grand Avenue	Carbondale
Jackson County Highway Department	1200 Enterprise Avenue	Murphysboro

Fire Station Facilities

Facility Name	Address	City
Ava Volunteer Fire Department	312 West Main Street	Ava
Campbell Hill Rural Fire District 162	109 Front Street	Campbell Hill
Carbondale Fire Department-Station 2	401 North Glenview	Carbondale
Carbondale Fire Department-Station 1	600 East College	Carbondale
Carbondale Township Fire Department	1125 East Park Street	Carbondale
De Soto Fire Department	210 West Lincoln Street	De Soto
Dowell Fire Department	215 Union Avenue	Dowell
Elkville Fire Department	201 North 5 th Street	Elkville
Gorham Fire Department	205 Washington Street	Gorham
Makanda Township Volunteer Fire Dept.	5420 Old US Highway 51	Carbondale
Makanda Township Volunteer Fire Dept.	5975 Giant City Road	Carbondale
Murphysboro Fire Department	218 North 10 th	Murphysboro
Murphysboro Fire Station II	1616 Pine Street	Murphysboro
Murphysboro-Pomona-Somerset Fire Dept.	322 South Williams	Murphysboro
Murphysboro-Pomona-Somerset Fire Dept.	771 Kimmel Bridge Road	Murphysboro
Tower Rock Fire Department	620 Front Street	Grand Tower
Vergennes Fire Department	700 Porter	Vergennes
Southern Illinois Airport	3470 New Era Road	Murphysboro

Police Station Facilities

Facility Name	Address	City
Ava Police Department	312 West Main Street	Ava
Carbondale Police Department	501 South Washington Street	Carbondale
De Soto Police Department	210 West Lincoln Street	De Soto
Dowell Village Police Department	213 Union Street	Dowell
Elkville Police Department	507 East Kimmel Street	Elkville
Grand Tower Police Department	201 Market Street	Grand Tower
Jackson County Sherriff's Admin	1001 Mulberry Street	Murphysboro
Murphysboro Police Department	202 N 11 th Street	Murphysboro
Southern Illinois Dept. of Public Safety	705 A Washington Street	Carbondale
Southern Illinois Airport	3470 New Era Road	Murphysboro

School Facilities

Facility Name	Address	City	Comments
Brehm Preparatory School	1245 East Grand Avenue	Carbondale	Grades 6-12; Private College Preparatory Day and Boarding School
Carbondale Community HS Central East	1301 East Walnut Street	Carbondale	Grades 9-12; Carbondale CHSD 165; 1066 Students
Carbondale Middle School	1150 East Grand Avenue	Carbondale	Grades 6-8; Carbondale ESD 95; 396 Students
Carbondale New School	1302 East Pleasant Hill Road	Carbondale	Grades PK-8; Private

Facility Name	Address	City	Comments
Carruthers Elementary School	80 Candy Lane	Murphysboro	Grades PK -5; Murphysboro CUSD #186; 422 Students
Christ Lutheran School	146 West Jacob Road	Jacob	Grades PK-8; Private Christian
Cope Safe School Program	1725 B Shoemaker Drive	Murphysboro	Grades 6-8
De Soto Elementary School	311 Hurst Road	De Soto	Grades PK-8; Desoto CUSD 86; 264 Students
Elverado High School	514 South 8 th Street	Elkville	Grades 9-12; Elverado CUSD 196; 147 Students
Elverado Intermediate School	190 Harrison Street	Vergennes	Grades 3-5; Elverado CUSD 196; 99 Students
Elverado Junior High School	190 Harrison Street	Vergennes	Grades 6-8; Elverado CUSD 196; 103 Students
Elverado Primary	114 South 8 th Street	Elkville	Grades PK-2; Elverado CUSD 196; 144 Students
General John A. Logan School	320 Watson Road	Murphysboro	Grades PK-5; Murphysboro CUSD 186; 512 Students
Giant City Elementary School	1062 Boskydell Road	Carbondale	Grades PK-8; Giant City CCSD 130; 265 Students
Immanuel Lutheran School	1915 Pine Street	Murphysboro	Grades PK-8; Private Lutheran; 56 Students
Lewis Elementary School	801 South Lewis Lane	Carbondale	Grades 4-5; Carbondale ESD 95; 306 Students
Montessori School of Southern Illinois	507 North 9 th	Murphysboro	Grades PK-8; Private
Murphysboro High School	50 Blackwood Drive	Murphysboro	Grades 9-12; Murphysboro CUSD 186; 589 Students
Murphysboro Middle School	2125 Spruce Street	Murphysboro	Grades 6-8; Murphysboro CUSD 186; 487 Students
Parrish Elementary School	121 North Parrish Lane	Carbondale	Grades PK-1; Carbondale ESD 95; 494 Students
Southern Illinois University	SIU Carbondale	Carbondale	Large University
Southern Illinois University Airport	3470 New Era Road	Murphysboro	University Airport
St. Andrew Elementary School	723 Mulberry Street	Murphysboro	Grades PK-8; Private Catholic
Thomas Elementary School	1025 North Wall Street	Carbondale	Grades 2-3; Carbondale ESD 95; 301 Students
Trico School	16343 Highway 4	Ava	Grades PK-5; Trico CUSD 176; 457 Students
Tri-County Special Education	1725 Shoemaker Drive	Murphysboro	Special Education; Ages 3-21
Trinity Christian School	1218 West Freeman Street	Carbondale	Grades K-12; Private Christian
Unity Point Elementary School	4033 South Illinois Avenue	Carbondale	Grades PK-8; Unity Point CCSD 140; 680 Students

Medical Care and Long Term Care Facilities

Facility Name	Address	City	Comments
Big Muddy Assisted Living	5 N. Shawnee Drive	Murphysboro	Retirement / Assisted Living Facility
Carbondale Rehab & Nursing Center	120 North Tower Road	Carbondale	Retirement / Assisted Living Facility
Century Assisted Living	701 S. Lewis Lane	Carbondale	Retirement / Assisted Living Facility
Integrity Healthcare of Carbondale	500 Lewis Lane	Carbondale	Retirement / Assisted Living Facility
Liberty Village	2950 Westridge Place	Carbondale	Retirement / Assisted Living Facility
Memorial Hospital of Carbondale	405 West Jackson	Carbondale	Southern Illinois Healthcare (SIH); 159 bed facility
Prairie Living at Chataqua	955 Villa Court	Carbondale	Retirement / Assisted Living Facility
St. Joseph Memorial Hospital	2 South Hospital Drive	Murphysboro	Southern Illinois Healthcare (SIH); 25 bed facility
Violet Lane Assisted Living	101 N. Violet Lane	Carbondale	Retirement / Assisted Living Facility

Appendix F. Critical Facilities Map

See Attached Large Format Map of Critical Facilities.