5:4 Risk Assessment

All Components of this Risk Assessment were developed using the best available data in the Purchase Region. GIS resources and public input were used to identify which hazards, of those listed below, affect the Purchase Region. The Purchase Area Development District (PADD) staff compiled this information to identify hazards and the Jackson Purchase Hazard Mitigation Council (JPHMC) reviewed the definitions and discussed their occurrence in and impact on the region. This review identified all hazards to the region and consequently all hazards that affect Fulton County.

For this revision, the Fulton County Mitigation Planning Team (MPT) reviewed and revised the prioritization of Hazards from their 2012 Plan using updated climatic/event data, 2016 revised flood zones, local events occurring since the previous plan, 2010 Census data and 2015 American Community Survey. These provided a higher resolution for the resulting Hazard re-prioritization and revised risk assessments. The resulting prioritization and risk assessments are contained in this county update.

5:4.1 Identifying Hazards

FEMA recognizes many forms of natural hazards. Major natural hazards that may occur include:

- Geologic hazards
  - Tsunami
  - Volcano
  - Earthquake
  - Land Subsidence/Karst Topography
  - Landslide
- Weather generated hazards
  - Avalanche
  - Hurricane
  - Severe Thunderstorm
  - Hailstorm
  - Windstorm/Microburst
  - Severe Winter storm
  - Tornado
- Wildfire
- Flooding
  - Flashfloods
  - General Flooding
  - Coastal
  - Riverine
- Urban
- Climatological
  - Drought
  - Extreme Heat
- Failure of Man-made structures from the impact of natural forces
  - Dam Failure
  - Levee/flood Wall Failure

Natural Hazards Addressed by the Regional Plan

The regional planning process identified hazards that significantly impact the entire Purchase Region and eliminated from consideration those natural hazards that do not. Natural hazards where a historical record of damage to people and property exists, or the potential for such damage to occur, are addressed in the plan. This determination does not preclude the plan from including more hazards in future updates. The Fulton County MPT agreed that the identification process was sufficiently thorough to serve all the signatory counties of the plan and will not be repeated for the Fulton County Annex. Table 5.1 summarizes why these hazards were identified.

Table 5.1 Hazards Identified and Reasons for Identification

Hazard	How Identified	Why Identified
Tornado	* Review of past disaster damage * Review of FEMA hazard maps * Public Input	* Several past occurrences * Hazard maps show all jurisdictions affected
Flood **Flash Flood** **River Erosion**	* Review of past disaster damage (FEMA & National Climatic Data Center) * Local Emergency Management * Public Input * Review of FIRM maps	* Affects the region frequently * Maps show many flood prone areas * Public identified several regions not mapped affected by flooding * Repetitive flooding has led to the deposit of enormous amounts of silt in Kentucky's Mississippi River ports
Thunderstorm Wind **Hail**	* Review of past disaster damage * Public Input * Review of past occurrences from National Climatic Data Center	* Many events in the past * Widespread: affects all jurisdictions * High wind zone
Earthquake	* Review of Ground Motion Maps * Review of the New Madrid and Wabash Seismic Zone Maps * Public Input	* Proximity to New Madrid/Wabash Seismic Zones * Historic accounts of 1812 disaster. * Potential for destructive impact in some jurisdictions
Winter Storm / Ice Storm	* Review of past disaster damage * Review of past occurrences from National Climatic Data Center * Public Input * Local DES/KYTC	* Several past occurrences * Variety of events including snow/ ice * Can affect all jurisdictions
Excessive Heat / Drought	* Review of past disaster damage * Public Input * Review of Palmer Drought Severity Index	* Losses have occurred in past * Large impact of agriculture on the region
Dam Failure	* Review of High Risk Dams in the region * Corps of Engineers Input	*Potential for flooding *Number of High Risk dams in region
Wildfire	* Review of State Mitigation Plan * Public Input	*Potential for loss at Wildland/urban interface, * Increased fuel supply due to ice storm damage

5:4.2 Hazard Profiles

The Fulton County MPT reviewed the previously profiled hazards based on; historical evidence gathered from the National Centers for Environmental Information (NCEI), Kentucky State Climatology Center, FEMA's Hazard Mapping website, the Kentucky State Hazard Mitigation Plan and the Kentucky Geological Survey. The PADD staff gathered GIS information and historical data to provide to the MPT. All components of this Risk Assessment were revised using the best available data in the Purchase Region. GIS resources and public input were used to identify which hazards, of those listed below, affect the Purchase Region. The JPHMC reviewed the definitions and discussed their occurrence in and impact on the region. This review identified all hazards to the region and consequently all hazards that affect Fulton County.

Summary of Hazard Profiles

Several conclusions can be drawn from the information gathered in the Hazard Profiles. Based on historical frequency and past disaster damages, several hazards identified in the regional plan, stand out as more significant threats to Fulton County, while several others appear to be less significant.

According to frequency and damage figures Thunderstorm Wind, Hail, Flood / Flash Flood, and Tornado stand out as the most significant threats to Fulton County. Earthquake is a hazard rated by committee members as one of the biggest potential threats, there is no historical data on actual earthquake damages in Fulton County to analyze the threat, and considerable debate as to the severity of the resultant damage even for the "worst case scenario". Therefore, the committee regarded it as a Moderate Risk Hazard, along with winter storms and river erosion.

The county's western border is the flood prone Mississippi River. Most of the property assets of the county lie outside the flood prone areas, which are mostly agricultural lands. But, the bluffs of the Mississippi River also constitute a potential landslide/river erosion problem, making Fulton County one of four counties in the Purchase Region with a landslide threat. Both Landslide and Wildfire are deemed hazards, but Low Risk Hazards.

Table 5.2 is a summary of past Declared Disasters as provided by FEMA for the Fulton County. Throughout our annex, we will refer to this table as we profile our hazard events. This table is limited to providing information only related to declared disasters on the county level and does not list each jurisdiction.

Table 5.2 Presidential Disaster Declarations that Affected PADD Counties

DR#	Declaration Date	Disaster Type	Total Declared Counties	Declared Counties	Counties Declared for Public Assistance and Individual Assistance	Counties Declared for Public Assistance Only	County	DH Approved Funding	IFG Approved
381	5/11/1973	Severe Storms, Flooding	5	Ballard, Carlisle, Fulton, Hickman, McCracken	Ballard, Carlisle, Fulton, Hickman, McCracken	0			
461	3/29/1975	Severe Storms, Flooding	17	Ballard, Calloway, Fulton, Graves, Hickman, Marshall, McCracken	Ballard, Calloway, Fulton, Graves, Hickman, Marshall, McCracken	0			
821	2/24/1989	Severe Storms, Flooding	67	Ballard, Carlisle, Graves, Hickman, Marshall, McCracken	Ballard, Carlisle, Graves, Hickman, Marshall, McCracken	0			
1089	1/13/1996	Blizzard	120	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			
1163	3/4/1997	Flooding	101	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	Ballard, Carlisle, Fulton, Hickman, Marshall, McCracken	Calloway	McCracken	$137,084.85	$78,709.00
1802	10/9/2008	Severe Wind Storm	36	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			
3302	1/28/2009	Severe Wind Storm	114	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			
1818	2/5/2009	Severe Winter Storm, Flooding	117	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			

DR#	Declaration Date	Disaster Type	Total Declared Counties	Declared Counties	Counties Declared for Public Assistance and Individual Assistance	Counties Declared for Public Assistance Only	County	DH Approved Funding	IFG Approved
1976	5/4/2011	Severe Storms, Tornadoes, Flooding	22	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken		Calloway			
4057	3/6/2012	Severe Storms, Tornadoes, Straight-line Winds, Flooding	1	Ballard		Ballard			
4216	4/30/2015	Severe Winter Storms, Snowstorms, Flooding, Landslides, Mudslides	3	Ballard, Marshall, McCracken		Ballard, Marshall, McCracken			
4218	5/12/2015	Severe Winter Storms, Snowstorms, Flooding, Landslides, Mudslides	3	Calloway, Fulton, Marshall		Calloway, Fulton, Marshall			
4278	8/26/2016	Severe Storms, Tornadoes, Flooding, Landslides, Mudslides	2	Calloway, Marshall		Calloway, Marshall			

Source:https://www.fema.gov/disasters?field_state_tid_selective=49&field_disaster_type_term_tid=All&field_disaster_declaration_type_value=All&items_per_page=20&=GO

According to State Department of Emergency Management records, Fulton County was eligible for Public Assistance as a result of the above declarations. For this revision, the Fulton County MPT reviewed and revised the prioritization of Hazards from their 2012 Plan using updated climatic/event data, 2016 revised flood zones, local events occurring since the previous plan, and 2010 census data and 2015 American Community Survey. These provided a higher resolution for the resulting Hazard re-prioritization and revised risk assessments. All following discussions of risk and risk assessment are in the order of these revised priorities.

Table 5.3 Fulton County Hazard Summary Table

PLAN VERSION	2017	2012
HIGH RISK HAZARDS	THUNDERSTORM WIND HAIL FLOOD TORNADO	SEVERE THUNDERSTORM HAIL FLOOD RIVER EROSION / DEPOSITION
MODERATE RISK HAZARDS	EARTHQUAKE WINTER STORM RIVER EROSION / DEPOSITION	TORNADO EARTHQUAKE SEVERE WINTERSTORM
LOW RISK HAZARDS	LANDSLIDE WILDFIRE	LANDSLIDE WILDFIRE

Source: Fulton County MPT 2017
Note: Based on review of the 2012 Hazards the MPT made a few revisions for 2017 and NCEI terminology was updated.

The storm events database for the NCEI, formerly the National Climatic Data Center, will be the source utilized for the best available data for the Purchase Region. Please see the NCEI contact page if you have questions. https://www.ncdc.noaa.gov/customer-support

Table 5.4 represents a summary of the hazard events identified by the MPT that are recorded in the NCEI Storm Events Database for Fulton County for the period 01/01/1950 thru 03/31/2017. Data is available as early as 1950, but depending on reporting for events, the first event on record may come at a much later time. The detailed, disaggregated listing of these events are included in Appendix 1.

Table 5.4 Summary of Hazard Previous Occurrences and Impacts
January 1, 1950 – March 31, 2017

Event	Events	Death	Injury	Property Damage($)	Crop Damage($)
Tornado	10	0	2	1.407M	0
Thunderstorm Wind	74	0	2	713.05K	0
Winter Storm	16	1	0	0	0
Ice Storm	4	0	0	10.20M	0
Flood	26	0	2	1.030M	20.00K
Flash Flood	24	0	4	1.354M	10.00K
Hail	39	0	0	54.00K	0
Excessive Heat	7	0	0	0	0
Drought	32	0	0	0	9.200M
Wildfire	1	0	0	0	0
Dam Failure	No History				
1 class A structure = no loss of life anticipated, only damage to dam owner's property					
2 class B structures = loss of life not probable, some economic loss & environmental damage					

Source: https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

For this update to the 2018 Jackson Purchase Hazard Mitigation (JPHM) Plan, the events from January 1, 2012 through the first quarter of 2017 (1/1/2017 – 3/31/2017) will be reviewed. This provides 5.25 years of recent data covering the current period for this cycle of the JPHM Plan update. For a complete listing of all events, please refer to the Appendix 1.

Thunderstorm Wind

A thunderstorm is formed from a combination of moisture, rapidly rising, warm air, or a force capable of lifting air, such as the meeting of a warm and cold front, a sea breeze, or a mountain. Thunderstorms can produce tornadoes, large hail and heavy rain which can cause flash flooding. The National Weather Service considers a thunderstorm as severe if it develops ¾ inch hail or 58 mph winds. Straight line winds during thunderstorms can exceed 100 miles per hour and are responsible for wind damage associated with thunderstorms. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Thunderstorms affect relatively small area when compared with winter storms, as the average storm is 15 miles in diameter and lasts an average of 30 minutes. All thunderstorms are dangerous and capable of threatening life and property in localized areas. Every thunderstorm produces lightning, which results from the buildup and discharge of electrical energy between positively and negatively charged areas.

Thunderstorms are quite frequent in Fulton County. They may produce damage, injuries, or fatalities. Numerous severe thunderstorms have been recorded that produce high winds, lightning, and hail, in the county. Many of these thunderstorms have caused property or crop damage. These storms, although relatively short in duration when compared to other weather events, are often long lived enough to track across the entire county before dissipating their energy or exiting the region.

Table 5.5 Thunderstorm Wind Events and Impacts in Fulton County January 1, 2012 – March 31, 2017

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
FULTON	06/11/2012	14:15	CST-6	52 kts. EG	0	0	6.00K	0.00K
FULTON	05/30/2013	15:15	CST-6	52 kts. EG	0	0	20.00K	0.00K
FULTON	06/15/2016	13:45	CST-6	56 kts. EG	0	0	8.00K	0.00K
HICKMAN	03/01/2017	05:05	CST-6	55 kts. MG	0	0	0.00K	0.00K
FULTON ARPT	03/01/2017	05:12	CST-6	65 kts. EG	0	0	25.00K	0.00K
TOTALS					**0**	**0**	**59.00K**	**0.00K**

Wind Magnitude Definitions:
Measured Gust:'MG', Estimated Gust:'EG', Measured Sustained:'MS', Estimated Sustained:'ES'
Source: Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

- Two of the more recent events in Fulton County are responsible for generating $45,000 in damages. During the event on May 30, 2013 clusters of thunderstorms moved north across western Kentucky. The storms occurred in a southwesterly flow of moist and moderately unstable air. The storms were enhanced by a 500 mb shortwave extending from the Ozarks to the Lower Mississippi Valley. A few of the storms produced large hail and strong winds. Trees and power lines were blown down. This storm generated an estimated $20,000 in damages.

- The second event occurred on March 1, 2017 when a squall line of severe thunderstorms produced widespread damaging winds from 70 to 80 mph across southwest Kentucky, mainly along and south of a Paducah to Princeton to Madisonville line. An isolated tornado was embedded within the damaging wind area. The squall line intensified ahead of an upper-level trough advancing east of the Plains states. The squall line was focused along and ahead of a cold front, where winds at 850 mb were southwesterly between 50 and 60 knots. Ahead of the squall line, the air mass was moist and rather unstable.

- Along U.S. Highway 51 between Fulton and Crutchfield, one small barn was destroyed. Another old small barn lost a large section of tin roof. This particular storm generated $25,000 in damages in Fulton County.

SUMMARY AND CONCLUSIONS OF THUNDERSTORM WIND PROFILE

During the period covered by the update (01/01/2012 – 03/31/2017) there have been five occurrences of Thunderstorm Wind Events in Fulton County reported by the NCEI. There are no reported fatalities or injuries as a result of these events. These occurrences produced $59,000 of reported damages in personal property.

Fulton County experienced five reported events over the 5.25 year update period, which divides out to 0.95 reported events per year, or a probability of occurrence of a 95% chance of that such an event will occur in any given year. Based on recorded events and reported damages in Fulton County, the cost of a Thunderstorm Wind Event could be calculated as:

- $59,000 in damages / 5 events = $11,800 per event on average.
- $11,800 damage per event x 0.95 events per year = $11,210 damage per year.

Of critical concern to the Fulton County MPT and the main contributing factor in their consideration of risks and vulnerability, is the potential of property damage and human cost of any occurring Thunderstorm Wind Event.

Hail

Hail is one of four types of precipitation that falls from the sky. It's also the most dangerous, damaging type, occurring during severe storms. If hail measuring larger than ¾ inches in diameter falls during a thunderstorm, it is classified as severe weather. Sometimes damaging winds accompany this type of storm as well. According to the National Oceanic and Atmospheric Administration, hail causes over one billion dollars of damage in the United States each year.

Generally, hail must be 1 ¼ inches in diameter (Half-Dollar size) before it causes damage to heavy composite shingles or wood shake shingles. Lightweight composite shingles may show damage after being struck by 1-inch diameter (Quarter size) hail. Only deteriorated composite shingles will show hail damage due to hail less than 1 inch in diameter, and the hail generally must be more than ¾ inch in diameter (Dime size).

TORRO Hailstorm Intensity Scale

The Torro Hailstorm Intensity Scale was introduced by Jonathan Webb of Oxford, England, in 1986 as a means of categorizing hailstorms. The scale extends from H0 to H10 (See Table 5.6) with its increments of intensity or damage potential related to hail size, texture, numbers, fall speed, speed of storm translation, and strength of the accompanying wind.

An indication of equivalent hail kinetic energy ranges (in joules per square meter) has now been added to the first six increments on the scale, and this may be derived from radar reflectivity or from hail pads. The International Hailstorm Intensity Scale recognizes that hail size alone is insufficient to accurately categorize the intensity and damage potential of a hailstorm, especially towards the lower end of the scale. For example, without additional information, an event in which hail of up to walnut size is reported (hail size code 3: hail diameter of 21-30 mm) would be graded as a hailstorm with a minimum intensity of H2-3. Additional information, such as the ground wind speed or the nature of the damage the hail caused, would help to clarify the intensity of the event. For example, a fall of walnut-sized hail with little or no wind may scar fruit and sever the stems of crops but would not break vertical glass and so would be ranked H2-3. However, if accompanied by strong winds, the same hail may smash many windows in a house and dent the bodywork of a car, and so be graded an intensity as high as H5.

However, evidence indicates that maximum hailstone size is the most important parameter relating to structural damage, especially towards the more severe end of the scale. It must be noted that hailstone shapes are also an important feature, especially as the "effective" diameter of non-spheroidal specimens should ideally be an average of the co-ordinates. Spiked or jagged hail can also increase some aspects of damage.

Table 5.6

H	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m^2	Typical Damage Impacts
H0	Hard Hail	5	0-20	No damage
H1	Potentially Damaging	5-15	>20	Slight general damage to plants, crops
H2	Significant	10-20	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75		Severe roof damage, risk of serious injuries
H8	Destructive	60-90		(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Size codes are presented in TABLE 5.7 The Size Code is the maximum reported size code accepted as consistent with other reports and evidence.

Table 5.7

Size code	Maximum Diameter mm	Description
0	5-9	Pea
1	10-15	Mothball
2	16-20	Marble, grape
3	21-30	Walnut
4	31-40	Pigeon's egg > squash ball
5	41-50	Golf ball > Pullet's egg
6	51-60	Hen's egg
7	61-75	Tennis ball > cricket ball
8	76-90	Large orange > Soft ball
9	91-100	Grapefruit
10	>100	Melon

From January 1, 2012 through March 31, 2017, there has been only one occurrence of a reported Hail Event in Fulton County by the NCEI. There were no reported injuries and no reported property or crop damages associated with this event.

Table 5.8 Hail Events and Impacts in Fulton County January 1, 2012 – March 31, 2017

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
BONDURANT	09/05/2012	15:00	CST-6	1 inch	0	0	0.00K	0.00K
TOTALS					0	0	0.00K	0.00K

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The event occurring on September 5, 2012 is typical of the type of Hail Event in recent years for Fulton County. Thunderstorms increased in coverage and strength during the late afternoon in a zone of strong instability along the southern edge of the westerly Jetstream. Thunderstorms that occurred over Illinois and Indiana earlier in the day left an outflow boundary that extended from west-northwest to east-southeast across western Kentucky. This boundary enhanced thunderstorm development. Rich low level moisture and steep lapse rates fostered isolated severe weather events until the atmosphere stabilized toward sunset.

SUMMARY AND CONCLUSIONS FOR HAIL PROFILE

Fulton County has experienced one reported Hail Event during the 5.25 year plan update period, which divides out to 0.19 events per year or a probability of 19% chance for an event with Hail occurrence in any given year.

Based on the few recorded events and no reported damages in Fulton County, the cost of a Hail Event could be not be calculated for this update cycle. A historical account of Hail Events recorded in Fulton County by NCEI can be found in Appendix 1.

Flash Flood / Flood

As can be seen in Table 5.7, Flash Flood is the most common (4/6) form of flooding in Fulton County. The cause, being too much rain water, delivered in too short of time. However, rather than steep slopes and narrow valleys channeling and concentrating the runoff from heavy rains, the runoff is too great in volume for the county's characteristic low lying, meandering streams, to carry away. This slow drainage is often exacerbated by stream blockages of tree limbs and trunks, which form effective check dams and barrages.

River basin flooding is common among Kentucky's major streams and bodies of water during the winter and early spring months. The major bodies of water in Fulton County are: the Mississippi River Obion Creek, and the Bayou du Chien. These rivers delivered catastrophic flooding to the area in the past, most memorably in 1937, but have since been contained, if not controlled by levees, floodwalls and dams. The potential failure of these structures, is of more concern to the County, than the direct effects of flooding. Of major concern during the most recent flooding event (DR-1976) was the development of sand boils in numerous locations on the land side of the flood wall and levee system.

Periodic flooding of land adjacent to rivers, streams and shorelines is natural and can be expected to take place at fairly regular intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. 100 Year Flood: as determined by the Federal Emergency Management Agency (FEMA), is a flood event of a magnitude expected to be equaled or exceeded once on the average during any 100-year period. The term "100-year flood" is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood is also used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance.

Table 5.9 Flash Flood / Flood Events and Impacts in Fulton County
January 1, 2012 – March 31, 2017

Location	Date	Time	Time Zone	Event Type	Deaths	Injuries	Property Damage	Crop Damage
STATE LINE	03/08/2012	15:00	CST-6	Flash Flood	0	0	0.00K	0.00K
FULTON	08/03/2013	08:00	CST-6	Flash Flood	0	0	50.00K	0.00K
FULTON	12/21/2013	18:52	CST-6	Flash Flood	0	0	0.00K	0.00K
HICKMAN	04/28/2014	08:00	CST-6	Flood	0	0	0.00K	0.00K
SASSAFRAS RIDGE	03/09/2016	20:17	CST-6	Flash Flood	0	0	0.00K	0.00K
FULTON	03/10/2016	04:00	CST-6	Flood	0	0	0.00K	0.00K
TOTALS					**0**	**0**	**50.00K**	**0.00K**

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information Storm Events Database:
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event descriptions are typical of the type of flooding experienced in Fulton County.

- August 3, 2013: Numerous clusters of thunderstorms persisted in the vicinity of a stationary front over the Lower Ohio Valley. The storms occurred along the southern fringe of the mid-level westerlies. Flash flooding of streets and low-lying areas was reported. Streets were closed by police and fire personnel. Floodwaters entered a church and a few businesses. This Event had an estimated $50,000 reported in damages to property.

- April 28, 2014: A few severe thunderstorms occurred during the afternoon and evening hours. A powerful mid-level shortwave trough and its associated 70-80 knot jet streak translated from the southern high Plains into the upper Midwest. On the heels of this initial shortwave trough, a channeled vorticity maximum and attendant 70-knot jet streak progressed across the southern Plains into southwest Missouri. In association with these features, a 40 to 50 knot southerly low-level jet became established over the Mississippi Valley. Isolated severe thunderstorms occurred during the afternoon hours near a surface warm front lifting north across the Lower Ohio Valley. During the evening, widespread storms including isolated severe storms occurred ahead of a cold front surging eastward across the Ozark Mountains. The strong supply of warm and moist air fueled heavy rainfall and some local flash flooding southwest of a Paducah to Murray line overnight. Kentucky Highway 94 was closed between Kentucky Highways 311 and 1099 near Hickman due to water over the road. High water signs were placed at flooded spots on several other state roads in the county. The flooding was due to thunderstorms the previous night combined with light to moderate rain the next day.

- March 10, 2016: A multi-day heavy rain event occurred from the 8th to the 15th. The heaviest rounds of showers and storms occurred on the 8th, 9th, and 10th. Parts of western Kentucky received 4 to 6 inches of rain. A deep upper-level low became stationary over Mexico, pumping warm and moist air northward into the central United States. This moisture was squeezed out by a slow-moving cold front that drifted east across Missouri and Illinois. Numerous roads flooded across western Kentucky, and the south fork of the Little River exceeded flood stage at Hopkinsville. The flash flood event from the previous evening evolved into a longer-term flood event. At Fulton, Harris Fork Creek exceeded its capacity and caused minor street flooding. Kentucky Highway 307 was closed in downtown Fulton. A trained spotter measured 4.25 inches in 24 hours in Fulton.

Figure 5.1 Fulton County 100 Year Floodplain

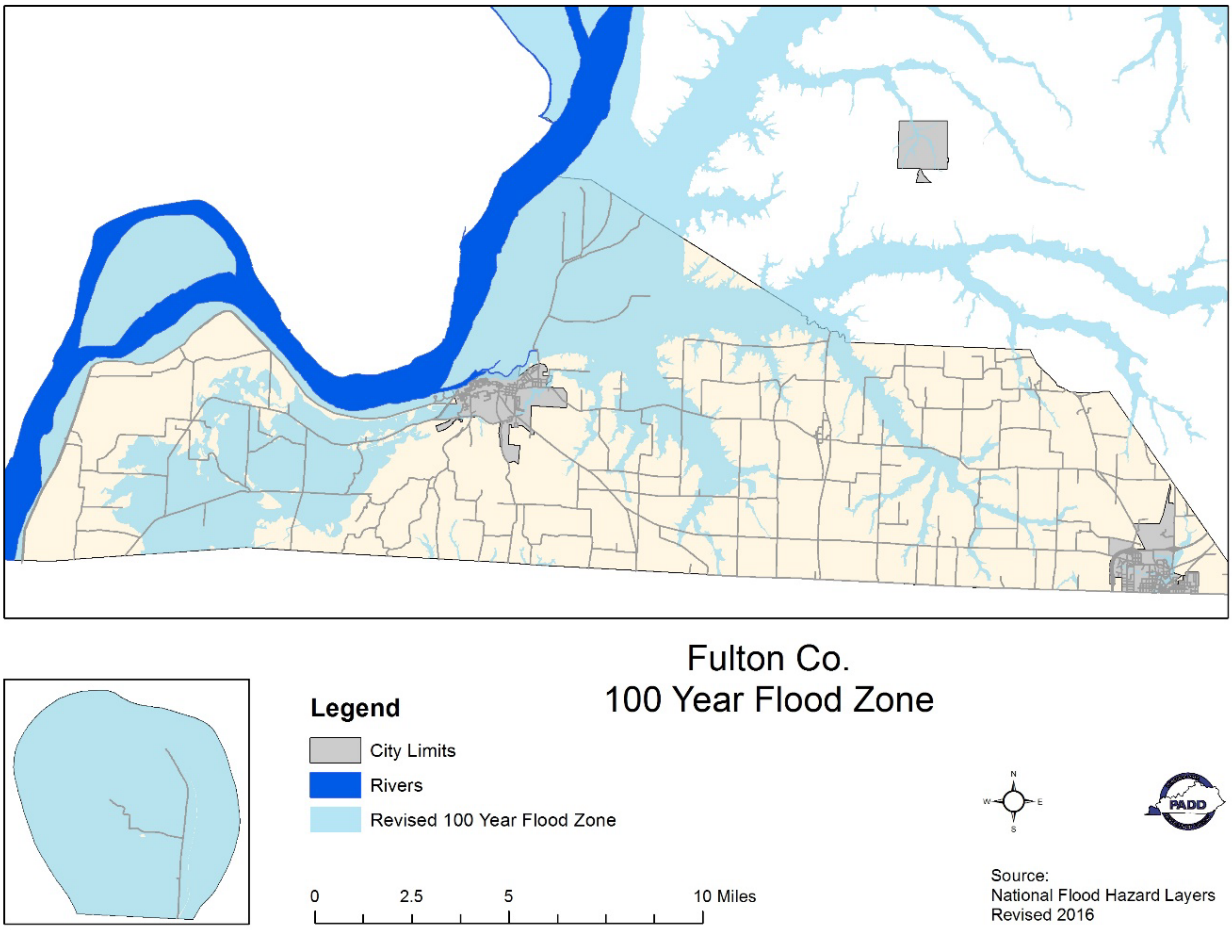


Figure 5.2 City of Fulton Flood Hazard Zone

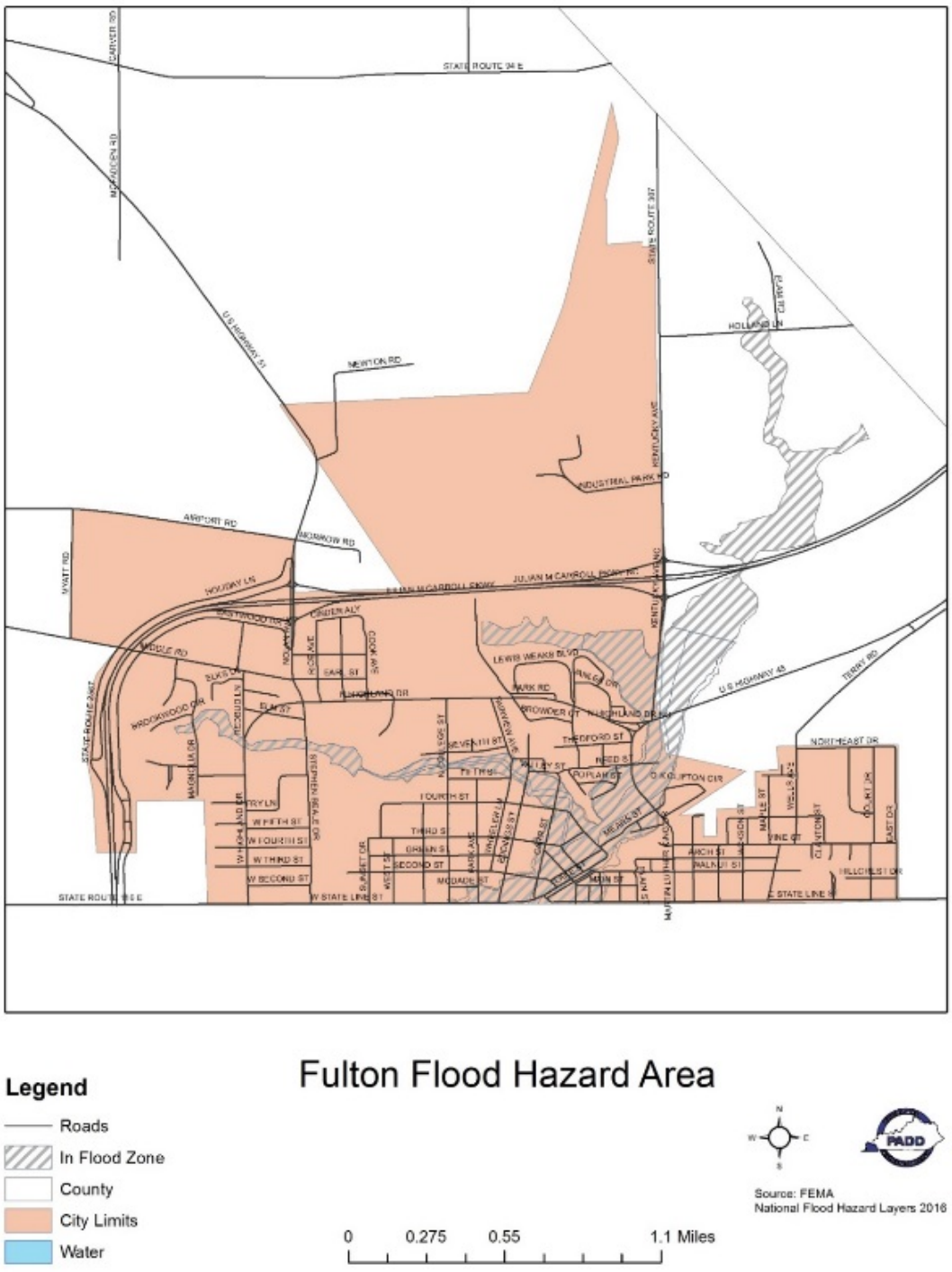


Figure 5.3 City of Hickman Flood Hazard Areas

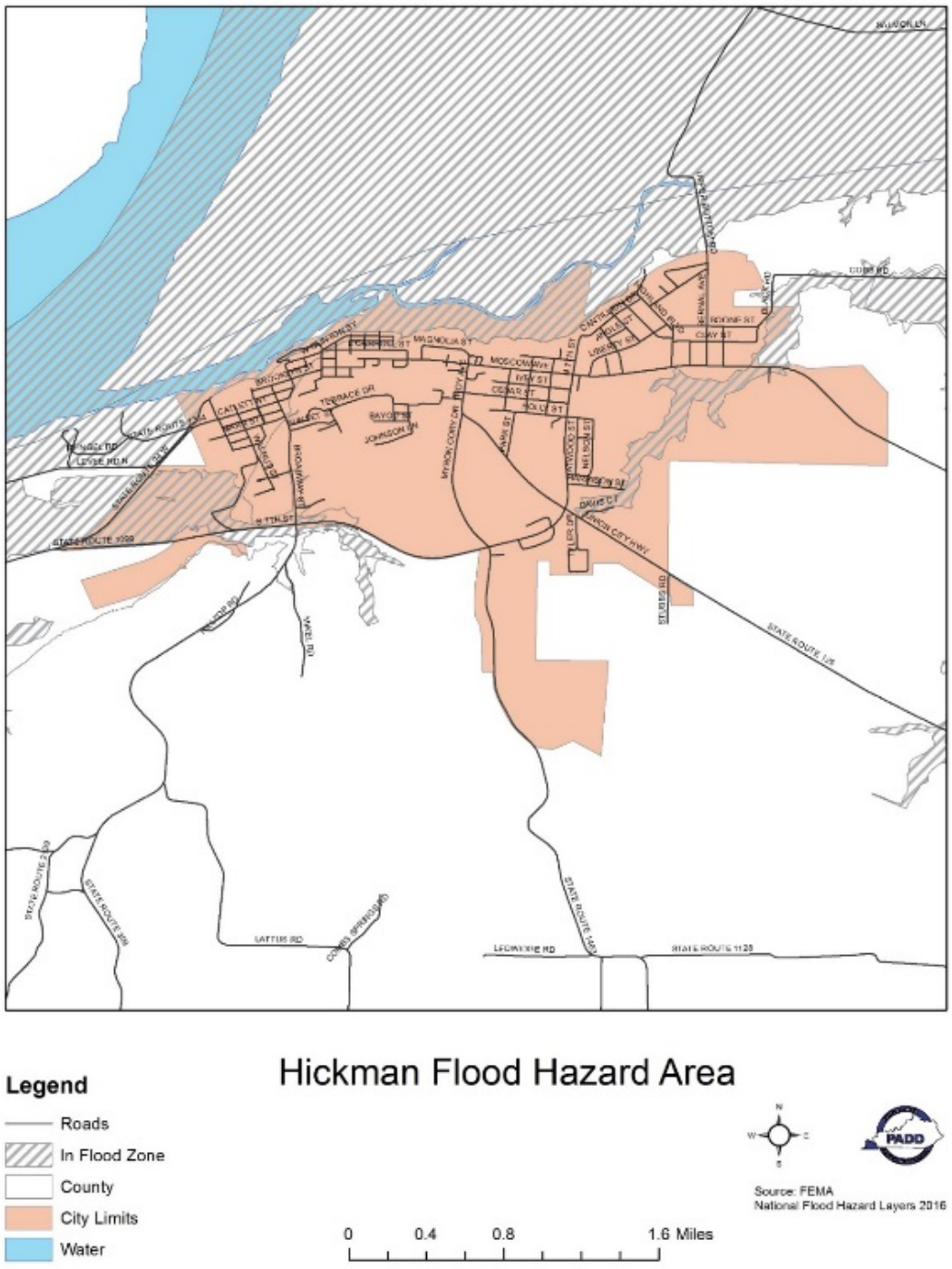


Table 5.10 National Flood Insurance Program Participation by Jurisdiction

Jurisdiction	Floodplain Management Ordinance	SFHA in Jurisdictional Limits	Comments	City Class
Ballard County	X	X		
City of Barlow			No mapped SFHA	6
City of Kevil			No mapped SFHA	6
City of La Center		X	SFHA mapped in 2009, NFIP under consideration	5
City of Wickliffe	X	X		5
Calloway County	X	X		
City of Murray	X	X		3
City of Hazel			No mapped SFHA	6
Carlisle County	X	X		
City of Bardwell	X	X		5
City of Arlington	X	X		6
Fulton County	X	X		
City of Fulton	X	X		4
City of Hickman	X	X		4
Graves County	X	X		
City of Mayfield	X	X		3
City of Wingo		X		6
Hickman County		X	Mapped SFHA, non-participant	
City of Clinton	X	X		5
City of Columbus			No mapped SFHA	5
Marshall County	X	X		
City of Benton	X	X		4
City of Calvert City	X	X		4
City of Hardin	X	X		5
McCracken County	X	X		
City of Paducah	X	X		2

Information from the FEMA Community Status Book as of 6-13-17

SUMMARY AND CONCLUSIONS OF FLOODING PROFILE

Information from the above tables and maps related to flooding can be used to define the frequency of Flood Events and the impact of these events. Data on flood event magnitude was not available. The frequency of occurrence that can be derived from this data is six Flood Events in 5.25 years, which divides out to 1.14 reported Flooding Events per year, or a probability greater than 100% for the occurrence of a Flood Event in any given year.

Based on recorded events and reported damages in Fulton County, the cost of a Flood Event could be calculated as:

- $50,000 divided by 6 events = $8,333 per event.
- $8,333 times 1.14 events/year = $9,500 per year

Additional Risk Factor: River Erosion and Deposition

For most instances of River Erosion, it is undercutting and bank erosion that are the major issues. For Fulton County and the City of Hickman, the periodic flooding of the Mississippi causes some erosion. The potential for River Erosion is high along the numerous streams, sloughs and bayous of Fulton County. However, there is currently no data set to support a record of damages caused by River Erosion. Of greatest concern to the Fulton County MPT is the threat of erosion to the levees that protect the county's low-lying areas. If those levees are breached, waters inundate the areas behind the levees, and get trapped there increasing the duration of the flood event.

It is the tremendous load of silt the river carries in flood stage that generates the hazard. The hundreds of tons of silt deposited by the river translates to several feet of shoaling for the Hickman-Fulton County Riverport and chokes its accessibility.

> "$1.9 Million for harbor dredging". The article quotes Congressman (Ed) Whitfield "I am pleased to have received confirmation ..... that some of the money made available from disaster relief legislation passed in December will be used to dredge the harbor. The money was designated for harbor repairs that are required as a result of flooding in early 2011, which caused several harbors to receive heavy deposits of silt and threatened the continued operation of the Hickman port. $1.9 million will be available for the work at the Elvis Star Harbor ".
>
> The dredging is thus an action taken to not only recover from the effects of multiple deposition events, but to mitigate the future impacts of similar events by deepening the existing harbor and approaches. The cost of this Hazard event is captured in the cost of the dredging operation as detailed above: $1,900,000.
>
> From *The Hickman Courier*

Tornado

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. It is most often generated by a thunderstorm when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly and upper level winds, especially the jet stream runs at an angle relative to the prevailing surface winds. These conditions occur with regularity over the Purchase Region in the spring, but as evidenced recently, can occur at any time of the year. Tornadoes are often accompanied by large hail and damage is most often the result of the high wind velocity and wind-blown debris. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction. They have the power to uproot trees, structures, and turn harmless objects into deadly flying debris.

Most tornadoes aren't very wide and touch down only briefly. However, a highly destructive tornado may carve a path over a mile wide and several miles long. Tornadoes typically cause the most damage to lightly or poorly built structures, such as residential homes. An average of 800-1000 tornadoes are reported nationwide and they are more likely to occur during the spring and early summer months. Tornadoes can occur at any time of the day, but are more likely to form in the late afternoon or early evening.

In 2007 the Enhanced Fujita (EF) Scale (see Table 5.9) was introduced to better reflect wind speed and the amount of damage produced by tornadoes. It replaced the Fujita-Pearson Scale that defined every tornado on record in the United States since 1950. EF rankings are assigned after a tornado event has occurred and the National Weather Service has inspected the damage.

Table 5.11 The Enhanced Fujita Tornado Measurement Scale

Scale	Estimated Wind Speed	Typical Damage
EF0	65-85 mph	Light Damage - Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
EF1	86 – 110 mph	Moderate Damage - Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	111 – 135 mph	Considerable Damage - Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light object missiles generated; cars lifted off ground and thrown.
EF3	136 – 165 mph	Severe Damage - Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
EF4	166 – 200 mph	Devastating Damage - Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
EF5	>200 mph	Incredible Damage - Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Table 5.12 Tornado Events and Impacts in Fulton County
January 1, 2012 – March 31, 2017

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
JORDAN	04/28/2014	16:24	CST-6	EF1	0	0	30.00K	0.00K
TYLER	06/07/2014	13:48	CST-6	EF1	0	0	10.00K	0.00K
SASSAFRAS RIDGE	03/09/2017	20:28	CST-6	EF1	0	0	250.00K	0.00K
HICKMAN	03/09/2017	20:41	CST-6	EF2	0	0	1.000M	0.00K
Totals					**0**	**0**	**1.290M**	**0.00K**

Source: National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Events Database:
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

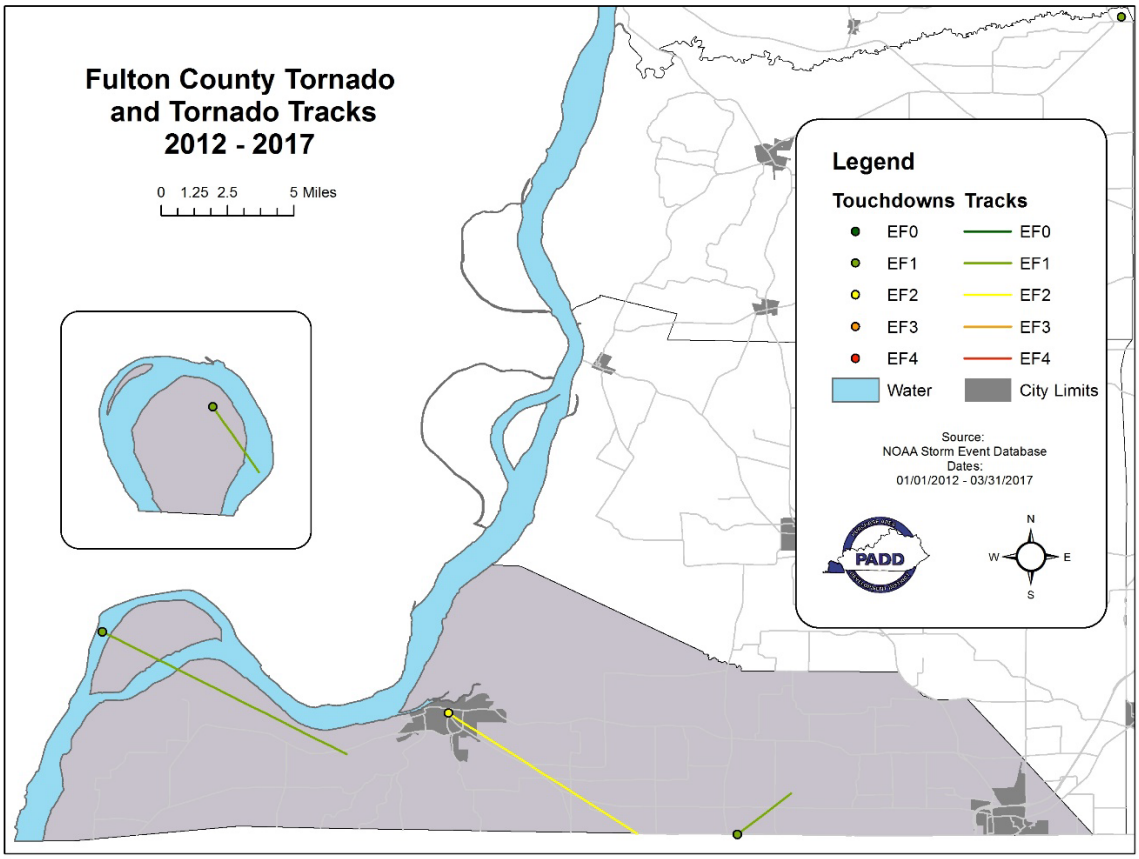
Two of the most recent tornado events occurred on the same day in Fulton County and caused a substantial amount of damage ($1.250M), luckily there were no reported injuries or fatalities.

- March 9, 2015: (1) this tornado began in New Madrid County, Missouri, where it briefly attained EF-2 strength. The tornado crossed the Mississippi River at EF-1 intensity into agricultural flatlands of western Fulton County. A swath of highly convergent tree damage occurred in some wooded bottomlands along the Mississippi River levee in Fulton County. As it crossed open farmland, a few farm sheds were destroyed. Power poles and power lines were blown across roads. Swaths of tree damage occurred along tree lines between farm fields. Irrigation pivots were blown over. Several grain bins were destroyed, including a grain bin that was blown over or through a row of trees and across Highway 94. Peak winds were estimated near 110 mph on the Kentucky side of the track. The tornado ended shortly after crossing Kentucky Highway 94 about 2.5 miles west of Hickman. There was scattered tree damage associated with straight-line winds south of the tornado track, likely associated with the rear-flank downdraft. A trained spotter measured a wind gust to 85 mph 5 to 10 miles west of Hickman. A reported $250,000 in damages.

- March 9, 2015: (2) A tornado quickly developed over the city of Hickman and moved southeast across Fulton County. This was the second of two tornadoes in Fulton County. In the center of Hickman, the tornado caused significant damage to the county's jail and 911 communications center, which lost parts of the roof and a section of a wall. About 100 inmates were moved to other facilities. Other damage in Hickman included a heavily damaged gas station, numerous downed signs and power poles, and considerable roof damage to a few homes. The tornado damaged or destroyed more than 45 homes and other buildings in the county, as well as several machine sheds, barns, grain bins, and irrigation systems. At least 20 power poles were broken, and numerous trees were

uprooted and snapped. The Kentucky Transportation Cabinet's Fulton County Highway Maintenance Facility was hit by the tornado. The salt dome, a tractor shed, and several tractors housed in the shed were damaged. The tornado reached its peak intensity just southeast of Hickman along Highway 125, where a frame house had its entire roof structure blown off. The tornado followed Highway 125 from the center of Hickman to the junction of Highway 166, about 4.5 miles southeast of Hickman. Most state highways were closed in and near Hickman, and the Red Cross opened a shelter. Peak winds were estimated near 125 mph. Straight-line winds up to 80 mph occurred mainly southwest of the tornado path. The tornado crossed into Tennessee along State Route 116. A reported $1.00M in damages.

Figure 5.4 Vulnerability to Tornados through Identification of Tornado Tracks January 1, 2012 – March 31, 2017



SUMMARY AND CONCLUSIONS OF TORNADO PROFILE

During the period covered by the update (01/01/2012 – 03/31/2017) there have been four occurrences of a Tornado Events in Fulton County recorded by the NCEI. There are no reported injuries or fatalities and the Events resulted in $1.290M in personal property damage.

Information from Table 5.10 and Figure 5.4 related to Tornadoes can be used to define the frequency of tornado events and the impact of these events. Data on tornado event magnitude is provided in the form of the Enhanced Fujita Scale as shown on the map.

Fulton County experienced four events over a 5.25 year period, which divides out to .76 Reported Tornado Events per year, or a 75% probability that such an event will occur in any given year. Based on recorded events and reported damages, the cost of a Tornado Event could be calculated as:

- $1.290M divided by 4 events = $322,500 per event.
- $322,500 times .75 events/year = $241,875 per year.

Any area in the county is as vulnerable as another and tornado events are completely random and unpredictable. Of critical concern to the Fulton County MPT, and the main contributing factor in their consideration of risks and vulnerability, is the potential human cost of Tornado Events. Although there are no recorded fatalities or injuries in recent events, the amount of damages sustained in two events on March 9, 2017 are a reminder to the MPT that the citizens of Fulton County were fortunate to have no loss of human life during these violent storms.

Earthquake

An earthquake is a geologic event that involves movement or shaking of the earth's crust. Earthquakes are usually caused by the release of stresses accumulated as a result of the rupture of rocks along borders of the earth's ten tectonic plates. Earthquakes can affect hundreds of thousands of square miles, causing damage to property, resulting in loss of life and injury, and disrupting the social and economic functioning of the affected area.

An assessment of the earthquake threat to the entire Purchase Region is provided in the regional plan. All of Fulton County lies in an area that has a 10 per cent probability of an earthquake in the new Madrid Seismic Zone producing ground motions that exceed 20-25% of "G" during the next 50 years (See Figure 5.5). That would equate to a VI on the Modified Mecalli Scale, or a 5.4 on the Richter. (Trees sway, suspended objects swing, and objects fall off shelves).

That does not mean it will happen in fifty years, as one could look at the data and just as correctly assume that there is a 90% probability that the region will not experience this level of ground motion during a given 50 year period. It should be noted that 25% of G is an acceleration of 98 inches/second/second.

Even the precise location of faults within the New Madrid Seismic Zone are subject to debate. No one knows what causes New Madrid earthquakes. However, there are ideas that are being researched. Although there is great uncertainty regarding the cause of earthquakes, scientists generally do agree on what happens when they do occur – that is, the likely levels of ground shaking associated with the waves earthquakes emit. These levels are reflected in the National Seismic Hazard Maps, which represent the products of a long consensus building process. These maps also account for the uncertainties in our understanding.

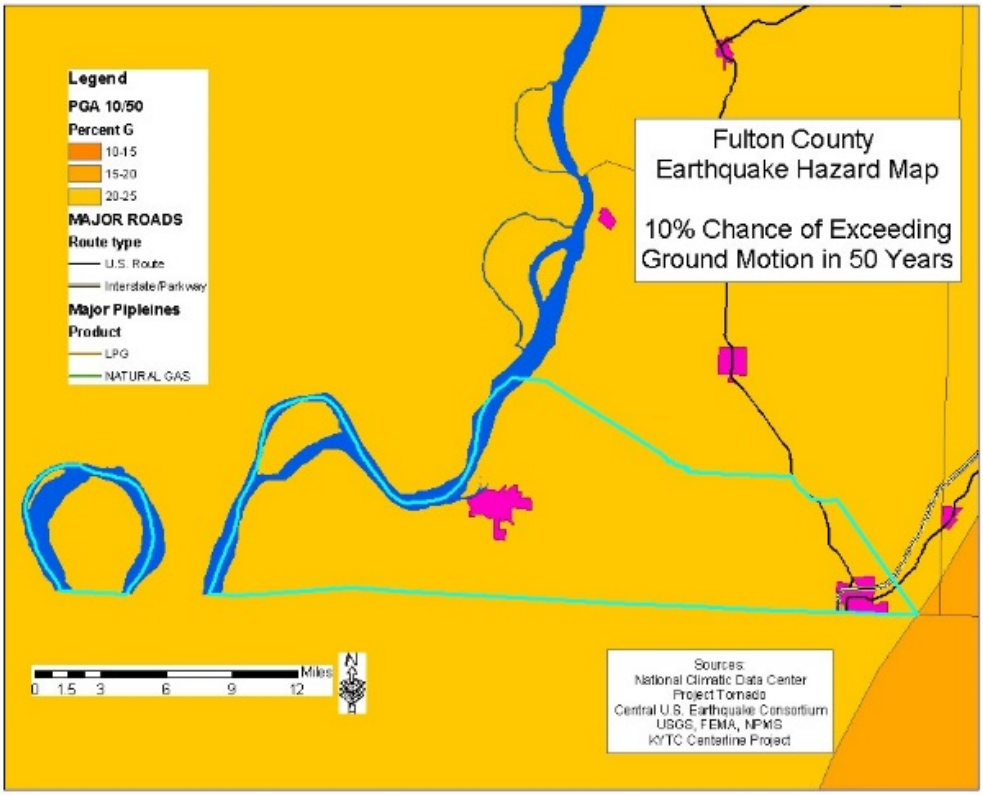
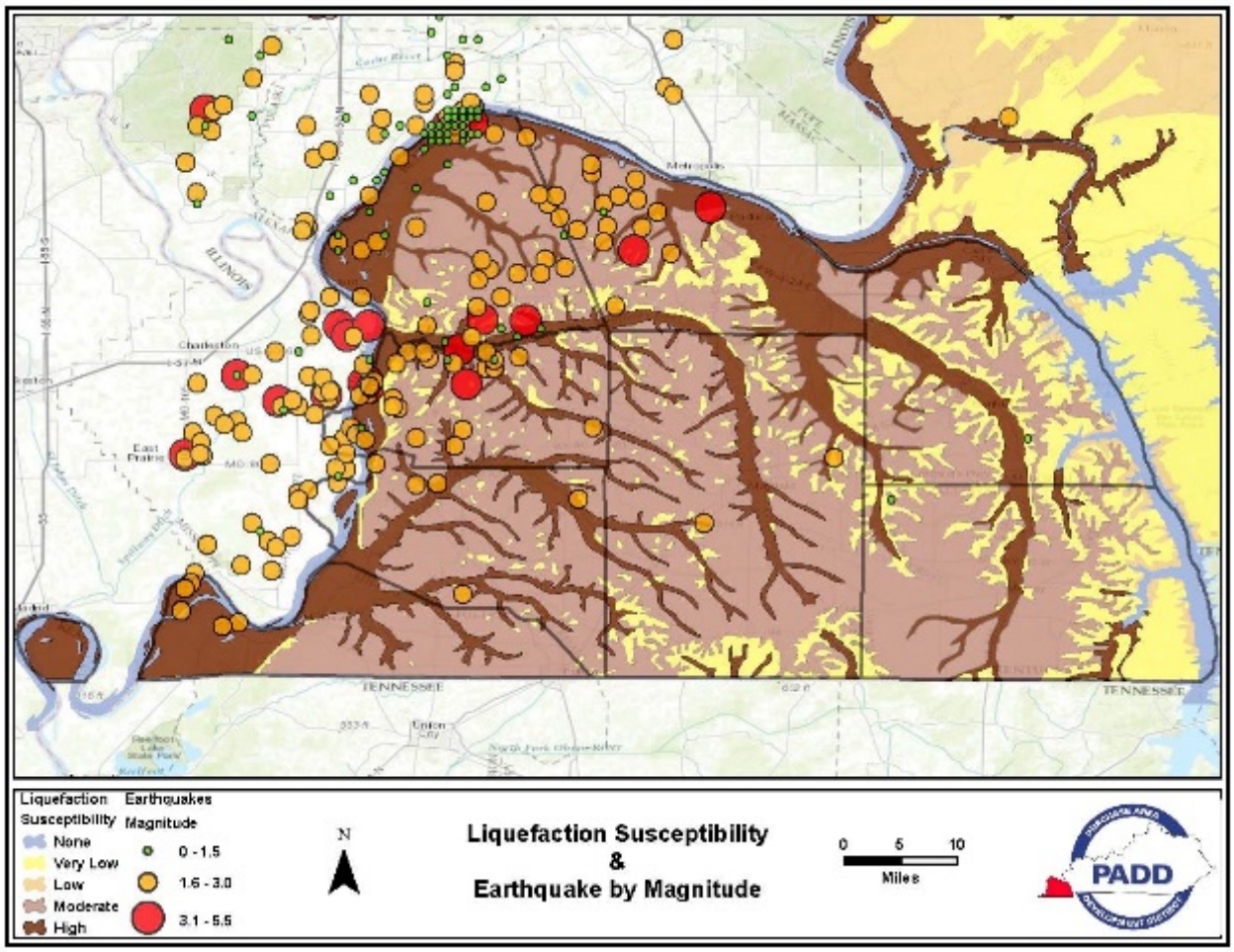


Figure 5.5 Earthquake Ground Motion Map

At issue for all the Purchase Region and virtually all of Fulton County would be the effect of a large magnitude quake on the soils underlying the region. The ground shaking estimate accounts for both the likely ranges of recurrence intervals and locations. Due to the relatively low rate of seismicity, ground cover, deep soil, etc., most faults within the region aren't even mapped.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends on the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site and regional geology. Earthquakes may also cause liquefaction. Liquefaction occurs when the ground soil loses the ability to resist shear and flows much like quick sand. When liquefaction occurs, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Figure 5.6 Generalized Liquefaction Susceptibility & Earthquake Magnitude of the Purchase Region



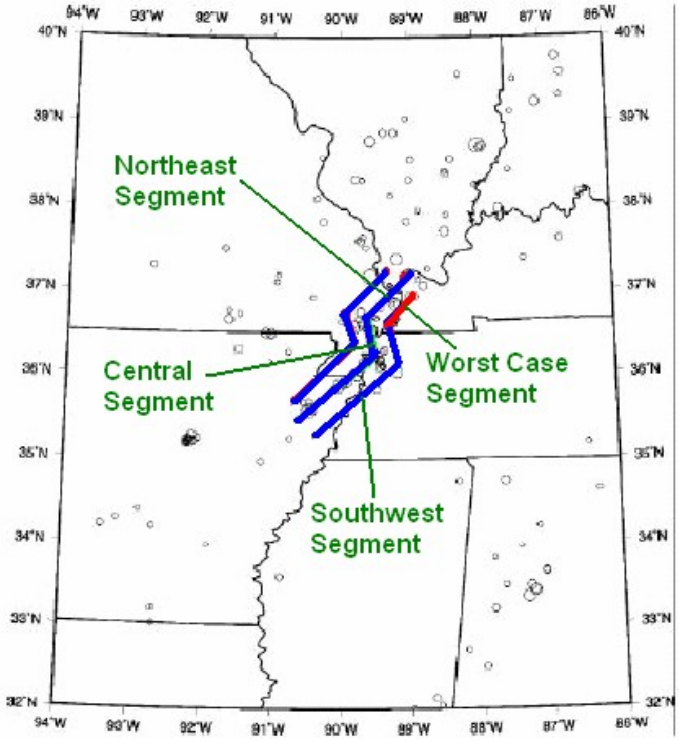
Source: USGS Map was derived from the USGS Earthquake Catalog, Available at: https://earthquake.usgs.gov/earthquakes/search/

Included as an Appendix 2 to the regional plan and the Fulton County Annex are excerpts from Mid-America Earthquake Center Report 08-02 "Impact of Earthquakes on the Central USA". This report is the result of a FEMA funded Project completed under the management of the U.S. Army Corps of Engineers.

> The NMSZ scenario for the State of Kentucky consists of a magnitude 7.7 (Mw7.7) earthquake along the northeast extension of the presumed eastern fault line in the New Madrid fault system. The ground motions used to represent this seismic event were developed by the U.S. Geological Survey (USGS) for the middle fault in the proposed New Madrid Seismic Zone (NMSZ). Each fault line is presumed to consist of three fault segments; northeastern, central, and southwestern. This scenario, the worst case event for Kentucky, employs an event in the northeast segment of the eastern fault. The location of this scenario event is illustrated in Figure 5.7. For more information on the ground motion used in this scenario please reference Appendix 2.
>
> This earthquake impact assessment includes all 120 counties in the State of Kentucky. Kentucky is approximately 40,400 square miles and is bordered by Indiana and Ohio to the north, Tennessee to the south, West Virginia and Virginia to the east and Illinois and Missouri to the west. For the purposes of this analysis, 25 critical counties have been identified in the western portion of the state where shaking is anticipated to be most intense. These 25 counties are the focus of much of the damage assessment included within this document". Purchase counties included as critical counties are Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, McCracken, and Marshall.
>
> Within the State of Kentucky, nearly 29,000 buildings experience complete damage, which are included in the nearly 53,000 at least moderately damaged buildings. While this is roughly 2% of all Kentucky buildings, many of these collapsed structures are concentrated in the western counties. As with previous state scenarios, residential buildings experience the greatest amount of damage. Nearly 98% of all building collapses occur to residential structures. In addition, about 94% of all at least moderate damage occurs in the 25 critical counties for Kentucky.

More detailed data from the scenario's results are included in the Appendix 2.

Figure 5.7 Scenario Fault Location for the State of Kentucky



SUMMARY AND CONCLUSIONS OF EARTHQUAKE HAZARD PROFILE

Low magnitude earthquakes occur constantly in the New Madrid Seismic Zone. Depending on the depth and magnitude, some of the stronger tremblers, 3 and above, are felt throughout the entire region. Damages amount to the rare instance of a picture being knocked off a wall or items shaken from shelves.

The potential for an earthquake of catastrophic proportions is not open to debate. Historic and geologic evidence are proof. However, the probability of such an event in any given time frame is open to interpretation and the effects are still a matter of discussion. The excerpts from Report 08-02 include the results generated by the team at the Mid-America Earthquake Center, of a HAZUS simulation for a New Madrid magnitude 7.7. The results clearly support at least the Moderate Risk ranking of this hazard, and provide detailed potential damage and casualty estimates.

Winter Storm

Winter Storms can produce an array of hazardous weather conditions that include heavy snow, freezing rain and sleet, high winds and extreme cold. Winter storms are fueled by strong temperature gradients and an active upper-level cold jet stream. Winter storms can paralyze a community by shutting down normal everyday operations. Accumulating snow and ice can result in downed trees and power lines and may block transportation routes or make them hazardous. Heavy snow can also lead to the collapse of weak roofs or unstable structures. Often, the loss of electricity results in the loss of heat in some homes and buildings. This presents a threat to human life, especially the elderly population.

The level of impact Winter Storms have on a community is greatly determined by their ability to manage and control the affect it has on the community, for example the rapid mobilization of snow removal equipment. Because severe winter storms are sporadic in western Kentucky, many communities cannot afford the expensive equipment and maintenance of snow removal equipment. This increases the potential damage a severe winter storm may cause. If more than a half-inch of ice accumulation occurs and damage is widespread, it can take a while to remove trees and repair power lines. This can result in a loss of electricity and heat for several days.

During the planning period for this update there have been seven Winter Storms recorded in Fulton County. No Damages or injuries were reported in these events, but there was one fatality caused by hypothermia.

Table 5.13 Winter Storm Events and Impacts in Fulton County, January 1, 2012 – March 31, 2017

Location	Date	Time	Time Zone	Deaths	Injuries	Property Damage	Crop Damage
FULTON (ZONE)	12/06/2013	00:00	CST-6	0	0	0.00K	0.00K
FULTON (ZONE)	02/04/2014	12:00	CST-6	0	0	0.00K	0.00K
FULTON (ZONE)	03/02/2014	10:00	CST-6	0	0	0.00K	0.00K
FULTON (ZONE)	02/16/2015	00:00	CST-6	0	0	0.00K	0.00K
FULTON (ZONE)	02/20/2015	14:00	CST-6	0	0	0.00K	0.00K
FULTON (ZONE)	03/04/2015	14:00	CST-6	1	0	0.00K	0.00K
FULTON (ZONE)	01/22/2016	01:00	CST-6	0	0	0.00K	0.00K
TOTALS				**1**	**0**	**0.00K**	**0.00K**

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event occurred in multiple counties, including Fulton County on March 4, 2015. The event contributed to the death of a 60-year old man in the City of Hickman.

- A major winter storm dumped 6 to 18 inches of snow across western Kentucky. The Kentucky governor declared a state of emergency for the second time in less than a month. Snowfall amounts were lowest in the Henderson and Owensboro areas, where 6 to 8 inches was reported. The highest amounts were from 15 to 18 inches in a swath extending from Mayfield east across the Land-Between-The-Lakes area, then east through the Western Kentucky Parkway corridor to Central City. Rain gradually changed over to snow during the afternoon and early evening. A few hours of sleet and freezing rain occurred during the transition from rain to snow. Up to an inch of sleet accumulated, followed by snow. The snow fell heavily during the night, accumulating at the rate of two inches per hour and reducing visibility below one-half mile. The highest specific snowfall reports were about 17 inches in Muhlenberg, southern Hopkins, and northern Christian Counties. Paducah and Hopkinsville each reported 12 inches. Other specific snowfall reports included: 15 inches at Benton, Mayfield, and Cadiz, 10 inches at Murray and near Fulton, 8 inches at Owensboro, and 6 inches at Henderson. North winds gusted up to 25 mph, causing some drifting of the snow. Drifts were locally up to two feet deep. Travel became very difficult. In much of western Kentucky, unplowed roads were impassable to smaller, lighter vehicles. Interstate 24 was closed through most of western Kentucky due to numerous crashes and stranded vehicles blocking traffic. The closure extended from exit 11 in the Paducah area to the Cadiz exit in Trigg County. Two companies of the Kentucky National Guard were deployed to assist hundreds of individuals stranded in their vehicles on Interstate 24, some of them for almost 24 hours. Hundreds of semis were stranded, along with numerous other vehicles. The interstate was blocked or closed for most of the 24-hour period following the snowstorm. The most persistent blockages and closures were in Lyon, Caldwell, and northern Trigg Counties. In Hopkins County, a double-trailer semi crashed on southbound Interstate 69, blocking both lanes for several hours. A portion of the Western Kentucky Parkway was also closed due to a semi that was stuck in snow. Across western Kentucky, authorities received hundreds of requests for assistance from stranded motorists, and there were over one hundred accidents. In Christian County alone, at least 138 motorists required assistance after sliding off roadways or getting stuck. Christian County reported 45 accidents in that county, including nine with injuries. In Marshall County, an elderly man died after his car slid into a ditch and caught fire (indirect fatality). In Graves County, two persons were injured in a two-vehicle accident on the Purchase Parkway. The parkway was closed for about an hour. At Paducah, the U.S. 45 Bridge over the Ohio River to Illinois was closed. Barkley Regional Airport at Paducah was closed for a day. Schools were closed for the remainder of the week in most counties. The 12.1 inches of snow at Paducah was the heaviest March snowstorm on record for that location. It was also the third largest snowstorm for any time of the year. This snowstorm was eclipsed only by the 14.2-inch snowstorm on Dec. 22-23 of 2004 and the 12.2-inch storm on January 16-17 of 1978. Some of the coldest air ever recorded in the month of March invaded western Kentucky the day after the snowstorm, hampering snow removal efforts. The low temperature of 6 below zero at

Paducah on March 6 was the coldest reading not only for the date, but also for the month of March. In Hickman, a 60-year-old man died of hypothermia while seeking shelter after a car accident (direct fatality). The man did not sustain any injuries in the crash, which occurred while snow was falling during the night. He was wearing a thin layer of clothes. His body was found up against a business the following afternoon. Wind chills dropped as low as 8 degrees above zero on the morning of his death. Road crews stopped spreading salt because of its ineffectiveness in the cold weather. In the wake of a strong cold front that passed through on the night of the 3rd, an arctic high pressure center moved southeast into the central Plains. A deep 500 mb trough progressed slowly eastward from the Rockies across the Plains. This trough was responsible for a sustained period of moist southwest flow aloft. The relatively moist air overrunning cold air near the surface set the stage for widespread moderate to heavy snow.

SUMMARY AND CONCLUSIONS OF WINTER STORMS PROFILE

From January 1, 2012 through March 30, 2017, there have been seven occurrences of Winter Storms in Fulton County reported by the NCEI. There were no recorded monetary damages reported with these occurrences. Likewise, there were no injuries but there was one fatality recorded as a result of hypothermia.

The seven reported Winter Storm Events over the 5.25 year plan update period, divides out to 1.33 Reported Winter Storm Events per year, or a more than 100% probability that such an event will occur in any given year. The annual cost of a Winter Storm Event could not be calculated based on recorded events for the planning update period.

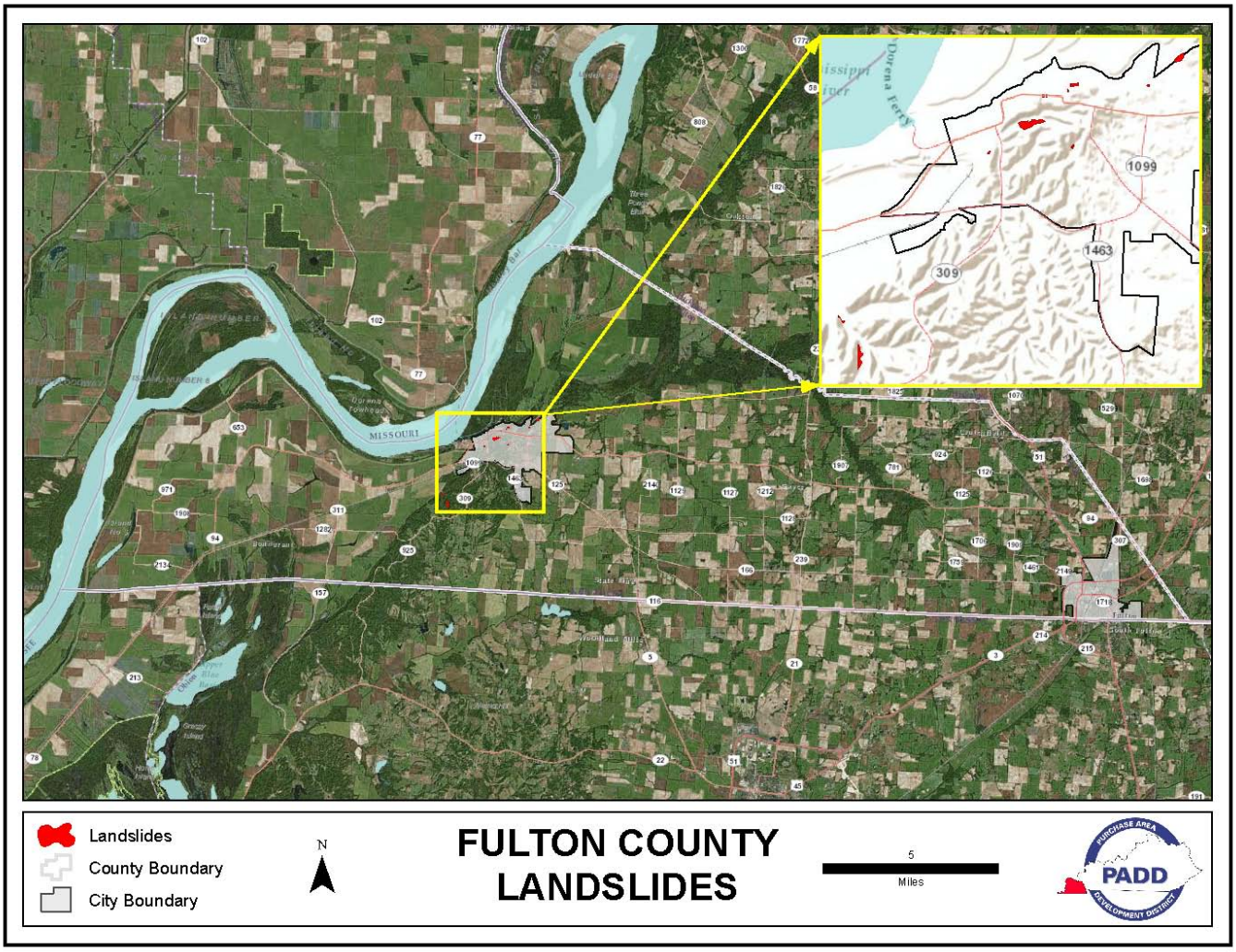
Landslides

Landslides most often happen in correlation with other natural disasters such as earthquakes and flooding. In western Kentucky, there are many large landslides along the bluffs of the Mississippi River. These slides usually occur within the thick loess deposits (mostly silt with some sand, gravel and clay) that cover the bluffs. Groundwater seeps through more permeable sands and gravels down to impermeable silts and clays. Continual seepage or after heavy rains can contribute to slides. The series of New Madrid earthquakes in 1811-1812 also caused several of the larger landslides along the bluff.

The Fulton County MPT had a concern for the threat posed by the Landslide Hazards, especially in the City of Hickman. Several residential areas in the city are within a few feet of the bluff's edge. During the flooding in 2011 the U.S. Army Corps of Engineers had to blow the levee at Blue Bird Point along the Mississippi River to relive flood waters from overtaking the City of Cairo, Illinois. MPT members mentioned that the percussion from the blast generated some small landslides along the bluffs in and near Hickman.

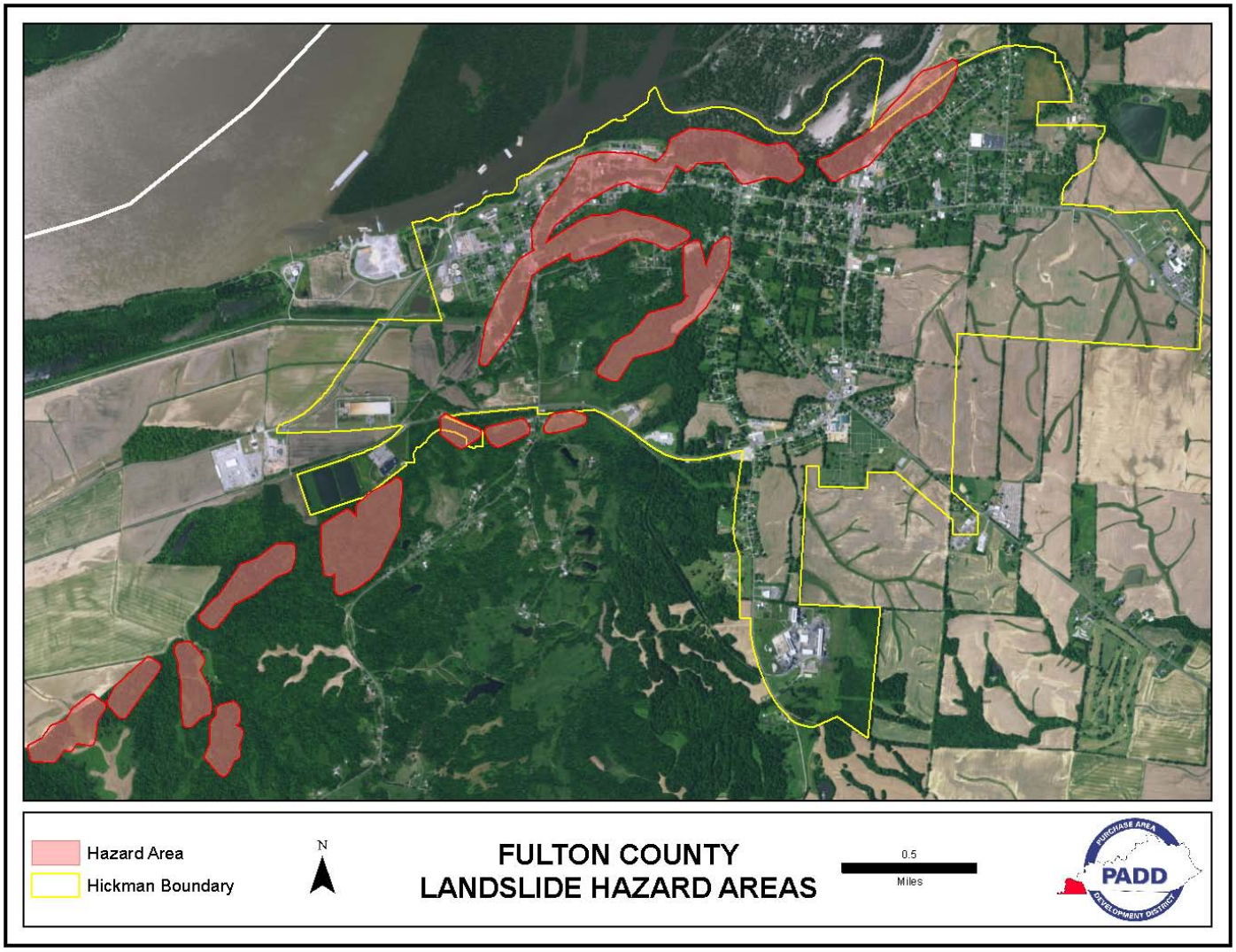
In the 2013 Kentucky State Hazard Mitigation Plan, Fulton County received a relatively moderate rating for landslide risk potential; however, scores for exposure, landslide hazard and vulnerability all rated in the severe category in and near the City of Hickman. The information from the maps below was developed by the Kentucky Geological Survey utilizing LiDAR (Light Detection and Ranging) data. Figure 5.8 displays landslide locations and Figure 5.9 identifies the landslide hazard areas in Fulton County.

Figure 5.8 Fulton County Landslides



Source: Kentucky Geological Survey

Figure 5.9 Fulton County Landslide Hazard Areas



Source: Kentucky Geological Survey

SUMMARY AND CONCLUSIONS OF LANDSLIDE PROFILE

The City of Hickman has suffered historically from landslides on the Mississippi Bluffs. However, there is no specific data on occurrences that would allow a Hazard Profile including periodicity and monetary damages to be developed. This shortcoming may be addressed as one of the mitigation measures, and data collected as events occur. The Kentucky Geological Survey (KGS) does maintain a Landslide Inventory that houses information to various degree of past landslide events as recorded anecdotally, publicly, etc. The KGS Landslide Inventory records fourteen (14) past landslide events for Fulton County. All events occurred in the City of Hickman. However, the Landslide Inventory does not convey much information beyond coordinates of the landslide report. Only 2 of the 14 events records even a date of observation (July 7, 2011).

Consequently, for the purpose of this analysis, Purchase ADD and Fulton County assumes 14 landslide events since 2011. Thus, from 2011 to 2018 (8 years), there have been 14 events recorded (all in the City of Hickman). So, the City of Hickman in Fulton County can assume 1.75 landslide events per year. This would translate into a 100% probability of a landslide event occurring in the City of Hickman in Fulton County. This certainty should be caveated with two considerations: 1) Again, this analysis assumes that events have been recorded since 2011. This may not be the case. And, related, 2) the 14 events recorded in the Landslide Inventory could be observations of old landslides made available through new technology, e.g., statewide LiDAR.

According to the Kentucky Geological Survey by the University of Kentucky, Landslides Fact Sheet, landslides are common natural hazards that occur in all 50 states causing $2 billion in damages and resulting in an average of 25 to 50 fatalities each year. In Kentucky, costs of landslides and rockfall repair exceed $4 million annually, largely costs incurred by the Kentucky Transportation Cabinet. However, many slides unrelated to transportation which go unreported also pose significant hazards to people and infrastructure. Landslide projects from 2003 to 2013 funded from a Kentucky Hazard Mitigation Grant Program that acquires landslide damaged homes or stabilizes the area totals approximately $5 million.

The most expensive landslide mitigation effort in the state occurred in Hickman where the federal government secured $17 million to stabilize a large slide on the bluff of the Mississippi River. This particular landslide had a track length of 750 ft., according to the KGS Landslide Inventory.

Wildfire

A wildfire is an uncontrollable burning of grasslands, brush or woodlands. The potential for wildfire depends on surface fuel characteristics, weather conditions, recent climate conditions, and topography and fire behavior. There are three different types of wildfire classes:

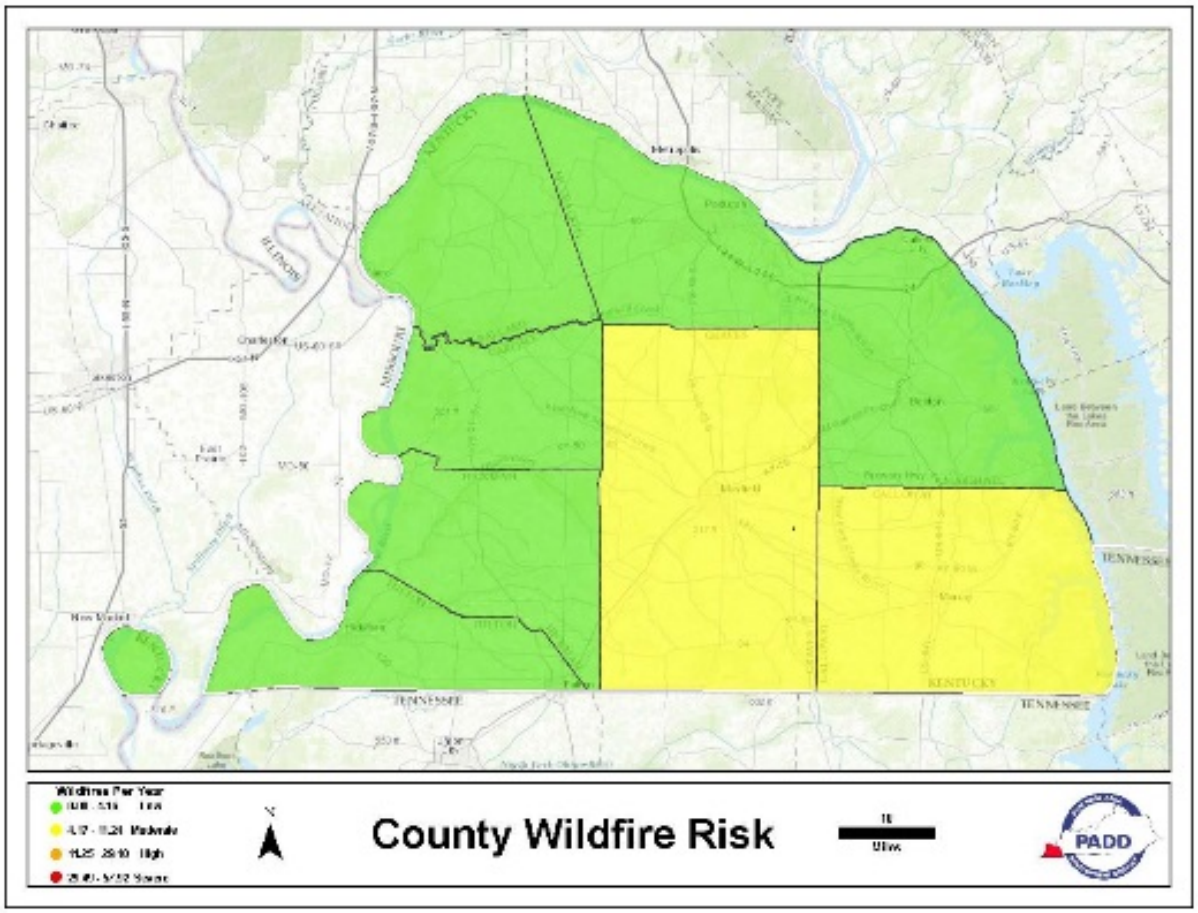
- *Surface fires* are the most common type. These fires burn along the forest floor moving slowly and will damage and kill trees.
- *Ground fires* are usually started by lightening. These fires burn on or below the forest floor.
- *Crown fires* are spread quickly by wind. These fires will move quickly by jumping along tree tops.
    - *Spotting* can be produced by crown fires as well as wind and topography conditions. Large burning embers are thrown ahead of the main fire. Once spotting begins, the fire will be very difficult to control.

Kentucky has two defined wildfire seasons: in the spring, February 15 – April 30 and in the fall, October 1 – December 15. These two seasons are separated by periods of higher moisture and colder, less conducive fire weather. When leaves begin to fall from deciduous hardwood trees a thick litter layer forms in wooded areas creating a fuel source for rapidly expanding wildfires. Also during the fall season, or periods of drought, tall grasses can become very flammable. It is possible for wildfires to occur outside the defined fire seasons during prolonged periods of drought.

Specific outdoor burning laws have been established to lessen the wildfire occurrence during these fire seasons. Kentucky Revised Statute 149.400 prohibits outdoor burning during the defined fire seasons between 6 am and 6 pm unless at a distance of at least 150 feet from woodlands or brushland. In Kentucky, wildfire risks are compounded by the state's extremely high arson rate. Sixty-two percent of Kentucky's wildfires are deliberately set by arsonists.

The biggest threat of wildfires in Kentucky exists in the eastern part of the state. In western Kentucky, specifically the Purchase Region, wildfires are less common. The 2013 State Hazard Mitigation Plan utilized a county risk assessment model to calculate county-level risk. This model was created using the *Average Annual Loss* data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by the average losses (See the 2013 State Hazard Mitigation Plan for more information.) This data was then joined to a county map for display purposes. The Purchase counties are seen in Figure 5.10. Based on this model the Purchase counties are at a moderate to low risk of wildfire occurrences. Fulton County is considered to be in the low risk category.

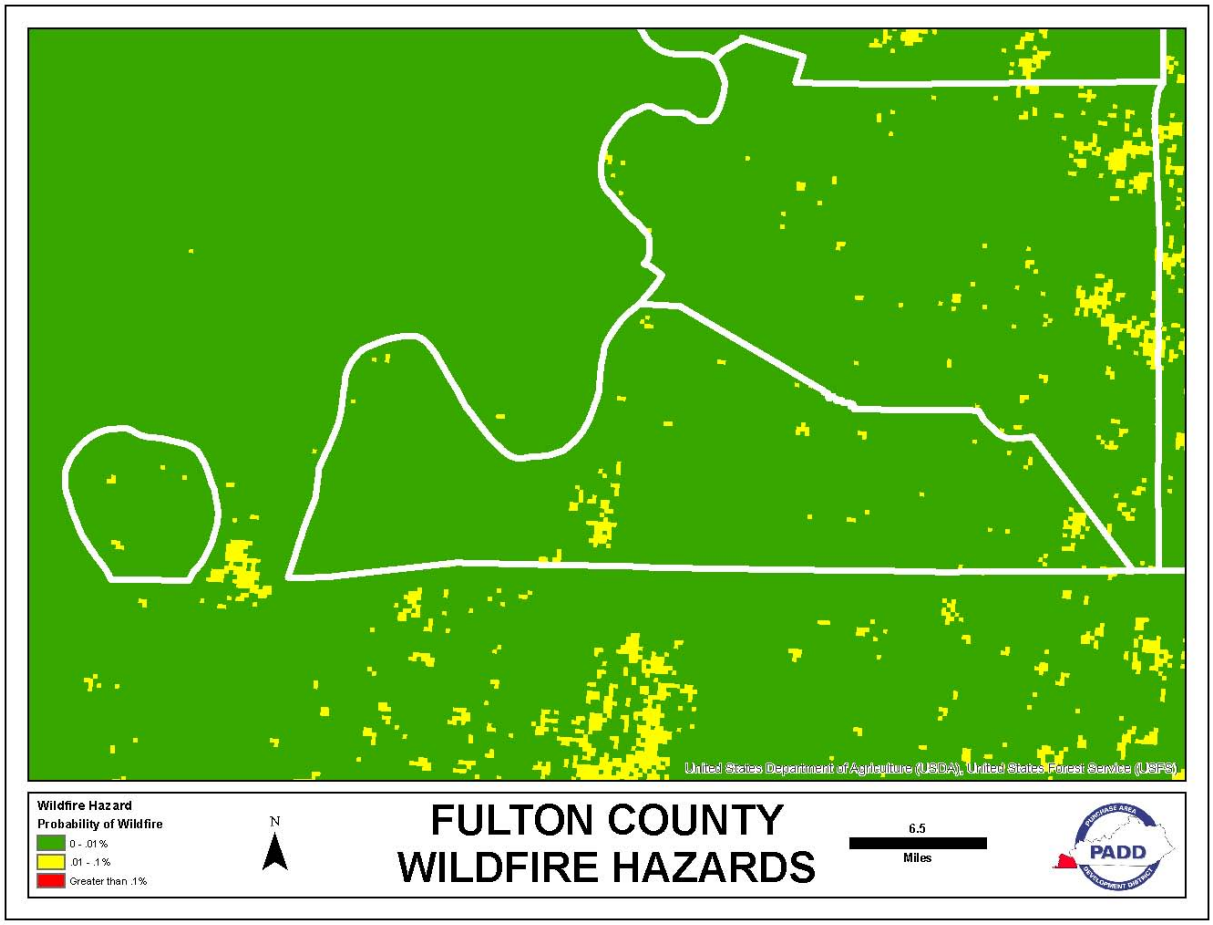
Figure 5.10 County Wildfire Risk



The JPHMC during the 2012 Plan update cycle believed, as a result of the 2009 Ice Storm, a significant percentage of the forest cover in the Purchase Region has been damaged. Some estimates suggest 30% or more of the existing forest could be killed off. This damage will result in considerable "dead and down" fuel, especially if drought and or wind events combine to exacerbate the problem. During the 2017 review, the general feeling is that this risk is greatly diminished at this time. It is likely that there were some number of small field fires during this period however that expense was not documented.

Information obtained from the Kentucky Division of Forestry, displayed in Figure 5.11, indicates that a majority of the county has a less than one percent probability of wildfire occurring.

Figure 5.11 Fulton County Wildfires



SUMMARY AND CONCLUSIONS OF WILDFIRE PROFILE

From January 1, 2012 through March 31, 2017, there have been zero occurrences of Wildfire Events reported in Fulton County by the NCEI and likewise zero events for the entire Purchase Region. In a search of the NCEI Storm Events Database there are only 11 reported events for the entire region. These occurred between February 1996 and January 2006. The last and only NCEI recorded event in Fulton County occurred on February 20, 2004. The complete history of wildfire events in the Purchase Region can be reviewed in Appendix 1.

With no historic data for damages to support wildfire as a hazard in Fulton County, does not mean that there have not been instances of brush fires that had or will have the potential to grow out of control, especially during periods of drought events. It is therefore included as a Hazard in the risk assessment, albeit a low risk, but a risk that needs to be continually assessed and planned for and perhaps anticipated.

The general feeling is that the ice storm of 2009 generated massive amounts of fuel, in the form of fallen limbs, and that this risk is greatly diminished at this time. It is likely that there were some number of small field fires during this period however that expense was not documented.

According to information found in the 2013 State Hazard Mitigation Plan, using the county risk assessment model, Fulton County has a 1.80 annual rate of occurrence for wildfires with an average loss of $1,153.00 per event.

5:4.3 Assessing Vulnerability: Identifying Assets Overall Summary Vulnerability

The vulnerability of structures to Severe Weather and Earthquake Hazards in Fulton County is equal to the total structure value of the county. These hazards are not limited to a particular geographic region. All critical facilities in the county were determined to be vulnerable to Severe Weather and Earthquake Hazards.

Fulton County's vulnerability to flooding was determined by GIS analysis. A GPS derived data base of Critical Facilities, and the Kentucky Infrastructure Authority database for Water and Waste Water facilities were brought into the GIS. FEMA revised Flood Hazard Areas were added as an overlay and where the data intersected those structures/facilities were deemed vulnerable to a 100 year flood. The vulnerability of residential structures was determined by a similar method, laying the Flood Hazard Areas over 911 GPS Structure Point Data, and imagery, to determine which structures were in the flood plain.

Impact & Frequency

The impact and frequency of each hazard is identified in each hazard profile in the previous section through maps frequency tables and graphs. Impact is addressed further in the charts and narrative discussions found in the following asset identification and vulnerability sections of this plan.

Identification of Assets

This section of the plan identifies what can be affected in each jurisdiction by the different hazard events that affect the Purchase Region. The information to complete this section was collected from a variety of sources using the HAZUS 4.0 Kentucky Data, the NOAA NCEI, the 2010 Census, U.S. Census Bureau 2011-2015 American Community Survey 5 Year Estimates and the Kentucky Revenue Cabinet. The information was collected, mapped and summarized by the PADD staff and reviewed and analyzed by the JPHMC for inclusion in the plan.

This section was prepared using the best available data for identifying the number of buildings, infrastructure and critical facilities and costs associated with them. Local structure point data was available to identify the types and numbers of structures in each hazard area.

Fulton County MPT members reviewed the following information to determine the vulnerability in each community. Tables were created by the PADD staff to estimate the numbers of existing buildings located in mapped Flood Hazard, Landslide and Wildfire Hazard areas. For the other identified hazards, tornados, thunderstorm wind, earthquakes, and winter storms MPT members were not able to identify specific hazard areas for those hazards which were determined to potentially affect anything within Fulton County. These hazards and their occurrence is not limited to any particular area based on past historical events and documentation as provided in the hazard profiles for the hazards.

Critical Facilities and Infrastructure

For the purpose of this plan, the JPHMC adopted the definitions of the FEMA HAZUS Loss Estimation Model according to FEMA publication 386-1, version 4.0, pages 3-9 that state the following definitions of critical facilities and infrastructure. HAZUS separates critical facilities into five categories based on their loss potential.

For the purpose of this plan, all of the following elements are considered critical facilities except Hazardous Materials Facilities. It was determined by the regional council that Hazardous Materials Facilities would not be addressed as critical facilities. Rationale: Hazardous Materials facilities are addressed in existing Emergency Operations Plans at the Facility and jurisdictional level, which are deemed by the Committee as being both sufficient and beyond the expertise of the committee.

FEMA Critical Facilities Definitions

- Transportation Facilities include airways – airports, heliports; highways – bridges, tunnels, roadbeds, overpasses, transfer centers; railways – track segments, tunnels, bridges, rail yards, depots; waterways – canals, locks, seaports, ferries, harbors, docks, and piers.

- Lifeline Utility Systems such as potable water, wastewater, oil, natural gas, electric power and communication systems.

- Essential Facilities are essential to the health and welfare of the whole population and are especially important following hazard events. Consider not only their structural integrity and content value, but also the effects on the interruption of their functions because the vulnerability is based on the service they provide rather than simply their physical aspects. Essential Facilities include hospitals and other medical facilities, police and fire stations, emergency operations systems, evacuation shelters, schools, and health and human services to the PADD.

- High Potential Loss Facilities are facilities that would have a high loss associated with them, both physical and economical, such as nuclear power plants, dams, and military installations.

- Hazardous Materials Facilities include facilities housing industrial/hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins. (Note: Not considered in this Plan)

Critical Facilities Estimated Replacement Value Methodology

Due to a software compatibility problem between FEMA's HAZUS Program, ESRI's Arc and MS Windows, PADD staff was unable to generate complete critical facilities values for the region. FEMA and KYEM have acknowledged this issue and have committed to resolving this problem however this process will not be complete before the region plan expires.

As a result, staff has supplemented updated HAZUS information when available with local data to establish the estimated value of critical facilities. As a last result, data generated during the 2012 update cycle has been utilized to complete tables. For purposes of the update to the 2018 JPHM Plan, this combination of data sources constitutes the best data available.

PADD staff used a combination of GIS data sources and local GIS data layers to build a map of the critical facilities and infrastructure for each jurisdiction found in the hazard area. Estimates were done on a county basis.

Types and Numbers of Buildings for Severe Weather and Earthquake Hazards

Severe Weather Hazards and Earthquakes have been determined to potentially affect anything within each jurisdiction depending on the path of the hazard event. These hazards and their occurrences are not limited to any particular area based on past historical events and documentation is provided in the hazard profiles. They constitute four of the top five priority risks identified by the Fulton County MPT.

Table 5.14 refers to the total number of structures vulnerable to these hazards. This table represents residential structures only and was derived from U.S Census Bureau 2011-2015 American Community Survey 5 Year Estimates. Due to data limitations, the numbers of other types of structures was not available at the time of this plan. Future updates of the plan will include numbers of other types of structures as data becomes available.

Table 5.14 Severe Weather/Earthquake Hazard Vulnerable Assets

County	Number of Residential Structures		
	Structures in County	Structures in Hazard Area	% in Hazard Area
Ballard	3,889	3,889	100%
Calloway	18,237	18,237	100%
Carlisle	2,426	2,426	100%
Fulton	**3,360**	**3,360**	**100%**
Graves	16,753	16,753	100%
Hickman	2,335	2,335	100%
Marshall	15,898	15,898	100%
McCracken	31,342	31,342	100%
Total	**94,240**	**94,240**	**100%**

Sources: U.S Census Bureau 2011-2015 American Community Survey 5 Year Estimates

Critical Facilities and Infrastructure at Risk to Severe Weather and Earthquake Hazards

Using the HAZUS MH definition for critical facilities and infrastructure, the county and cities helped the PADD staff identify types and numbers of critical facilities and infrastructure (Table 5.15) that are vulnerable to storm, tornado, and earthquake vulnerability in Fulton County. These hazards have been determined to potentially affect anything within each jurisdiction, depending on the path of the hazard event. These hazards are not limited any particular area based on past events and documentation as provided in the hazard profiles.

Table 5.15 Fulton County Critical Facilities & Infrastructure Storm, Tornado, Earthquake Vulnerability

Type of Facility	# of Existing Buildings	Current Replacement Value	# in Hazard Area
County EOC	1	$2,117,395	1
Communication-Radio	2	$280,000	2
Fire Stations	3	$2,400,000	3
Public Safety Buildings	3	$5,400,000	3
Railways	4	$1,800,000	4
Government Buildings	17	$15,776,000	17
Hospitals			
Electric Power Plants			
Sewage Plants	2	$90,000,000	2
Package Treatment Plants			
Water Plants	2	$4,707,329	2
Pump Stations	12	$780,000	12
Lift Stations	16	$2,278,581	16
Flood Control Pump Stations	1	$988,380	1
Wells	4	$500,000	4
Storage Tanks	8	$6,207,543	8
Schools	6	$60,000,000	6
Airport	1	$1,940,000	1
Natural Gas Facilities			
Dams			
Bridges	31	$248,080,000	31
TOTAL	**113**	**$443,255,228**	**113**

Sources: When available local data was used and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System data and the costs were calculated based on standard planning costs.

Critical Facilities and Infrastructure at Risk to Flooding

The PADD GIS staff reviewed the best available information to provide an estimated number of residential structures and Critical Facilities that are vulnerable to flooding. GPS structure points, overlain with the Flood Hazard Areas were the primary source of at risk data, and Water Information System data base were used to determine at risk Critical Facilities.

Table 5.16 summarizes the numbers of structures in the flood hazard area for each county. The highlighted areas indicate the data for Fulton County.

Table 5.16 Flood Hazard Vulnerable Assets

County	Estimated Number of Residential Structures In Flood Hazard Areas		
	Number of Structures in County	Percentage of Structures in Flood Hazard Area	Number of Structures in Flood Hazard Area
Ballard	3,889	3.7%	147
Calloway	18,237	0.5%	101
Carlisle	2,426	3.2%	80
Fulton	**3,360**	**7.8%**	**268**
Graves	16,753	2.2%	361
Hickman	2,335	6.3%	147
Marshall	15,898	2.8%	444
McCracken	31,342	2.5%	768
Total	**94,240**	**2.5%**	**2,316**

Sources: U.S Census Bureau 2011-2015 American Community Survey 5 Year Estimates
PADD GIS Database

Figures 5.12, 5.13, 5.14 and 5.15 depicts the location of Fulton County's critical and transportation facilities in relation to the mapped 100 year flood zones.

Figure 5.12 Fulton County Flood Zones and Structures

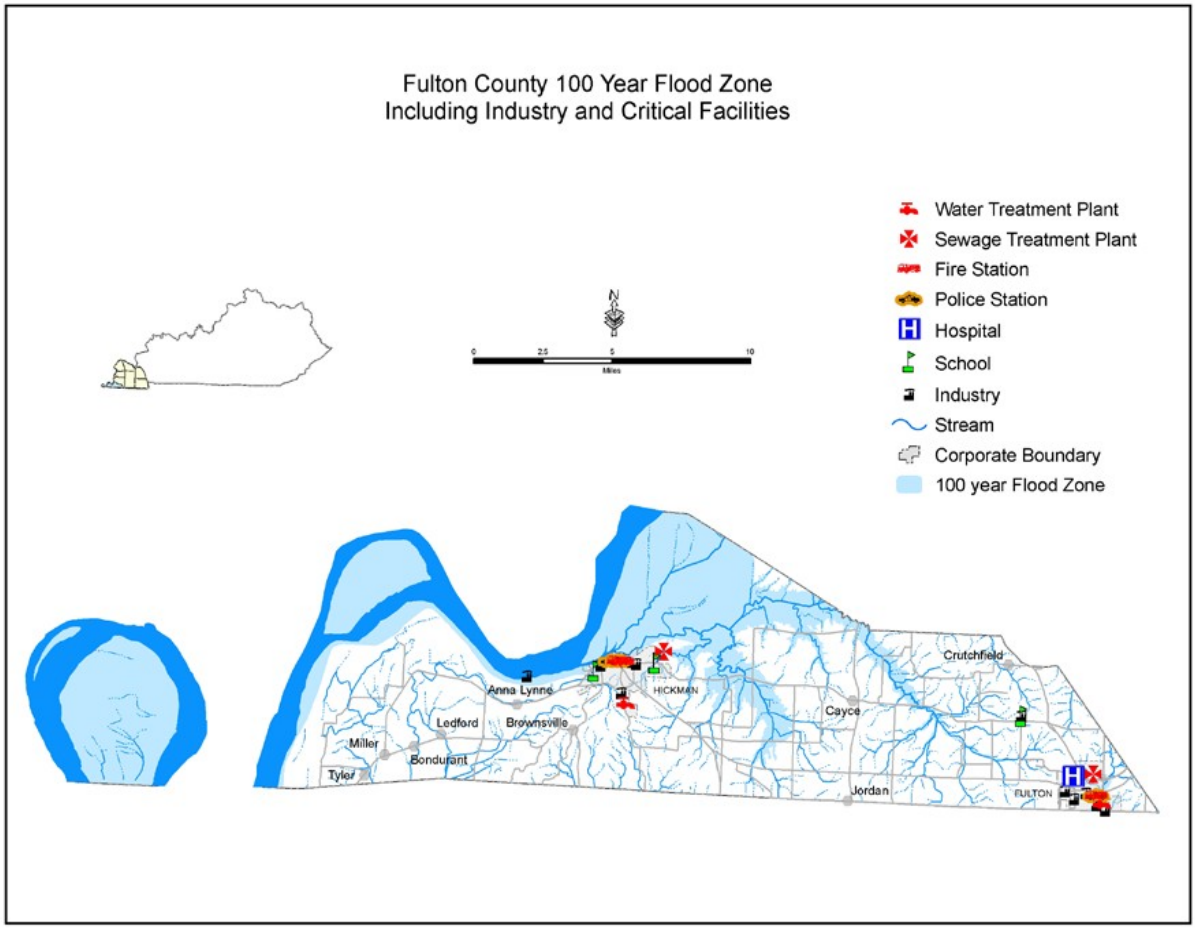


Figure 5.13 Fulton County Flood Zone Including Industry and Critical Facilities

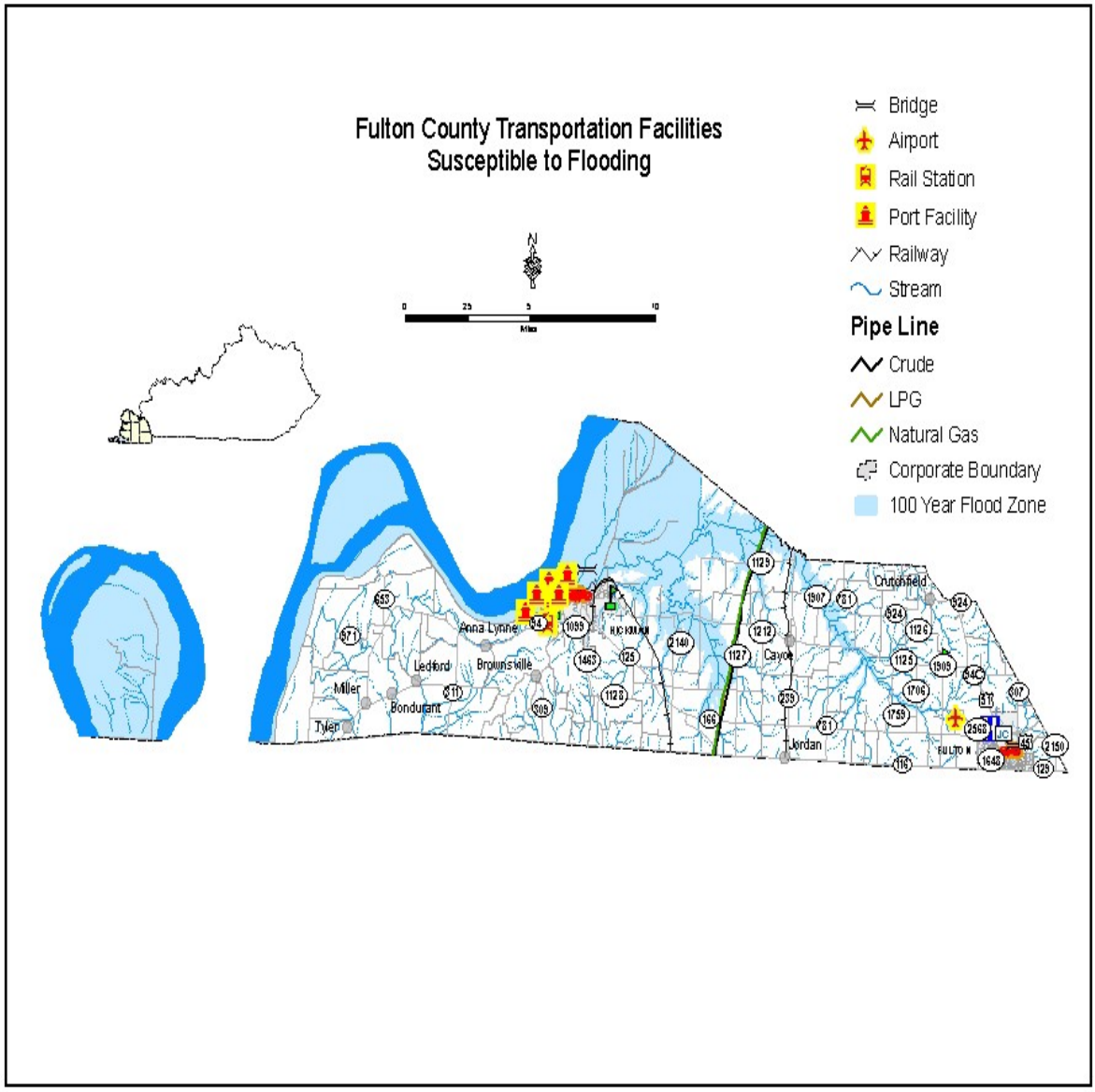


Figure 5.14 City of Fulton 100 Year Flood Zone Structure Map

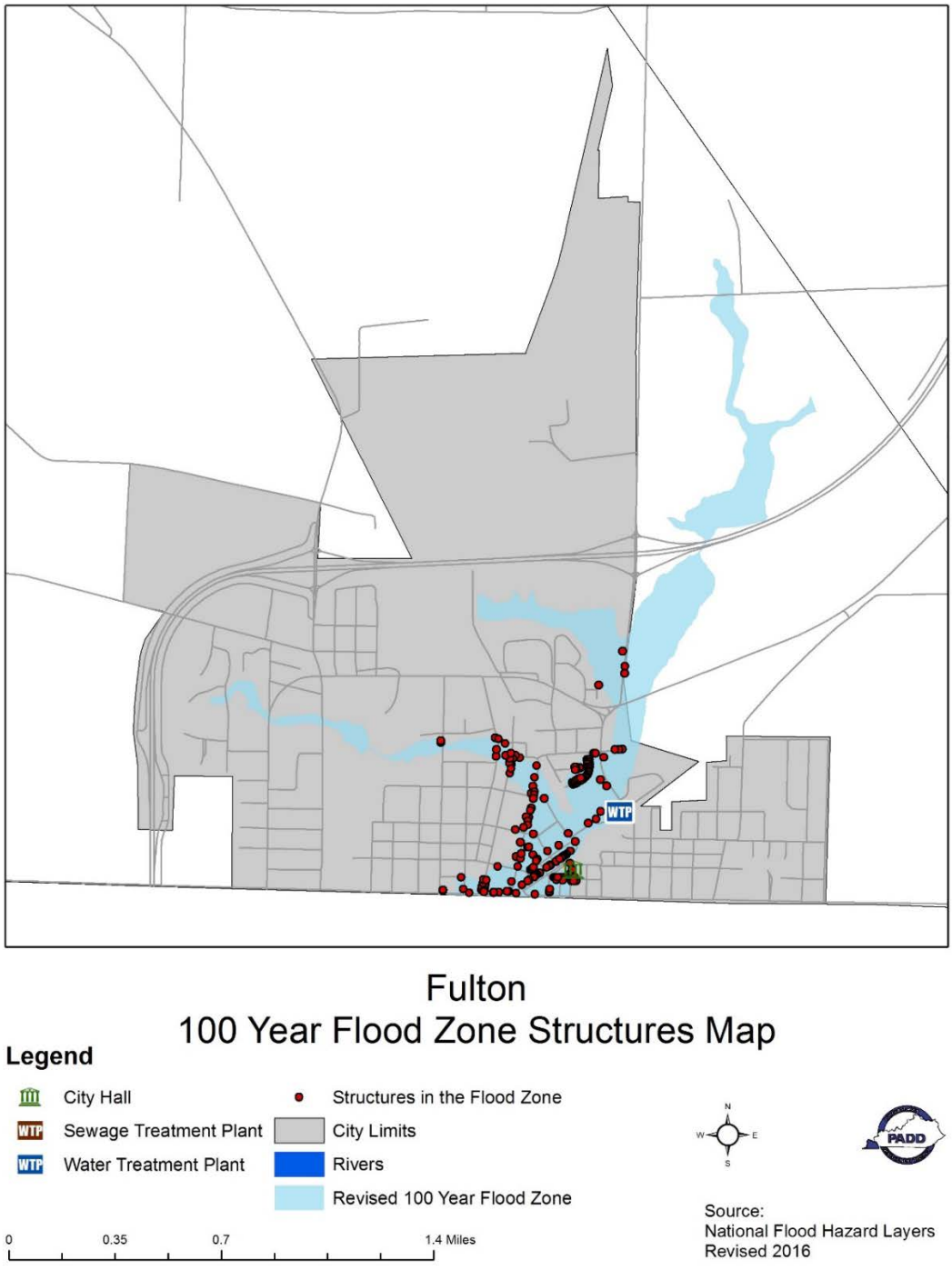


Figure 5.15 City of Hickman 100 Year Flood Zone Structure Map

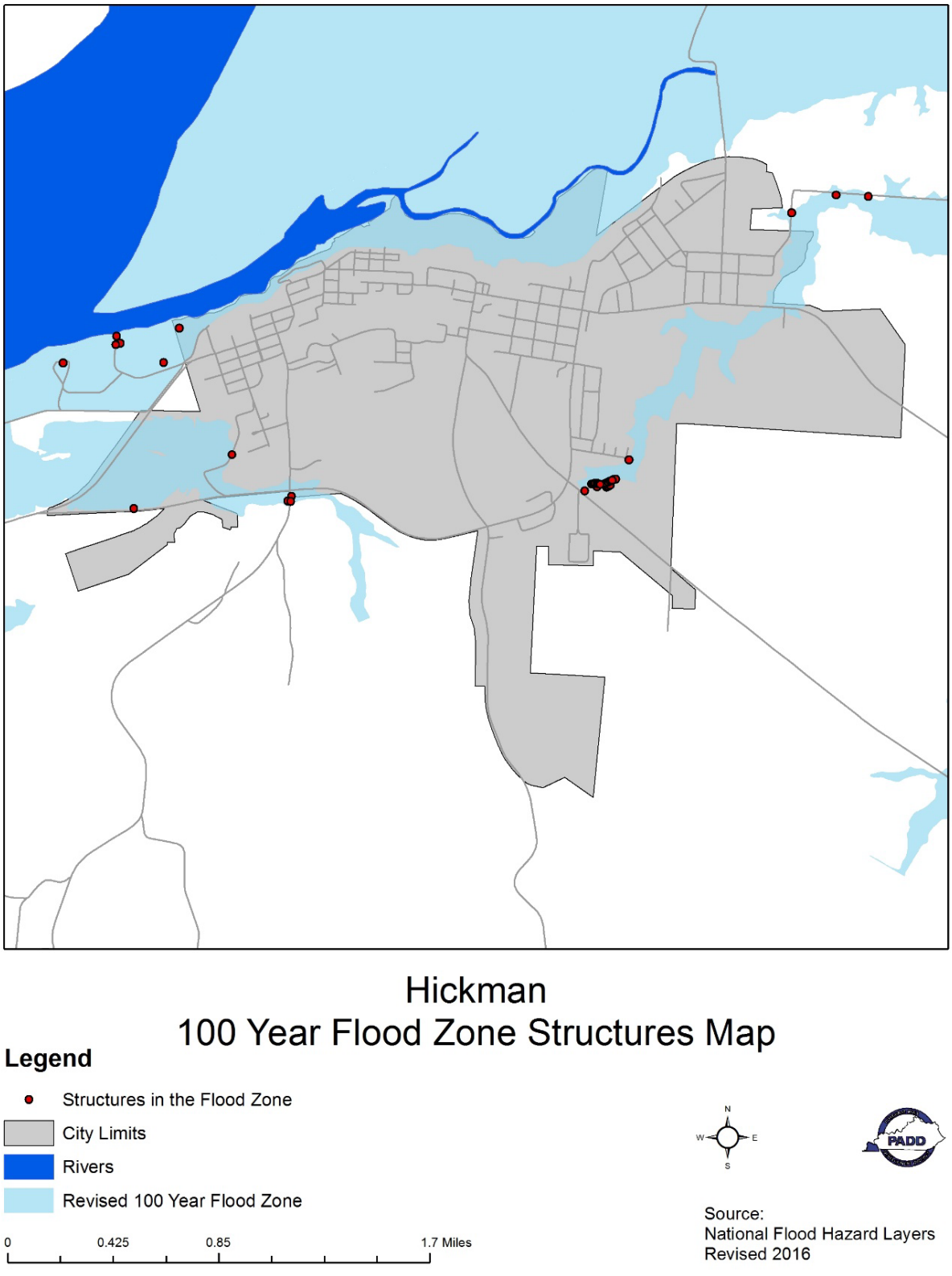


Table 5.17 summarizes the types and number of critical facilities and infrastructure in the identified flood hazard areas. Ownership issues provided some limitation in distinguishing what critical facilities belonged to a particular jurisdiction; therefore, asset vulnerability was determined on a county level.

Table 5.17 Fulton County Flood Vulnerability: Critical Facilities and Infrastructure

Type of Facility	# of Existing Buildings	Current Replacement Value	# in Hazard Area
County EOC	1	$2,117,395	
Communication-Radio	2	$280,000	
Fire Stations	3	$2,400,000	
Public Safety Buildings	3	$5,400,000	
Railways	4	$1,800,000	
Government Buildings	17	$15,776,000	1
Hospitals			
Electric Power Plants			
Sewage Plants	2	$90,000,000	1
Package Treatment Plants			
Water Plants	2	$4,707,329	1
Pump Stations	12	$780,000	2
Lift Stations	16	$2,278,581	5
Flood Control Pump Stations	1	$988,380	1
Wells	4	$500,000	
Storage Tanks	8	$6,207,543	
Schools	6	$60,000,000	
Airport	1	$1,940,000	
Natural Gas Facilities			
Dams			
Bridges	31	$248,080,000	17
TOTAL	**113**	**$443,255,228**	**28**

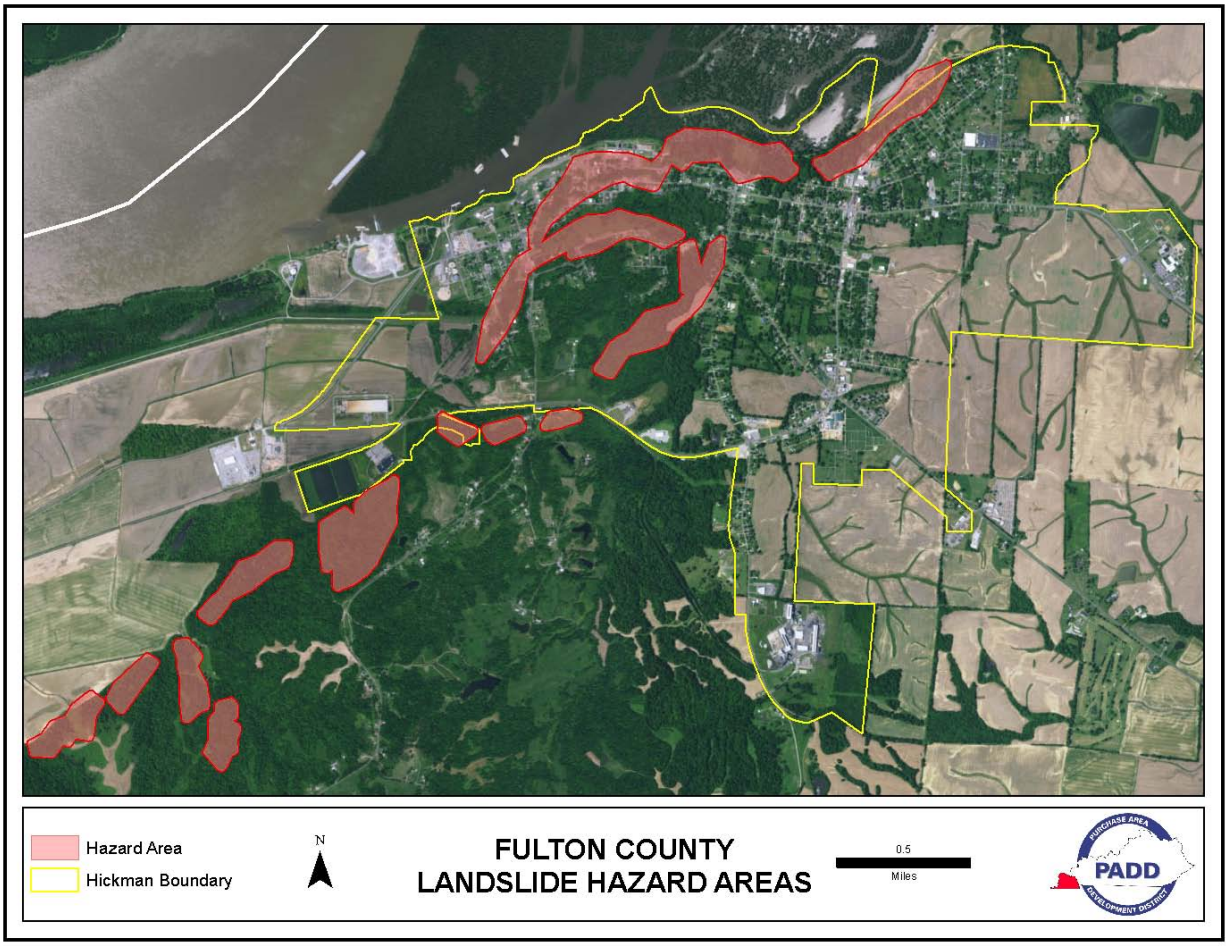
Sources: When available local data was used and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System data and the costs were calculated based on standard planning costs.

Landslide Hazard

Types and numbers of buildings

A GIS analysis was conducted to determine an estimated number of residential structures in landslide hazard areas. Utilizing the best available data and the identified landslide hazard areas obtained from the Kentucky Geological Survey, GIS staff estimate less than two percent of the county's 3,360 structures appear to be in or near the impacted areas. The area most at risk would appear the bluff areas in the City of Hickman. Figure 5.16 indicates the landslide hazard areas in the City of Hickman.

Figure 5.16 Fulton County Landslide Hazard Areas



Source: Kentucky Geological Survey

Table 5.18 summarizes the types and number of critical facilities and infrastructure in the identified landslide hazard areas. These charts were created using the mapped information above. Ownership issues provided some limitation in distinguishing what critical facilities belonged to a particular jurisdiction; therefore, asset vulnerability was determined on a county level.

Table 5.18 Fulton County Landslide Vulnerability: Critical Facilities and Infrastructure

Type of Facility	# of Existing Buildings	Current Replacement Value	# in Hazard Area
County EOC	1	$2,117,395	
Communication-Radio	2	$280,000	1
Fire Stations	3	$2,400,000	1
Public Safety Buildings	3	$5,400,000	1
Railways	4	$1,800,000	
Government Buildings	17	$15,776,000	
Hospitals			
Electric Power Plants			
Sewage Plants	2	$90,000,000	1
Package Treatment Plants			
Water Plants	2	$4,707,329	1
Pump Stations	12	$780,000	1
Lift Stations	16	$2,278,581	8
Flood Control Pump Stations	1	$988,380	1
Wells	4	$500,000	2
Storage Tanks	8	$6,207,543	3
Schools	6	$60,000,000	
Airport	1	$1,940,000	
Natural Gas Facilities			
Dams			
Bridges	31	$248,080,000	4
TOTAL	**113**	**$443,255,228**	**24**

Sources: When available local data was used and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System data and the costs were calculated based on standard planning costs.

Wildfire Hazard

Types and numbers of buildings

Wildfire was rated by the Fulton County MPT as a Low Risk Hazard. In addition, much of the wooded area of Fulton County is in seasonal wetlands. Table 5.19 shown below represents residential structures only and was U.S. Census Bureau 2011-2015 American Community Survey 5-Year Estimate data. Due to data limitations, the numbers of other types of structures was not available at the time of this plan. Future updates of the plan will include numbers of other types of structures as data becomes available.

Table 5.19 Fulton County Wildland/Urban Interface Wildfire Risk:

County	Number of Residential Structures		
	Structures in County	Structures in Hazard Area	% in Hazard Area
Ballard	3,889	72	1.9
Calloway	18,237	153	0.8
Carlisle	2,426	5	0.2
Fulton	**3,360**	**6**	**0.2**
Graves	16,753	156	0.9
Hickman	2,335	5	0.2
Marshall	15,898	168	1.1
McCracken	31,342	148	0.5
Total	**94,240**	**713**	**0.8%**

Sources: U.S. Census Bureau 2011-2015 American Community Survey 5 Year Estimate, PADD GIS Database

Future Development: Types and Numbers of Future Buildings, Critical Facilities, and Infrastructure

Fulton County is not expected to grow in population over the next ten years. There will likely be little, if any, increase in the number of residential structures, or critical facilities and infrastructure.

Table 5.20 Population Projections for the Purchase Region of Kentucky

County	Census 2000	Census 2010	Census 2015	Census Projection				
				2020	2025	2030	2035	2040
Kentucky	4,041,769	4,339,367	4,425,092	4,533,464	4,634,415	4,726,382	4,808,682	4,886,381
Ballard	8,286	8,249	8,212	8,164	8,097	8,005	7,906	7,780
Calloway	34,177	37,191	38,343	39,328	40,487	41,687	42,604	43,503
Carlisle	5,351	4,874	5,036	4,737	4,604	4,450	4,298	4,139
Fulton	**7,752**	**6,238**	**6,528**	**5,726**	**5,252**	**4,789**	**4,349**	**3,939**
Graves	37,028	37,421	37,433	37,883	38,243	38,483	38,657	38,788
Hickman	5,262	4,612	4,767	4,349	4,077	3,803	3,563	3,306
Marshall	30,125	31,101	32,301	31,149	31,060	30,830	30,347	29,980
McCracken	65,514	65,018	66,188	65,317	65,487	65,376	64,918	64,273
Purchase	**193,495**	**195,819**	**195,313**	**196,653**	**197,307**	**197,423**	**196,732**	**195,708**

Source: U.S. Census Bureau, http://www.ksdc.louisville.edu/data-downloads/projections/ 2017

There are no significant changes in land use anticipated for Fulton County. Should land use changes occur, they will be included in future updates of the plan where applicable. The lack of significant growth in the county should also result in a corresponding lack of increase in landslide vulnerability. The area most vulnerable are those areas with steep slope and are not conducive to construction.

New Residential Structures – Tornado, Earthquake, Severe Thunderstorm, Severe Winter Storm

The PADD staff calculated the estimated future residential structure growth (Table 5.21) by multiplying the existing number of residential structures by the expected growth rate for each county. Results of these calculations are represented in the following table. These numbers would represent the approximate number of new future residential structures vulnerable to tornadoes, earthquakes, thunderstorm wind, and winter storms. With the forecast lack of growth, there is unlikely to be an increase in the housing stock in Fulton County.

Table 5.21 Estimated Future Structure Growth for the Purchase Region

County	Estimated Housing Units (2015)	Estimated % Household Growth Rate (2025)	Estimated Future Growth	Median Structure Value	Estimated Value of Future Growth
Ballard	3883	0.79%	31	$101,800	$3,155,800
Calloway	18,537	7.20%	1335	$119,900	$160,066,500
Carlisle	2437	-6.53%	-159	$77,200	*
Fulton	**3,359**	**-15.81%**	**-531**	**$61,000**	*****
Graves	16,741	2.79%	467	$92,900	$43,384,300
Hickman	2,338	-8.68%	-203	$68,400	*
McCracken	31,544	2.04%	643	$111,600	$71,758,800
Marshall	15,982	1.45%	232	$124,400	$28,860,800
Purchase	**94,821**	**2.01%**	**1906**		

* Projected Negative Growth Rate

Source: EHHGR - Kentucky State Data Center (Vintage 2016)

EHU - US Census Bureau, Population Division (June 2017)

MSU - American Community Survey 5- Year Estimates (2011-2015)

Flood

Fulton County is a member of the NFIP. It has a Flood Plain Management Ordinance IAW the appropriate State Revised Statutes. As a consequence, development is not likely to occur in flood regions identified in on the FIRMS and by the Q3 Flood data used in this plan. Industrial expansion that takes place will be in existing industrial parks. Some of the industry in Fulton County is dependent upon the National Waterway Transportation System. Industrial expansion could occur in the 100-year floodplain, but in accordance with all State and Local ordinances. These facilities are largely engineered out of the flood zones of the Mississippi River.

The PADD staff and Fulton County MPT members discussed potential increase in numbers of vulnerable critical facilities, industry and infrastructure; however, there was no consensus for making a reliable calculation. In future updates, involvement from the local planning process may assist in estimating the increase of critical facilities and infrastructure based on projected population growth.

5:4.4 Assessing Vulnerability: Estimating Potential Losses

Tornado, Earthquake, Thunderstorm Wind, Winter Storm

The total valuation of adjusted property as provided by the Kentucky Department of Revenue was used to estimate the potential dollar loss for all vulnerable structures for the following hazards: Tornado, Thunderstorm Wind including Hail, Winter Storm, and Earthquake.

The Table 5.22 summarizes the total value of adjusted property as provided by the Kentucky Department of Revenue, and the population for each county as provided by 2011-2015 American Community Survey 5 Year Estimate. These values were used to determine potential dollar losses and the number of people at risk in a county and all its jurisdictions, for those hazards that have no defined area: tornado, thunderstorm wind, winter storm, and earthquake. The figures for Fulton County are highlighted.

Table 5.22 Total Value of Adjusted Property for the Purchase Region

County	County Square Miles	Population 2011-2015 ACS	Total Property Value 2016($)
Ballard	273.70	8,256	545,949,576
Calloway	412.50	38,106	2,355,178,011
Carlisle	199.10	4,984	234,857,047
Fulton	**230.70**	**6,422**	**277,810,192**
Graves	556.00	37,502	1,886,576,304
Hickman	253.20	4,720	265,028,387
Marshall	340.00	31,181	2,457,186,169
McCracken	268.30	65,408	5,111,587,459
Region	**2,433.5**	**196,579**	**13,134,173,145**

Source: Kentucky State Hazard Mitigation Plan. 2011-2015 American Community Survey 5 Year Estimate, Kentucky Revenue Cabinet, Year Estimate, Kentucky Revenue Cabinet, https://revenue.ky.gov/Property/Pages/default.aspx

Table 5.23 is specifically focused on residential structures.

Table 5.23 Severe Weather/Earthquake Hazard Vulnerable Asset

County	Structures in County	Structures in Hazard Area	% in Hazard Area
Ballard	3,889	3,889	100%
Calloway	18,237	18,237	100%
Carlisle	2,426	2,426	100%
Fulton	**3,360**	**3,360**	**100%**
Graves	16,753	16,753	100%
Hickman	2,335	2,335	100%
Marshall	15,898	15,898	100%
McCracken	31,342	31,342	100%
Region	**94,240**	**94,240**	**100%**

Sources: U.S. Census Bureau 2011- 2015 American Community Survey 5-Year Estimates

PADD staff and the Fulton County MPT determined that all 3,360 residential structures in the county are vulnerable to the threats of severe weather and earthquake. According to the 2011-2015 American Community Survey 5-Year Estimates, the median house value for Fulton County is $61,000. An estimate of the maximum potential residential loss for Fulton County is $204,960,000.

Critical Facilities and Infrastructure for Severe Weather and Earthquakes

It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with critical facilities and infrastructure was to use the insurance replacement values for those structures when available, or default to values from the HAZUS tables. Table 5.22 summarizes the potential dollar loss of vulnerable critical facilities and infrastructure to the non-geospecific hazards of Severe Weather and Earthquakes. Additional information on potential earthquake losses, especially for in-ground infrastructure can be found in the Appendix 2.

Table 5.24 Fulton County Critical Facilities & Infrastructure Severe Weather and Earthquake

Type of Facility	# of Existing Buildings	Current Replacement Value	# in Hazard Area	Replacement Cost
County EOC	1	$2,117,395	1	$2,117,395
Communication-Radio	2	$280,000	2	$280,000
Fire Stations	3	$2,400,000	3	$2,400,000
Public Safety Buildings	3	$5,400,000	3	$5,400,000
Railways	4	$1,800,000	4	$1,800,000
Government Buildings	17	$15,776,000	17	$15,776,000
Hospitals				
Electric Power Plants				
Sewage Plants	2	$90,000,000	2	$90,000,000
Package Treatment Plants				
Water Plants	2	$4,707,329	2	$4,707,329
Pump Stations	12	$780,000	12	$780,000
Lift Stations	16	$2,278,581	16	$2,278,581
Flood Control Pump Stations	1	$988,380	1	$988,380
Wells	4	$500,000	4	$500,000
Storage Tanks	8	$6,207,543	8	$6,207,543
Schools	6	$60,000,000	6	$60,000,000
Airport	1	$1,940,000	1	$1,940,000
Natural Gas Facilities				
Dams				
Bridges	31	$248,080,000	31	$248,080,000
TOTAL	**113**	**$443,255,228**	**113**	**$443,255,228**

Sources: When available local data was used and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System data and the costs were calculated based on standard planning costs.

Flood

Residential Structures: After the vulnerability maps were created for the flood hazard areas, the cost associated with replacing those structures was evaluated. It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with the flood hazard areas was to use the median structure value as identified by the 2011- 2015 American Community Survey 5-Year Estimates for residential structures.

Table 5.25 summarizes the median residential structure value used to determine the value of structures located in flood hazard areas. Table 5.23 also lists the average number of people per household for Fulton County according to 2011-2015 ACS 5-Year Estimates. This value was used to determine the number of people in a flood hazard area. The data for Fulton County is highlighted.

Table 5.25 2011 – 2015 Selected Housing Characteristics

Subject	Ballard	Calloway	Carlisle	Fulton	Graves	Hickman	Marshall	McCracken	Purchase Region
Total Housing Units	3,889	18,237	2426	**3360**	16,753	2335	15,898	31,342	94,240
Occupied Housing Units	3288	14,834	2059	**2568**	14,390	1973	12,062	27,514	79,228
Vacant Housing Units	601	3403	367	**792**	2363	362	3296	3828	15,012
Mobile Homes	657	2306	500	**205**	2220	360	2966	2988	12,202
Owner-occupied	2678	9355	2059	**2568**	14,390	1470	9813	18,511	60,844
Renter-occupied	610	5479	367	**792**	2363	503	2789	9003	21,906
Household Size – Owner	2.42	2.49	2.34	**2.51**	2.63	2.26	2.50	2.46	2.45
Household Size– Renter	2.73	2.09	2.58	**2.07**	2.37	2.39	2.18	2.06	2.31
Median House Value -	$101,800	$119,900	$77,200	**$61,000**	$92,900	$68,400	$111,600	$124,400	$94,650

Source: U.S. Census Bureau 2011- 2015 American Community Survey 5-Year Estimates

According to the 2011-2015 ACS 5-Year Estimates the median house value for Fulton County is $61,000. An estimate of the potential residential flood damage for Fulton County is $16,348,000.

Table 5.26 represents a comparison of estimated of potential dollar loss of vulnerable residential structures in flood hazard areas by county. Using imagery, PADD staff determined that 268 residential structures are located in areas with a map flood hazard. The data for Fulton County is highlighted.

Table 5.26 Flood Hazard Vulnerable Residential Structures by County

County	Number of Residential Structures			Total Property Value		Number of People		
	Structures in County*	Structures in Hazard Area**	% in Hazard Area**	Total Value in County***	Value in Hazard Area**	Residents*	Residents in Hazard Area**	% in Hazard Area**
Ballard	3,889	147	3.7%	$545,949,576	$18,016,336	8,256	305	3.7%
Calloway	18,237	101	0.5%	$2,355,178,011	$9,420,712	38,106	229	0.6%
Carlisle	2,426	80	3.2%	$234,857,047	$751,543	4,984	199	4%
Fulton	**3,360**	**268**	**7.8%**	**$277,810,192**	**$21,669,195**	**6,422**	**450**	**7%**
Graves	16,753	361	2.2%	$1,886,576,304	$41,504,679	37,502	1,013	2.7
Hickman	2,335	147	6.3%	$265,028,387	$16,696,788	4,720	189	4.0%
Marshall	15,898	444	2.8%	$2,457,186,169	$68,801,213	31,181	1,871	6.0%
McCracken	31,342	768	2.5%	$5,111,587,459	$127,789,686	65,408	2,158	3.3%
Total	**94,240**	**2,818**	**2.9%**	**$13,134,173,145**	**$304,650,152**	**196,579**	**6,733**	**3.2%**

*Sources: * U.S Census Bureau 2011-2015 American Community Survey 5 Year Estimates,*
*** PADD GIS Database, HAZUS & PVA information,*
****Kentucky Revenue Cabinet and PVA data.*

Critical Facilities and Infrastructure

It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with critical facilities and infrastructure was to use the insurance replacement values for those structures provided by the jurisdictions to the maximum extent possible, or default to values from the HAZUS tables.

Table 5.27 tables summarize the potential dollar loss of vulnerable critical facilities and infrastructure in flood hazard areas by county.

Table 5.27 Fulton County Critical Facilities & Infrastructure Flood Vulnerability

Type of Facility	# of Existing Buildings	Current Replacement Value	# in Hazard Area	Replacement Cost
County EOC	1	$2,117,395		
Communication-Radio	2	$280,000		
Fire Stations	3	$2,400,000		
Public Safety Buildings	3	$5,400,000		
Railways	4	$1,800,000		
Government Buildings	17	$15,776,000	1	$928,000
Hospitals				
Electric Power Plants				
Sewage Plants	2	$90,000,000	1	$45,000,000
Package Treatment Plants				
Water Plants	2	$4,707,329	1	$2,353,664
Pump Stations	12	$780,000	2	$1,560,000
Lift Stations	16	$2,278,581	5	$712,055
Flood Control Pump Stations	1	$988,380	1	$988,380
Wells	4	$500,000		
Storage Tanks	8	$6,207,543		
Schools	6	$60,000,000		
Airport	1	$1,940,000		
Natural Gas Facilities				
Dams				
Bridges	31	$248,080,000	17	$136,043,860
TOTAL	**113**	**$443,255,228**	**28**	**$187,585,959**

Sources: When available local data was used and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority (KIA), Water Resource Information System (WRIS) data and the costs were calculated based on standard planning costs.

Landslide

Residential Structures: After the vulnerability maps were created for the Landslide hazard areas, the cost associated with replacing those structures was evaluated. The same methodology used above for Flood Vulnerability assessment was used by the PADD staff to estimate the potential dollar loss associated with the Landslide hazard areas. Once again, the median structure value as identified by 2011-2015 ACS 5-Year Estimates information for residential structures was used to determine the value of structures located in Landslide hazard areas.

It was determined that the use of median values provided a fair assessment of potential dollar loss and the number people in hazard area when no other data was available. According to the 2011-2015 ACS 5-Year Estimates the median house value for Fulton County is $61,000. Using the estimated two percent of residential structures identified in the landslide hazard risk assessment, which equals 67 structures, the estimate of the potential residential landslide damage for Fulton County is $4,087,000.

Landslide Vulnerability of Critical Facilities and Infrastructure

It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with critical facilities and infrastructure was to use the estimated replacement values for those structures provided in the HAZUS data tables. Table 5.26 summarize the potential dollar loss of vulnerable critical facilities and infrastructure in Landslide Hazard areas for Fulton County.

Table 5.28 Fulton County Critical Facilities & Infrastructure: Landslide

Type of Facility	# of Existing Buildings	Current Replacement Value	# in Hazard Area	Replacement Cost
County EOC	1	$2,117,395		
Communication-Radio	2	$280,000	1	$280,000
Fire Stations	3	$2,400,000	1	$800,000
Public Safety Buildings	3	$5,400,000	1	$1,800,000
Railways	4	$1,800,000		
Government Buildings	17	$15,776,000		
Hospitals				
Electric Power Plants				
Sewage Plants	2	$90,000,000	1	$45,000,000
Package Treatment Plants				
Water Plants	2	$4,707,329	1	$2,353,664
Pump Stations	12	$780,000	1	$65,000
Lift Stations	16	$2,278,581	8	$1,139,288
Flood Control Pump Stations	1	$988,380	1	$988,380
Wells	4	$500,000	2	$250,000
Storage Tanks	8	$6,207,543	3	$2,327,828
Schools	6	$60,000,000		
Airport	1	$1,940,000		
Natural Gas Facilities				
Dams				
Bridges	31	$248,080,000	4	$32,010,320
TOTAL	**113**	**$443,255,228**	**24**	**$87,014,480**

Sources: When available local data was used and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority (KIA), Water Resource Information System (WRIS) data and the costs were calculated based on standard planning costs.

Wildfire Hazard for Residential Structures

After the vulnerability maps were created for the Wildfire hazard areas, the cost associated with replacing those structures was evaluated. It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with the Wildfire Hazard areas was to use the median structure value as identified by the 2011-2015 ACS 5-Year Estimates for residential structures. Table 5.29 summarizes the wildfire risk to residential structures in the Purchase Region. The data for Fulton County is highlighted.

Table 5.29 Fulton County Wildland/Urban Interface Wildfire Risk

County	Structures in County	Structures in Hazard Area	% in Hazard Area
Ballard	3,889	72	1.9
Calloway	18,237	153	0.8
Carlisle	2,426	5	0.2
Fulton	**3,360**	**6**	**0.2**
Graves	16,753	156	0.9
Hickman	2,335	5	0.2
Marshall	15,898	168	1.1
McCracken	31,342	148	0.5
Region	**94,240**	**713**	**0.8%**

Sources: U.S. Census Bureau 2011-2015 American Community Survey 5 Year Estimate, PADD GIS Database

Using wildfire vulnerability data obtained from the United States Department of Agriculture, United States Forestry Service PADD Staff estimated that 0.2% by area or six residential structures are in the wildfire threat area. According to the 2011-2015 ACS 5-Year Estimates the median house value for Fulton County is $61,000. An estimate of the potential residential Wildfire damage for Fulton County is $3,660,000.

Further GIS analysis shows that no Critical Facility are identified in proximity to even a “Low” wildfire threat.

5:4.5 Assessing Vulnerability: Analyzing Development Trends

The PADD grew 1.2% in population between 2000 and 2010 compared to a growth of 7.4% for the state of Kentucky. Fulton County is projected to decrease in population by 8.2% by 2020. This projected decline is expected to continue through 2040.

Fulton County is primarily rural in nature. Most residential development occurs on property that fronts primary and secondary roads. However with the projected population decline and an estimated negative growth rate (-15.81% by 2025) in future residential structure growth, the county can expect very little if any in residential development over the next several years. It could be expected that any new residential structures built would be to replace older or deteriorated homes by existing population. Essential facilities and services may show little to no increase as the population decreases. Table 5.30 utilizes Census data as reported by the Kentucky State Data Center to analyze population trends in the PADD. Fulton County is highlighted.

Table 5.30 2011 Population Projects for the Purchase Region

County	Census 2000	Census 2010	Census 2015	Census Projections				
				2020	2025	2030	2035	2040
Kentucky	4,041,769	4,339,367	4,425,092	4,533,464	4,634,415	4,726,382	5,808,682	4,886,381
Ballard	8,286	8,249	8,212	8,164	8,097	8,005	7,906	7,780
Calloway	34,177	37,191	38,343	39,328	40,487	41,687	42,604	43,503
Carlisle	5,351	4,874	5,036	4,737	4,604	4,450	4,298	4,139
Fulton	**7,752**	**6,238**	**6,528**	**5,726**	**5,252**	**4,789**	**4,349**	**3,939**
Graves	37,028	37,421	37,433	37,883	38,243	38,483	38,657	38,788
Hickman	5,262	4,612	4,767	4,349	4,077	3,803	3,563	3,306
Marshall	30,125	31,101	32,301	31,149	31,060	30,830	33,886	29,980
McCracken	65,514	65,018	66,188	65,317	65,487	65,376	64,918	64,273
Purchase	**193,495**	**195,819**	**195,313**	**196,653**	**197,307**	**197,423**	**196,732**	**195,708**

Source: http://ksdc.louisville.edu/ 2017

Land Use

Farmland is the principle land use in Fulton County. Land use for commercial purposes is primarily concentrated in or near the incorporated cities. Industrial development takes place primarily in the industrial parks. Fulton County also makes use of land for recreation and greenspace. Fulton County has both city and county parks for recreational purposes.

Economic and Social Growth Trends

The economy in the PADD is experiencing trends similar to those of the state averages, both in growth and decline. There have been new businesses and industries to open in the region, but in turn there have been layoffs and closures within the market. The fastest growing sectors of the local economy in the Purchase Region were services and manufacturing. The following table represents the expansion and location of plants in the Fulton County from 2014 to present. This information was retrieved from the Kentucky Cabinet for Economic Development website.

Table 5.31 Summary of Recent Locations and Expansions, 2014-Present

		Reported	
	Companies	Jobs	Investment
Manufacturing Location	1	110	$18,675,000
Manufacturing Expansion	1	100	$8,473,000
Service & Technology Location	0	0	$0
Service & Technology Expansion	0	0	$0

Note: Totals include announced locations and expansions.
Source: Kentucky Cabinet for Economic Development (8/8/2017)

Table 5.32 Employment by Major Industry by Place of Work, 2015

	Fulton County		Labor Market Area	
	Employment	Percent	Employment	Percent
Total All Industries	2,073	100.0	41,049	100.0
Total Private Industries	1,552	74.9	30,851	75.2
Natural Resources and Mining	N/A	N/A	857	2.1
Construction	43	2.1	1,145	2.8
Manufacturing	347	16.7	5,429	13.2
Trade, Transportation and Utilities	476	23.0	8,143	19.8
Information	N/A	N/A	337	0.8
Financial Activities	97	4.7	1,685	4.1
Professional and Business Services	0	0.0	1,367	3.3
Education and Health Services	N/A	N/A	2,883	7.0
Leisure and Hospitality	N/A	N/A	3,051	7.4
Other Services and Unclassified	0	0.0	784	1.9

Source: U.S. Department of Labor, Bureau of Labor Statistics

While manufacturing and service sectors are important to the region's economy, agriculture proves to be a vital part of the economy as a whole. The changes, both hazard related and non-hazard related, that affect farming greatly impact the Purchase Region. Hazards such as hail, flooding, tornadoes, and high wind damage crops and thus have an effect on the

economy of the region. As previously stated, farming is the most prevalent land use in the Fulton County. Table 5.33 is a summary of the farmland located in the Purchase Region and the land use for those acres. This data was retrieved from the United States Department of Agriculture.

Table 5.33 Total Farmland Located in Purchase Region

County	Number of Farms	Land in Farms(acres)	Avg. Farm Size(acres)
Ballard	408	107,186	263
Calloway	821	176,076	214
Carlisle	325	98,620	303
Fulton	**178**	**83,382**	**468**
Graves	1,442	291,813	202
Hickman	298	141,131	474
Marshall	719	94,879	132
McCracken	447	67,192	150
Total	4,638	1,060,279	276

Source: U.S. Department of Agriculture, National Agricultural Statistics Service 2012 Census of Agriculture http://www.nass.usda.gov:8080/census/Pull_Data_Census

Social growth trends also play a key role in the economy of the Purchase Region. Median income and housing characteristics of the region are valuable tools in analyzing these growth trends. Tables 5.34 and 5.35 describe the median income and housing characteristics retrieved from the Kentucky State Data Center Census 2010 information.

Little to no population growth (0.4%) is expected to occur in the Purchase Region between 2010 and 2020. Fulton County is expected to decline by 8.2% during that same time period. Development is not likely to occur in flood regions identified in each jurisdiction, because the threat of flooding is known and occurs on an annual basis. Industrial expansion that takes place will be in existing industrial parks. Fulton County is a Member of the NFIP and has implemented a Flood Plain Ordinance IAW the applicable paragraphs of the Kentucky Revised Statues.

Table 5.34 2010 Census and ACS 2011-2015 Median Household Income

Area	Median Household Income		
	2010 Census*	ACS 2011-2015**	Percent Change
Kentucky	$42,302	$43,740	3.3%
Ballard	$39,995	$42,240	5.3
Calloway	$34,947	$37,034	5.6
Carlisle	$35,853	$38,829	7.7
Fulton	**$27,524**	**$28,359**	**2.9**
Graves	$34,550	$39,530	12.6
Hickman	$37,045	$41,218	10.1
Marshall	$41,891	$45,212	7.3
McCracken	$40,976	$44,067	7.0

*Source: *2010 data http://www.thinkkentucky.com/edis/cmnty/QuickFacts.aspx?cw=096, Kentucky State Data Center; **U.S. Census Bureau, 2011-2015 American Community Survey 5 Year Estimate*

Table 5.35 2010 Census: Selected Housing Characteristics for the Purchase Region

Subject	Ballard	Calloway	Carlisle	Fulton	Graves	Hickman	Marshall	McCracken
Total Housing Units*	3,889	18,237	2,426	**3,360**	16,753	2,335	15,898	31,342
Occupied Housing Units*	3,288	14,834	2,059	**2,568**	14,390	1,973	12,602	27,514
Vacant Housing Units*	601	3,403	367	**792**	2,363	362	3,296	3,828
Seasonal Use Units**	547	5,654	353	**144**	1442	290	1,426	1,678
Mobile Homes*	657	2,306	500	**205**	2,220	360	2,966	2,988
Owner- occupied*	2,678	9,355	2,059	**2,568**	14,390	1,470	9,813	18,511
Renter- occupied*	610	5,479	367	**792**	2,363	503	2,789	9,003
Household Size – Owner*	2.42	2.49	2.34	**2.51**	2.63	2.26	2.50	2.46
Household Size – Renter*	2.73	2.09	2.58	**2.07**	2.37	2.39	2.18	2.06
Median House Value – Owner Occupied*	$101,800	$119,900	$77,200	**$61,000**	$92,900	$68,400	$111,600	$124,400

*Source * U.S. Census Bureau, 2011-2015 American Community Survey 5 Year Estimate*
***2010 Census Updates; http://ksdc.louisville.edu/1census.htm*

5:5 Mitigation Strategy

5:5.1 Capability Assessment

Mitigation strategies were developed in response to the hazard profiles and vulnerability of the assets in each jurisdiction. These strategies provide each jurisdiction with a blueprint for reducing potential losses identified in the risk assessment. These strategies are based on existing authorities, policies, programs, resources, and the ability to expand on and improve the existing tools.

The capability assessment has been divided into three sections:

(A) Existing Authorities, Policies, Programs, and Resources
(B) Existing Governmental Structure
(C) Existing Professional Staff Departments

The purpose of the capability assessment is to identify potential hazard mitigation opportunities available to each jurisdiction through daily operations as a local unit of government. This assessment will highlight the positive measures already in place in the jurisdiction as well as identify weaknesses that could increase vulnerability in a jurisdiction. The capability assessment serves as the foundation for an effective hazard mitigation strategy by establishing goals and objectives for jurisdictions.

(A) Existing Authorities, Policies, Programs, and Resources

The PADD, along with MPT members, evaluated existing authorities, policies, programs, and resources in each jurisdiction. Table 5.34 is a summary of each jurisdiction and the current status of these authorities. Local committee members evaluated this information to determine what goals, objectives, and actions would be necessary to effectively mitigate the vulnerability of a jurisdiction and what resources they currently have that can be used to implement the mitigation strategies identified in this plan.

Table 5.36 Existing Authorities, Policies, Programs, and Resources in the Purchase Region

Jurisdiction	Floodplain Management Ordinance	CRS & FMA Plans	Zoning Regulations	Subdivision Regulations	Land Development Plans	Fire Prevention Code	Comprehensive Plan	Capital Improvement Plan	Stormwater Management Plan	CERT Team	NWS StormReady Program	Local Economic Development	Regional Economic Development	City Class
Ballard County	X							X		X		X	X	
City of Barlow								X				X	X	6
City of Kevil								X				X	X	6
City of La Center					X		X	X				X	X	5
City of Wickliffe	X							X				X	X	5
Calloway County	X		X	X						X	X	X	X	
City of Murray	X		X	X	X		X		X			X	X	3
City of Hazel												X	X	6
Carlisle County	X									X	X	X	X	
City of Bardwell	X											X	X	5
City of Arlington	X											X	X	6
Fulton County	**X**									**X**	**X**	**X**	**X**	
City of Fulton	**X**		**X**	**X**	**X**		**X**	**X**				**X**	**X**	**4**
City of Hickman	**X**		**X**		**X**		**X**					**X**	**X**	**4**
Graves County	X									X		X	X	
City of Mayfield	X		X	X	X		X		X			X	X	3
City Wingo												X	X	6
Hickman County										X		X	X	
City of Clinton	X											X	X	5
City of Columbus													X	5
Marshall County	X				X	X				X	X	X	X	
City of Benton	X		X				X					X	X	4
City of Calvert City	X		X	X	X		X	X	X			X	X	4
City of Hardin	X											X	X	5
McCracken County	X		X	X	X	X	X			X	X	X	X	
City of Paducah	X		X	X	X		X	X	X			X	X	2

All jurisdictions are members of the PADD. Services are provided by the district in GIS/GPS, Economic Development, Community Development, Aging Services, Workforce Development, and Fiscal Management.

The existing authorities, policies, and programs are further explained in relation to the existing governmental structure and powers of the local jurisdiction. It is the responsibility of each local jurisdiction to develop, enact, and enforce the above referenced authorities and programs.

(B) Existing Governmental Structure

Tables 5.37 (county government) and 5.38 (city government) summarize the governmental structure for each jurisdiction in the PADD. Each jurisdiction is responsible for the implementation of mitigation strategies in their community. These governmental structures were reviewed by the JPHMC to determine the capability of implementing and enforcing existing and future authorities, policies, programs, and resources.

Table 5.37 County Government Structure in the Purchase Region

County	Type of Government
Ballard County	Judge/Executive and 5 magistrates
Calloway County	Judge/Executive and 4 magistrates
Carlisle County	Judge/Executive and 3 magistrates
Fulton County	**Judge/Executive and 4 magistrates**
Graves County	Judge/Executive and 3 commissioners
Hickman County	Judge/Executive and 3 magistrates
Marshall County	Judge/Executive and 3 commissioners
McCracken County	Judge/Executive and 3 commissioners

Table 5.38 Governmental Structure and Class of Incorporated Cities

City	Class	County	Type of Government
City of Barlow	6	Ballard	Mayor and 4 commissioners
City of Kevil	6	Ballard	Mayor and 6 council members
City of La Center	5	Ballard	Mayor and 4 commissioners
City of Wickliffe	5	Ballard	Mayor and 6 council members
City of Murray	3	Calloway	Mayor and 12 council members
City Hazel	6	Calloway	Mayor and 6 council members
City of Bardwell	5	Carlisle	Mayor and 6 council members
City of Arlington	6	Carlisle	Mayor and 4 commissioners
City of Hickman	**4**	**Fulton**	**Mayor and 4 commissioners**
City of Fulton	**4**	**Fulton**	**Mayor and 4 commissioners**
City of Mayfield	3	Graves	Mayor and 10 council members
City of Wingo	6	Graves	Mayor and 4 commissioners
City of Clinton	5	Hickman	Mayor and 6 council members
City of Columbus	5	Hickman	Mayor and 6 council members
City of Benton	4	Marshall	Mayor and 6 council members
City of Calvert City	4	Marshall	Mayor and 6 council members
City of Hardin	5	Marshall	Mayor and 6 council members
City of Paducah	2	McCracken	Mayor and 4 commissioners

Legal Authority of Local Jurisdictions

There are many tools available to local governments in Kentucky that may help them implement mitigation programs, policies and actions. Any hazard mitigation program can utilize any or all of the five types of government powers granted by the State of Kentucky: Regulation; Acquisition; Taxation; Spending, and Education.

Regulation

- Police Power: Local governments have been granted broad regulatory powers in their jurisdictions. Kentucky Revised Statutes grant the general police power to local governments, allowing them to enact and enforce ordinances and laws that define, prohibit, regulate or abate acts, omissions, or conditions detrimental to the health, safety and welfare of the citizens of their jurisdiction. The general police power also has the ability to define and abate nuisance ordinances, including those related to public health.

- Jurisdictions can include hazard mitigation requirements in their ordinances as protection of public health, safety and welfare. They may also use this power to enforce nuisance ordinances identifying nuisances that threaten the general health and safety of the public.

- Building Codes and Inspection: The construction and rehabilitation of homes, business and other structures according to standards that will make the structures more resistant to the impact of natural hazards is a big part of mitigation activity in a jurisdiction. These standards can be enforced in a jurisdiction through building codes. Through the adoption and enforcement of building codes in each jurisdiction, it can be assured that mitigation strategies are in place for the planning area.

- Land Use: Local governments can control the use of land in the jurisdiction through regulatory powers granted to them by the State of Kentucky. Jurisdictions can control certain aspects of development under these powers. The amount and type of growth in a jurisdiction can greatly affect the vulnerability of the community in the event of a natural hazard. Land use powers include the power to enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls, as well as the power to engage in planning.

    - Acquisition**:** The State of Kentucky Revised Statutes allows for jurisdictions to acquire property for public purpose. Acquisition can be a useful tool for mitigation goals in that property in hazard prone areas may be acquired so that future development is prohibited in a hazardous area.

    - Taxation**:** Local governments have been given the power to levy taxes and special assignments by the State of Kentucky. Taxation extends beyond the collection of revenue and can provide the means by which the community develops in the future.

- Spending**:** Local governments have also been given the power to make expenditures on behalf of the public in their interest. Hazard mitigation principles should be incorporated in the spending decisions made by the local government in a jurisdiction.

- Education**:** Although most residents in a jurisdiction have some knowledge of the natural hazards that potentially threaten their community, most of them have had little formal education about what they as individuals can do to reduce their vulnerability to a natural hazard event. Education involving mitigation strategies and potential vulnerability will be essential for all jurisdictions in the planning area.

(C) Existing Professional Staff Departments

Members of Fulton County MPT reviewed their existing Capabilities based on their current professional staff departments. During the public input meetings, participants determined that the implementation of Mitigation Strategies and Projects would depend on the capability of that department in each jurisdiction.

Table 5.39 Capabilities Assessment: Existing Professional Staff Departments

Jurisdiction	Board of Education	Building Inspectors	Court Clerk	Emergency Management	County/City Treasurer	Mayor /County Judge/Executive	Health Department	Road Department	Sheriff Department	City Police Department	PVA (Tax Assessment)	Social Services	Utilities Department
Ballard County	X		X	X	X	X	X	X	X		X	X	X
Wickliffe				X	X	X							X
Barlow				X	X	X				X			X
Kevil				X	X	X							X
LaCenter				X	X	X				X			X
Calloway County	X		X	X	X	X	X	X	X		X	X	X
Murray	X	X		X	X	X		X		X			X
Hazel				X	X	X							X
Carlisle County	X	X	X	X	X	X	X	X	X		X	X	X
Bardwell		X		X	X	X				X			X
Arlington		X		X									X
Fulton County	X		X	X	X	X	X	X	X		X	X	X
Hickman				X	X	X		X		X			X
Fulton	X			X	X	X		X		X			X
Graves County	X		X	X	X	X	X	X	X		X	X	X
Mayfield	X	X		X	X	X		X		X			X
Wingo				X	X	X				X			X
Hickman County	X		X	X	X	X	X	X	X		X	X	X
Clinton				X	X	X				X			X
Columbus				X	X	X							X
Marshall County	X	X	X	X	X	X	X	X	X		X	X	X
Benton		X		X	X	X		X		X			X
Calvert City		X		X	X	X		X		X			X
Hardin				X	X	X							X
McCracken County	X	X	X	X	X	X	X	X	X		X	X	X
Paducah	X	X		X	X	X		X		X			X

The following definitions summarize the duties and responsibilities of the professional staff departments listed in Table 5.37.

The **Board of Education** maintains the operations of the county school system. This board is elected at large by the people of the community. County funds usually maintain the buildings and provide for other capital projects. State funds usually pay for salaries and the purchase of textbooks and supplies.

The **Building Inspectors** are responsible for enforcing the State Building Code, the NFIP, the Community Rating System, and other applicable local codes. These items are enforced through an inspection and permitting program.

The **PVA, Court Clerk,** and **Sheriff** are elected every four years by the citizens in the county. The PVA is responsible for the valuation of property for tax purposes. The Court Clerk is the custodian of the court system in each county. This office is financed through the State of Kentucky. The Sheriff operates on a budget approved annually by the magistrates (fiscal court) of each county and is responsible for the enforcement of state and local laws.

The **City Police Departments** are responsible for enforcing local and state laws in their designated jurisdiction.

The **Road Departments** are responsible for the care and maintenance of the public roadways in their designated jurisdiction.

The **Utility Departments** are responsible for providing water, gas, electric and sewer services to the public.

The **Emergency Management Service** is responsible for the mitigation, preparedness, response and recovery operations for both natural and man-made disasters. The formation of an emergency management office in each county is mandated under the Kentucky Revised Statutes.

The **County/City Treasurers** are responsible for the management of the budget and fiscal programs for their jurisdiction. This also includes the administration of state and federal grants.

The **Mayor or County Judge/Executive** is responsible for overseeing the daily operations of County or City government in their respective jurisdictions. They are also responsible for the enforcement of County/City policies and regulations.

The **Health Departments** and **Social Services** have separate boards appointed by commissioners. Employment in these departments is approved by the commissioners with state personnel policies applying. These agencies protect and promote public health and provide social services for medical care and governmental social programs for displaced families.

The **Emergency Management, Road Department, Building Inspectors, and Utilities Department** have been identified as the specific departments that will be responsible for carrying out mitigation activities. Each of these departments has been involved in the hazard mitigation planning process by participating in the JPHMC meetings.

It has been determined by the committee that each of these departments have limited available staff that are responsible for multiple duties within their departments. All jurisdictions have limited funding resources available to hire additional staff. Each staff member is adequately trained to accomplish their current work load. Increase in work

activities, including hazard mitigation activities, will increase the need for additional staff to effectively perform tasks.

The PADD, as a regional planning agency, has become a primary resource for technical assistance for all jurisdictions in the region. The PADD staff are trained in planning, GIS/GPS, financial management and project development.

SUMMARY: Capability Assessment

The available staff and financial resources of the departments in each jurisdiction determine the ability for expansion and improvement of existing authorities, policies, programs, and resources to reduce potential losses. The capability of cities in the Purchase Region varies so communities often work cooperatively with county government to perform projects that improve the quality of life for residents, including mitigation projects and activities. Because counties have more resources available to implement mitigation activities, it has been suggested that the goals and objectives be prioritized at a county level. City jurisdictions will have the opportunity at any given time to implement mitigation activities if their capabilities expand and the opportunity exists.

The jurisdictions that have participated in the mitigation planning process are identified in this plan. In addition to local participation, the PADD staff has provided professional assistance in GIS and plan development to help enhance the ability of the local jurisdictions to implement mitigation activities.

Based on the above information, the local Hazard Mitigation Goals, Objectives and Actions were compiled at a county level, taking city jurisdiction public input into consideration.

5:5.2 Hazard Mitigation Goals

The PADD staff, along with Fulton County MPT analyzed the loss estimates in the risk assessment to establish goals and objectives for loss reduction. The goals were established on a regional basis with the input from local city participants. The goals and objectives will serve as a guide to develop specific actions to reduce potential losses caused by hazard events. These goals and objectives were determined to concur with existing community goals and the goals set forth by the Kentucky State Hazard Mitigation Plan.

Mitigation Goals – The mitigation goals were set to be general, long-term guidelines for hazard mitigation in the jurisdictions.

Mitigation Objectives – The mitigation objectives define the strategies and process of implementation to achieve the identified goals. The objectives are specific, measurable, and have a defined completion.

Goal 1: Improve the survivability of critical facilities and infrastructure in order to preserve their capabilities to provide essential services during a hazard event, by reducing the vulnerability of these facilities.

Purpose of Goal in Relation to the Risk Analysis: It is understood that there will be a certain level of vulnerability to critical facilities and infrastructure depending on the nature of a hazard event. Loss of these capabilities directly affect public health and public safety in part or all of Fulton County. During a natural hazard event, roadways can be damaged and utility services knocked out. These types of damages hinder emergency first responders from being able to effectively get help to those in need.

The following objectives have been developed as a result of this goal:

1.1: Enhance the rapid restoration of transportation systems.
1.2: Enhance the rapid restoration of utility systems.
1.3: Where possible, move the critical facilities out of flood prone areas.
1.4: Enhance the resistance of/harden critical facility structures to the effects of natural hazards.
1.5: Enhance the capability to maintain essential public health and public safety services by providing back-up sources of power and redundant communications to critical facilities.

Goal 2: Reduce the potential damaging effects of natural hazards through development policies without limiting the goals for growth of the community.

Purpose of Goal in Relation to the Risk Analysis: It has been determined that potential losses associated with development in the Fulton County may be greatly reduced by enforcing or developing county and city policies that regulate development in hazard prone areas. Policies that regulate and guide the development of future infrastructure, residential, and industrial projects will reduce the vulnerability of these facilities.

The following objectives have been developed as a result of this goal:

2.1 Enforce existing policies and authorities.
2.2 Develop new policies such as ordinances and building codes that require new structures to meet standards that will resist natural hazards.
2.3 Develop land use planning policies that restrict development in hazard prone areas such as flood zones.
2.4 Develop subdivision requirements to protect utilities, such as buried power and phone lines.

Goal 3: Protect public health and safety by increasing public awareness of natural hazards that affect Fulton County and by fostering a sense of responsibility within the public for mitigating risks associated with those natural hazards.

Purpose of Goal in Relation to the Risk Analysis: It has been determined that the general public in Fulton County needs to be aware of the high-risk areas, and potential harm associated with the natural hazards that affect their area. While policies can be developed to reduce the development in hazard prone areas, public education will ensure that those policies are utilized to their fullest to reduce the number of existing and future structures in those areas. Through public education, individuals may realize the seriousness of potential hazards and act upon this realization by taking steps to secure their property and protect their families against the risks of natural hazards.

The following objectives have been developed as a result of this goal:

3.1 Educate the public on potential natural hazards that affect Fulton County.
3.2 Increase public understanding and support of the hazard mitigation process.
3.3 Educate the public on how they can take personal responsibility for their own health, safety and property protection.
3.4 Develop and maintain emergency evacuation routes. Educate the public to the location and use of evacuation routes.
3.5 Storm Ready: Maintain Fulton County's status as a Storm Ready Community.
3.6 Pursue Firewise Community status for Fulton County, City of Fulton, and City of Hickman.

Goal 4: Efficiently make use of public and private funds to increase the capabilities of local jurisdictions to reduce potential losses associated with flood hazard events.

Purpose of Goal in Relation to the Risk Area: It has been determined that potential losses can be reduced in Fulton County by their ability to effectively communicate, plan, and implement mitigation projects. Efficiently using public or private money to improve communication, planning, and implementation capabilities for the general public as well as key critical facilities can reduce the impact a hazard has on Fulton County.

The following objectives have been developed as a result of this goal:

4.1 Promote inter-agency and inter-local cooperation for the use of mitigation funds and activities.

4.2 Take advantage of State Hazard Mitigation grants associated with Disaster Declarations, Pre-Hazard Mitigation Grant announcements, and other grants to fund Mitigation Projects.

4.3 Leverage State and local funding, local match sources and in-kind match resources to get the maximum utility from available Mitigation Funds.

Goal 5: Protect Fulton County's most vulnerable populations, buildings and critical facilities and infrastructure through the implementation of cost-effective and technically feasible mitigation projects.

Purpose of Goal in Relation to the Risk Area: During the review of the risk analysis, council members determined several structures and critical facilities and infrastructure that will need to have specific mitigation actions taken in order to be effective in reducing the vulnerability. Some identified structures and critical facilities and infrastructure need to be removed from the flood hazard area completely or built to appropriate standards to reduce the potential losses.

The following objectives have been developed as a result of this goal:

5.1 Increase the availability of adequate shelters and community shelters for protection from the direct and indirect effects of severe weather events.

5.2 Continue to improve early warning of impending severe weather events.

5.3 Reduce the number critical facilities and infrastructure in identified flood hazard areas.

5.4 Utilize available mitigation measures to reduce the number of vulnerable structures in the flood hazard areas.

5.5 Utilize available mitigation measures such as structure elevation to reduce the vulnerability of structures in the flood hazard areas.

5.6 Identify and remove stream blockages of tree limbs and trunks, form effective check dams and barrages, and result in the pooling of water during flood events.

Goal 6: Protect dwellings, structures and their occupants along the Wildland/Urban interface from the potential of Wildfire.

Purpose of Goal in Relation to the Risk Area: While there is not historic data to support damaging wildfires in Fulton County, small field fires and brush fires do occur, especially during periods of drought events. These events, historically, have been very small threats and generally not consider a risk. Although considered a low risk, it should be continually planned for and perhaps anticipated.

The following objectives have been developed as a result of this goal:

6.1. Ensure the protection of first responders.
6.2. Enhance the response capability for response to brush fires to mitigate growth into wildfires.
6.3. Facilitate communities/neighborhoods participation in the State's "Firewise" program.
6.4. Reduce the quantity of available wildfire fuels in proximity to critical facilities and to any/all structures in Fulton County
6.5. Incorporate fire buffer planning into the design considerations for any new critical facility.

Goal 7: Support and participate in regional Hazard Mitigation Planning

Purpose of Goal in Relation to the Risk Area: Fulton County, the City of Hickman, the City of Fulton, and representatives of various groups and organizations represented the county and participated in the JPHMC and the development of the regional portion of the plan. Because a regional "Authority" does not exist, the realization of the goals and objectives of the JPHMC Multi-jurisdictional Plan depends on the support and cooperation of Fulton County and the City of Hickman and the City of Fulton. This is especially true in that; the Regional Goals and Objectives affect all jurisdictions in the Purchase Region, damage to or destruction of the Regional Critical Facilities identified in the plan affect all jurisdictions in the Region, the strategies and mitigation projects that will evolve from these goals require the participation of all the jurisdictions in the region and the results will benefit all the participants. In the same vein Fulton County, and the City of Hickman and the City of Fulton will require the cooperation and assistance of other jurisdictions, both neighboring and region wide, and the assistance of Regional organizations such as the PADD, the Kentucky State Police, KYTC District One, Purchase District Health Department to help plan, fund and implement Hazard Mitigation projects.

The following objectives have been developed as a result of this goal:

7.1. Request agencies such as the Kentucky Geological Survey and the University of Kentucky to conduct/expand further studies into seismicity, soils and ground shaking potential within the region.

7.2. Develop a regional high resolution, spatially accurate imagery data base from which to extract precise point locations and structure footprints for buildings and other critical facilities.

7.3. Adopt an All-Hazard Week public awareness campaign to include earthquake, flood, tornados and severe storms.

Goal 8: Obtain the best data and analysis available to assess the landslide hazard in particular with regard to the stability Mississippi River bluffs in Fulton County and especially the City of Hickman.

8.1. Identify and map vulnerable structures, critical facilities, and risk prone areas.
8.2. Monitor the condition of the USCE Bluff Stabilization in the City of Hickman
8.3. Update County EOP as required.

5:5.3 Identification and Analysis of Mitigation Measures

The intention of this section is to identify, evaluate, and analyze a range of mitigation actions that will help reduce the potential effects of hazard events identified in the risk assessment section of the plan. These actions were derived based on the analysis of the risk assessment and support the goals and objectives identified in this plan.

The following list describes potential loss reduction mitigation actions and techniques identified for mitigation of hazard events. These actions and objectives were determined to have the greatest influence on hazard loss reduction in Fulton County. Hazard specific mitigation actions are listed in order of priority in accordance with the High Risk Hazards for the county as identified and prioritized by the Fulton County MPT.

- Prevention activities are designed to keep current problems from getting worse and to eliminate the possibility of future problems. Prevention activities reduce a jurisdiction's vulnerability to hazard events. This type of activity is especially effective in hazard prone areas where development has not occurred. Prevention activities include the following:
  - Planning and Zoning
  - Floodplain regulations
  - Stormwater management
  - Building codes
  - Capital improvement programs
  - Open space preservation
  - Dam inspection and monitoring

- Property protection activities are designed to adapt existing structures to withstand natural hazards or to remove structures away from hazard prone areas. Property protection activities include the following:
  - Acquisition
  - Relocation
  - Foundation elevation
  - Insurance – flood and homeowner's
  - Retrofitting (includes activities such as wind-proofing, flood-proofing, and seismic design standards)

- Structural projects lessen the impact of a natural hazard by changing the natural progression of the hazard. These types of projects are usually designed by engineers. Structural projects include the following:
  - Storm sewers
  - Floodwalls
  - Highway Projects
  - Retention Basins
  - Reservoirs
  - Dams
  - Levees
  - Dredging
  - Minor flood control projects
  - Culvert resizing
  - Retaining walls
  - Safe rooms

- Emergency services minimize the impact that a natural hazard has on the residents of a jurisdiction. Usually, actions are taken by emergency response services immediately before, during, or in response to a hazard event. Emergency service activities include the following:
  - Warning systems: sirens / automated calling system
  - Evacuation planning and management
  - Sandbagging for flood protection
  - Emergency response services
  - Protection of critical facilities
  - Emergency generators

- Public information and awareness activities are used to educate the residents of a jurisdiction about the potential hazards that affect their area, hazard prone areas, and mitigation strategies they can take part in to protect themselves and their property. Public information and awareness activities include the following:
  - Public speaking events
  - Outreach projects
  - Availability of hazard maps
  - School programs
  - Library materials
  - Hazard Awareness Weeks
  - Real estate disclosure
  - Storm Ready Community Program
  - Firewise Community Program
  - CERT Teams and CERT Training
  - Citizens Corps Organizations

- Natural resource protection activities include those that minimize hazard losses and preserve or restore the functions of natural systems. Natural resource protection actions include the following:
  - Sediment and erosion control
  - Stream corridor restoration
  - Watershed management
  - Forest and vegetation management
  - Wetlands preservation and management

The goals and objectives for hazard mitigation in Fulton County were developed on a multi-jurisdictional basis. The mitigation activities defined for each goal and objective were largely based on the capability of the county to complete the activities given their geographical location and financial capability. Specific projects included in this plan or evolved out of participation in this planning process.

Table 5.40 Fulton County Hazard Summary Table

HIGH RISK HAZARDS	THUNDERSTORM WIND HAIL FLOOD TORNADO
MODERATE RISK HAZARDS	EARTHQUAKE WINTER STORM RIVER EROSION / DEPOSITION
LOW RISK HAZARDS	LANDSLIDE WILDFIRE

SOURCE: Fulton County MPT 2017

Thunderstorm Wind/Hail Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Listen to the latest forecasts, especially when planning outdoor activities
- Keep a NOAA weather radio with extra batteries nearby to listen for weather updates.
- Listen especially for severe thunderstorm watches and warnings.
- Practice lightning safety.
  - Outdoor activities should not take place when lightning is present.
  - Fully enclosed vehicles and large permanent buildings provide safe havens from lightning.
- Pursue programs to provide or subsidize the provision of weather radios to low income populations.
- Promote trimming of tree limbs and debris, particularly in areas close to critical facilities and infrastructure such as power lines.
- Ensure all critical facilities have a backup source of power - generators

Flash Flood / Flood Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

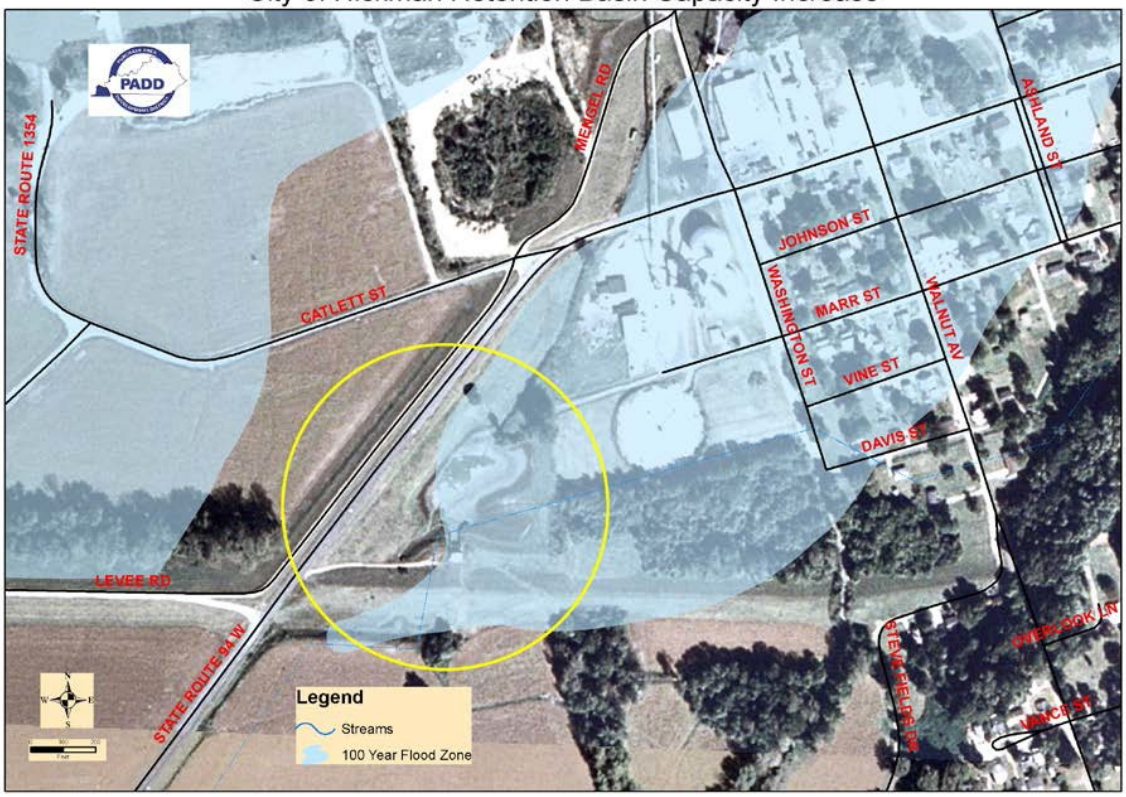
- Enforce City and County Floodplain Ordnances.
- Participation in the NFIP.
- Promote the purchase flood insurance.
- Construct/Maintain a levee or flood wall.
- Elevate the lowest floor level of existing structures above the floodplain
- Elevate flood prone roads
- When feasible, relocate structures out of the floodplain
- Acquire and demolish structures in the floodplain
- Provide openings in foundation walls to allow water to flow in and out
- Install backflow valves to drains, toilets, and other sewer connections
- Maintain ditches and storm water drainage systems
- Ensure all critical facilities have a backup source of power – generators
- Sedimentation control
- Wetland restoration.
- Stream re-alignment (see City of Fulton project below)
- Increase culvert cross section
- Dredge existing channels to maintain current depths and flows
- Identification and removal of stream blockages of tree limbs and trunks forming effective check dams and barrages, and resulting in the pooling of water during flood events.
- Continue to monitor and evaluate the vulnerability of repetitive loss properties to determine if Mitigation action is warranted. Take mitigation action elevation, acquisition or other as required.

City of Hickman/Fulton County Flood Mitigation Project

Increase the capacity of the City of Hickman retention basin located between State Route 94 West and Catlett Street. This storm water retention basin may have been undersized when built, but over the years has also had its capacity significantly reduced by sedimentation. Consequently during periods of heavy rain, it becomes necessary to pump out the retention basin while the ground and ditch drainages downstream are still full or saturated. The result is that this additional water can cause, or exacerbate flooding along State Route 94 and tributary Roads. Fulton County and the City of Hickman would both benefit from the expansion of the capacity of this facility. This is a priority mitigation project for the County.

Figure 5.17

City of Hickman Retention Basin Capacity Increase



City of Hickman Waste Water Plant Flood Protection.

During the most recent Flood Hazard Event along the Mississippi River, DR 1976, significant effort and expense ($187,000) was expended protecting the City of Hickman waste water treatment plant from rising flood waters. Additional mitigation action, possibly the construction of impervious berms around the facility, need to be taken to secure the plant against the threat of future flood events.

Figure 5.18

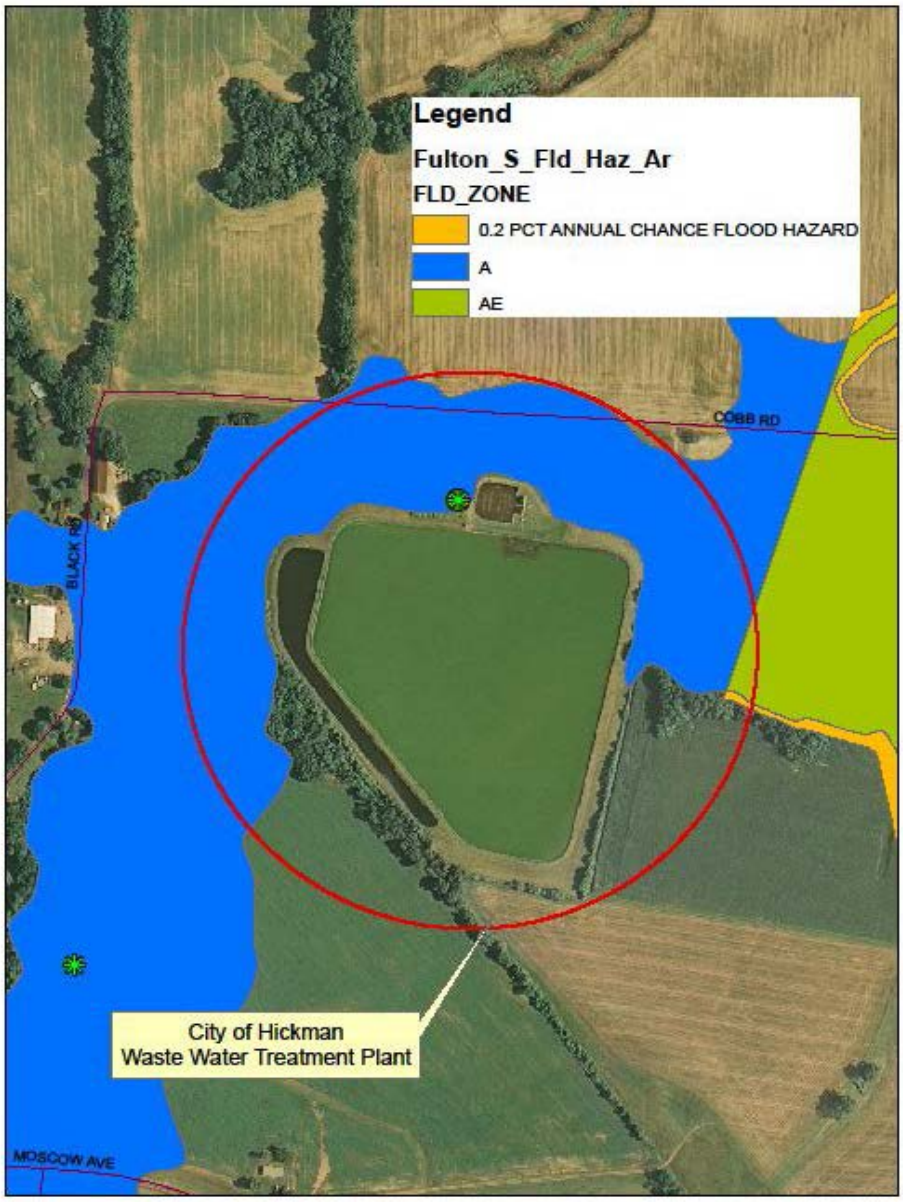
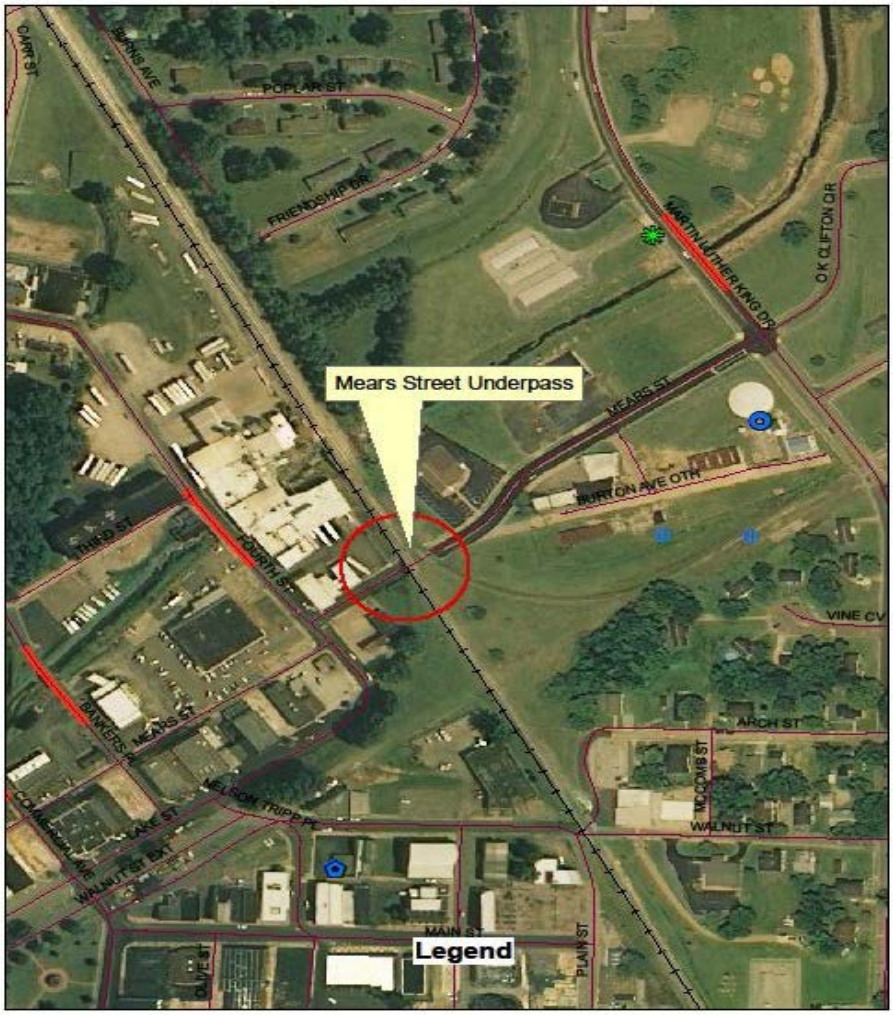

Legend
Fulton_S_Fld_Haz_Ar
FLD_ZONE
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
A
AE
COBB RD
BUCK RD
City of Hickman
Waste Water Treatment Plant
MOSCOW AVE

Figure 5.19



River Erosion/Deposition: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Dredge existing channels to maintain current depths and flows
- Identification and removal of stream blockages of tree limbs and trunks forming effective check dams and barrages, and resulting in the pooling of water during flood events

Tornado Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following:

- Develop a plan of action for a tornado event – include home, work, school, and outdoor situations
- Have tornado drills on a regular basis
- Encourage all households to maintain a disaster supply kit:
  - A three day supply of water (1 gallon per person per day)
  - Non-perishable food items
  - One change of clothing and shoes per person
  - One blanket or sleeping bag per person
  - A first-aid kit, including all prescription medicines
  - A battery-powered NOAA weather radio with warning alarm and extra batteries
  - A flashlight and extra batteries
  - Special items for infants, elderly or disabled individuals
- Listen to the latest forecasts, especially when planning outdoor activities.
- Publicize multi-media access to tornado watches and warnings.
- Inspect designated tornado shelters for compliance with building codes to ensure their ability to withstand high winds.
- Install warning systems that are not completely dependent upon electricity.
- Pursue programs to provide or subsidize the provision of weather radios to low income populations.
- Evaluate the need for tornado safe rooms, particularly for mobile home parks.
- Analyze the shelter requirements for temporary residents/visitors to the County's Elder Care facilities.
- Evaluate the need for tornado safe rooms, particularly for mobile home parks.
- Initiate mobile home anchoring program
- Build tornado safe rooms where deemed necessary.
- Ensure all critical facilities have a backup source of power – generators
- Train, equip and maintain Storm Spotter cadre
- Build Community Shelters in critical locations

Earthquake Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Support, encourage, and lobby for the continuing study of the threat of ground shaking from the Wabash and New Madrid Seismic Zones.
- Evaluate public critical facilities and infrastructure to determine their resistance to ground movement.
- Replacement of brittle water and waste water infrastructure specifically cast iron pipe, asbestos cement pipe, and vitreous clay pipe.
- Ensure that all homes and other structures are secured to their foundations.
- Enforce existing seismic building standards (current building code)
- Identify "safe places" in structures that are vulnerable during an earthquake. A safe place might include space under a sturdy table or desk against an interior wall. Stay away from windows.
- Practice the "drop and cover" technique in each identified safe place. Drop under your identified safe place, duck your head between your knees, and cover the back of your neck with your hands. Practice makes this process an automatic response in the event of an earthquake.
- Participate in any/all earthquake planning and exercises at the state and national level.

Winter Storm Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Make sure critical facilities have a backup source of heat
- Provide public education as to the safe use of back up heat sources
- Promote trimming of tree limbs and debris, particularly in areas close to critical facilities and infrastructure such as power lines.
- Evaluate subdivision regulations for inclusion of underground utilities for new development
- Insulate the walls and attic of structures
- Caulk and weather-strip doors and windows
- Allow water to slowly drip from faucets to prevent pipes from freezing
- Check the antifreeze and battery in vehicles
- Stay off snow or ice covered roads if possible
- Keep a supply of non-perishable food and water
- Ensure all critical facilities have a backup source of power – generators
- Maintain residential addressed structure point database for house to house recon during widespread power failures.

Landslide Mitigation Actions: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Identify and map vulnerable structures, critical facilities, and risk prone areas.
- Monitor the condition of the USCE Bluff Stabilization in the City of Hickman
- Monitor and discourage construction in close proximity to high risk landslide areas.

Wildfire Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Each community to strive to be a "Firewise" Community.
- Proper storage of flammables o Class Shingles or tin on roofs o Masonry construction
- Remove plants with resins, waxes, or oils from landscaping
- Remove dead branches
- Reduce the amount of fuel around homes
- Aggressively reduce available fuels in the vicinity of critical facilities
- Amnesty programs for hazardous materials/storage vessels
- Tire amnesty programs
- Removal of potential fuels from the vicinity of Critical Facilities.
- Pursue the acquisition of equipment and training to rapidly respond to brush fires to mitigate their becoming wildfires.

5:5.4 Implementation of Mitigation Measures

The purpose of this section is to provide a road map on how the mitigation actions identified in section 5:5.3 will be prioritized, implemented and administered in Fulton County.

All jurisdictions will adopt the JPHM Plan upon approval in 2018. Each county in the PADD has equal ability to enforce and implement mitigation strategies. The smaller cities in the Purchase Region, depend greatly upon the county government, and the PADD for support and combine resources to perform projects that improve the quality of life for residents, including mitigation projects and activities.

Given the (small) size of most of the Purchase region's cities, the planning process from which the following mitigation actions derived and were prioritized occurred at the county level. However, each city was represented at county-level meetings. Further, within each county-level planning meeting, individual city mitigation actions were discussed and prioritized. In practice, a city would derive one or two structural or property protection projects that it intended to pursue during the next five years and, first, discussed these projects' feasibility to implement in terms of local financing. Predictably, local financing was a significant constraint for both the county and its cities.

Preventative, natural resource protection, emergency service measures, and public information mitigation actions certainly were discussed at each planning meeting. However, the actions are not highly specific actions, by nature. Building code enforcement and enhancement, floodplain mapping and data, floodplain regulation, storm-water management, and planning activities, as examples, do not typically appear distinctive amidst a county and its cities. It is generally universally important, uncontroversial, and prescient to enforce codes, map and regulate floodplains, manage storm-water activity, and plan and zone. Similar that emergency service activities and public information activities are uncontroversial and generally sought (and not mutually exclusively) by both counties and its cities. So, while such activities were discussed individually for counties and for cities, their inclusion within the following mitigation action list will appear similar within each jurisdiction's list. In other words: Fulton County and its incorporated cities, Fulton and Hickman all agreed that preventative activities, emergency service measures, and public information activities primarily should be implemented using local and federal-cum-state financing (e.g., EMPG) and are a high priority for pursuance during the next five years.

The jurisdictions that have participated in the mitigation planning process are listed in this plan. In addition to local participation, the PADD staff has provided professional assistance in GIS and plan development to help enhance the ability of the local jurisdictions to implement mitigation activities.

Funding: Outside of local financing and state financing options, the jurisdictions of the PADD will attempt to utilize the following funding sources in implementing goals, objectives and actions when possible: the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation

Assistance Program (FMA), the Pre-Disaster Mitigation Program (PDM), Hazard Mitigation Technical Assistance Programs (HMTAP), the National Earthquake Technical Assistance Program, the Wind and Water Technical Assistance Program, and federal-state matching programs. It should be noted that the above list represents known funding sources at the time of this writing. It is not exhaustive.

Project Prioritization: Fulton County will maintain the list of set goals, objectives, and actions that have been identified in this plan. These items were prioritized based on a set of criteria located in the FEMA Multi-Hazard Mitigation Planning Guidance that includes social, technical, administrative, political, legal, economic, and environmental factors (STAPLE+E) within the county jurisdictions.

As mentioned above, this mitigation strategy will divide mitigation actions into Community-Rating System (CRS) categories *preventative activities*, *property protection activities*, *natural resource protection activities*, *emergency services measures*, *structural projects*, and *public information activities*.

Mitigation actions falling under *preventative activities*, *emergency services measures*, and *public information activities* generally (i.e., unless otherwise specified) are process-driven by nature and driven by uncontroversial and laudable goals. It is thus muddying and complicated to subject such measures to a formal, qualitative, and subjective prioritization mechanism like STAPLE+E. How does a community distinguish "technical assistance" or "hazard response operations" or "enforcement of building codes" as of equally or of higher priority than the construction of a community safe room? Consequently, such process-oriented actions are treated as default "High" in priority and are considered pursued by Fulton County and its incorporated cities of Arlington and Bardwell, e.g., Fulton County will "enforce building codes" while its cities may not.

The categories *structural projects*, *property protection activities*, and *natural resource protection activities* primarily will include actions that involve construction activity toward new and existing building structures. It is these intended projects and project categories that were prioritized using STAPLE+E.

Each structural/construction action for each community was given a High, Medium, or Low priority using the STAPLE+E framework. Because STAPLE+E relies upon qualitative and subjective assessment, Table 4.43 defines how each component of the STAPLE+E framework was interpreted. Generally, the mitigation actions with the highest priority were the most cost-effective and most compatible with the jurisdiction's social and cultural values. The below list of structural/construction actions includes a column specifying which components of the STAPLE+E framework as defined below were relevant in the designation of the projects' priority status. "E1" in the project lists refers to the "Economic" consideration. "E2" refers to the "Environmental" consideration.

The PADD staff reviewed each jurisdiction's priorities annually to ensure that they were properly prioritized. The designated council representative from each jurisdiction will be responsible for maintaining this list.

The STAPLE+E criteria guidelines for action prioritization that were given to the council members in order to analyze their actions were as follows:

Table 5.41 STAPLE+E Criteria Explanation

S - Social	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 – Technical	Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered and opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. It is important to evaluate whether an action is cost-effective, as determined by a cost-benefit review, and possible to fund.
E - Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with Federal, State, and local environmental regulations, and that are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

Tables 5.42-5.44 represent non-process actions requiring construction or acquisition related to the goals and objectives set forth in this plan, prioritized by each jurisdiction. The table identifies the hazard the action addresses, the action, the action priority, the entity responsible for the action, the potential sources of funding for the action, and to which Community Rating System (CRS) action category each project belongs.

Table 5.45 represents process actions that, thusly, are of High priority to Fulton County *and* to its incorporated jurisdictions equally: For example, it is expected that "adopting and enforcing building codes" applies with equally "High" priority to Fulton County and to its incorporated cities of Fulton and Hickman.

Construction/Non-Process Projects to Be Pursued by Each Jurisdiction:

Table 5.42: Fulton County, Unincorporated

Hazard	Action	Priority	STAPLE+E	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeline
Flooding	Elevate segments of roads prone to flooding	High	S, T, A, P, L, E1, E2	Fiscal Court; KYTC	Local, State, Federal Grant Programs	Structural	On going
Flooding	Acquire/Demolish Repetitive-Loss Properties	High	S, T, A, P, L, E1	Fiscal Court; KYEM; FEMA	FEMA HMA, Local	Property Protection	On Going
Flooding	Relocate Critical Facilities out of flood-prone areas or Elevate them	High	S, T, P, L, E2	Fiscal Court; Owners of Facilities	Local, State, Federal Grants Programs	Property Protection	Immediate
Tornadoes	Purchase and Install Emergency Warning Sirens for Cayce and Brownsville Communities	High	S, T, A, P, E1	Fiscal Court	Local, FEMA HMA	Emergency Services Measures	Immediate
Tornadoes	Construct Community Safe Room for the Cayce Community	High	S, T, A, P, L, E1	Fiscal Court	FEMA HMA, Local	Structural; Emergency Services Measures	Immediate
All Identified Hazards	Purchase Generators for Critical Facilities such as the EOC	High	S, T, A, P, E1	Fiscal Court	Local, FEMA HMA	Emergency Services Measures	On Going
All Identified Hazards	Purchase Emergency Power Sources for rural areas' designated shelters	High	S, T, P, L, E1	Fiscal Court	Local, FEMA HMA	Emergency Services Measures	On Going
Flooding	Develop a Debris Removal Plan for Streams and Ditches	Medium	S, P, L, E1, E2	Fiscal Court; Public Works	Local, Federal Grants	Public Information; Natural Resource Protection	On Going
Tornadoes; Severe Storms; Ice Storms	Trim Trees and Debris from Overhead Powerlines	Medium	S, P, L, E1	Utilities Providers	Private, Local	Preventative Activities	On Going
Wildfires	Purchase Equipment to suppress brush fires	Medium	S, P, E1	Fire Departments; Fiscal Court	Non-Profit, Private, Local, Federal Grants	Natural Resource Protection	On Going
All Identified Hazards	Upgrade Emergency Services Communication Equipment (for Critical Facilities)	Medium	S, T, P, E1	Emergency Management Agency	FEMA/DHS, Other Federal Grants, Local	Emergency Services Measures	On Going

Table 5.43: Fulton, City of

Hazard	Action	Priority	STAPLE+E	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeline
Flooding	Study cause of Harris Fork Creek flooding in the vicinity of Wells Ave and identify measures to alleviate flooding	High	S, T, A, P, L, E1, E2	City	Local, State, Federal Grant Programs	Structural	Immediate
Tornadoes	Purchase and Install Emergency Warning Sirens for portions of the City of Fulton that don't have adequate coverage	High	S, T, A, P, E1	City; Fiscal Court	Local, FEMA HMA	Emergency Services Measures	Immediate
Tornadoes	Construct Community Safe Room for the City of Fulton	High	S, T, A, P, L, E1	City	FEMA HMA, Local	Structural; Emergency Services Measures	Immediate
All Identified Hazards	Purchase Generators for Critical Facilities such as City Hall	High	S, T, A, P, E1	City	Local, FEMA HMA	Emergency Services Measures	On Going
Flooding	Identify measures to eliminate flooding in the Mears Street area and implement	Medium	S, T, A, P, L, E1, E2	City	Local, State, Federal Grant Programs	Structural	Immediate
Tornadoes; Severe Storms; Ice Storms	Trim Trees and Debris from Overhead Powerlines	Medium	S, P, L, E1	Utilities Providers	Private, Local	Preventative Activities	On Going

Table 5.44: Hickman, City of

Hazard	Action	Priority	STAPLE+E	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeline
Flooding	Dredge the Elvis Stahr Harbor	High	S, T, A, P, L, E1, E2	City	Local, State, Federal Grant Programs	Preventive Activities	Immediate
Flooding	Expand the City of Hickman's retention basin	High	S, T, A, P, L, E1, E2	City	Local, State, Federal Grant Programs	Structural	Immediate
Tornadoes	Purchase and Install Emergency Warning Sirens for the areas in the City of Hickman that don't have adequate coverage	High	S, T, A, P, E1	City	Local, FEMA HMA	Emergency Services Measures	Immediate
Tornadoes	Construct Community Safe Room for the City of Hickman	High	S, T, A, P, L, E1	City	FEMA HMA, Local	Structural; Emergency Services Measures	Immediate
All Identified Hazards	Purchase Generators for Critical Facilities	High	S, T, A, P, E1	City	Local, FEMA HMA	Emergency Services Measures	On Going
Tornadoes; Severe Storms; Ice Storms	Trim Trees and Debris from Overhead Powerlines	Medium	S, P, L, E1	Utilities Providers	Private, Local	Preventative Activities	On Going
Landslide	Continue to monitor the Hickman Bluffs Project	Medium	S, T, A, P, L	City, KYEM, USACE	Local, State, Federal Grant Programs	Preventive Activities	Long Term

Table 5.45: Process Mitigation Actions That Apply to Fulton County and Each of Its Incorporated Cities (Fulton and Hickman) with Equally (i.e., "High") Priority

Hazard	Action	Priority	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeline
All Hazards	Upgrade Emergency Services Communication Equipment (for Critical Facilities)	High	Fulton County Emergency Management Agency	FEMA/DHS, Other Federal Grants, local	Emergency Services Measures	Immediate
Flooding	Enforce NFIP Flood Ordinances	High	County and City Executives; Floodplain Managers	Fiscal Court; City Councils	Preventative Activities	On Going
Flooding	Monitor, Evaluate, Collect Damages Data to determine additional and on existing Repetitive-Loss Properties	High	County EMAs; City-Appointed Designees; Floodplain Managers	Fiscal Court; City Councils	Preventative Activities; Property Protection	On Going
Flooding	Provide Updated Floodplain Mapping and other information regarding flood-prone areas to Public	High	County and City EMA and EM agents; Floodplain Managers	Fiscal Court; KYEM; KDOW	Public Information; Preventative Activities	On Going
All Identified Hazards	Provide generators for all critical facilities	High	County; City; County EMA and EM agents; Floodplain Managers; Insurance	Fiscal Court; City Councils; KYEM	Public Information; Preventative Activities	Immediate
Flooding	Develop a debris removal plan for all streams and ditches	High	County; City	Fiscal Court; City Councils; KYEM; FEMA (through HMGP Initiative)	Preventative Activities	On Going
All Identified Hazards	Public Outreach for the Development of Evacuation Plans and Procedures relevant to All Identified Hazards	High	County; City	Fiscal Court; City Councils; KYEM	Public Information; Emergency Services Measures; Preventative Activities	Long Term
All Identified Hazards	Develop and Implement a Protection Program for Critical Information Systems	High	County; City	Fiscal Court; City Councils	Emergency Services Measures; Preventative Activities	Immediate
All Identified Hazards	Promote the Usage of NOAA Weather Radios	Med	County; City; EMA; EM Agents	Fiscal Court; City Councils	Preventive Activities; Public Information	On Going