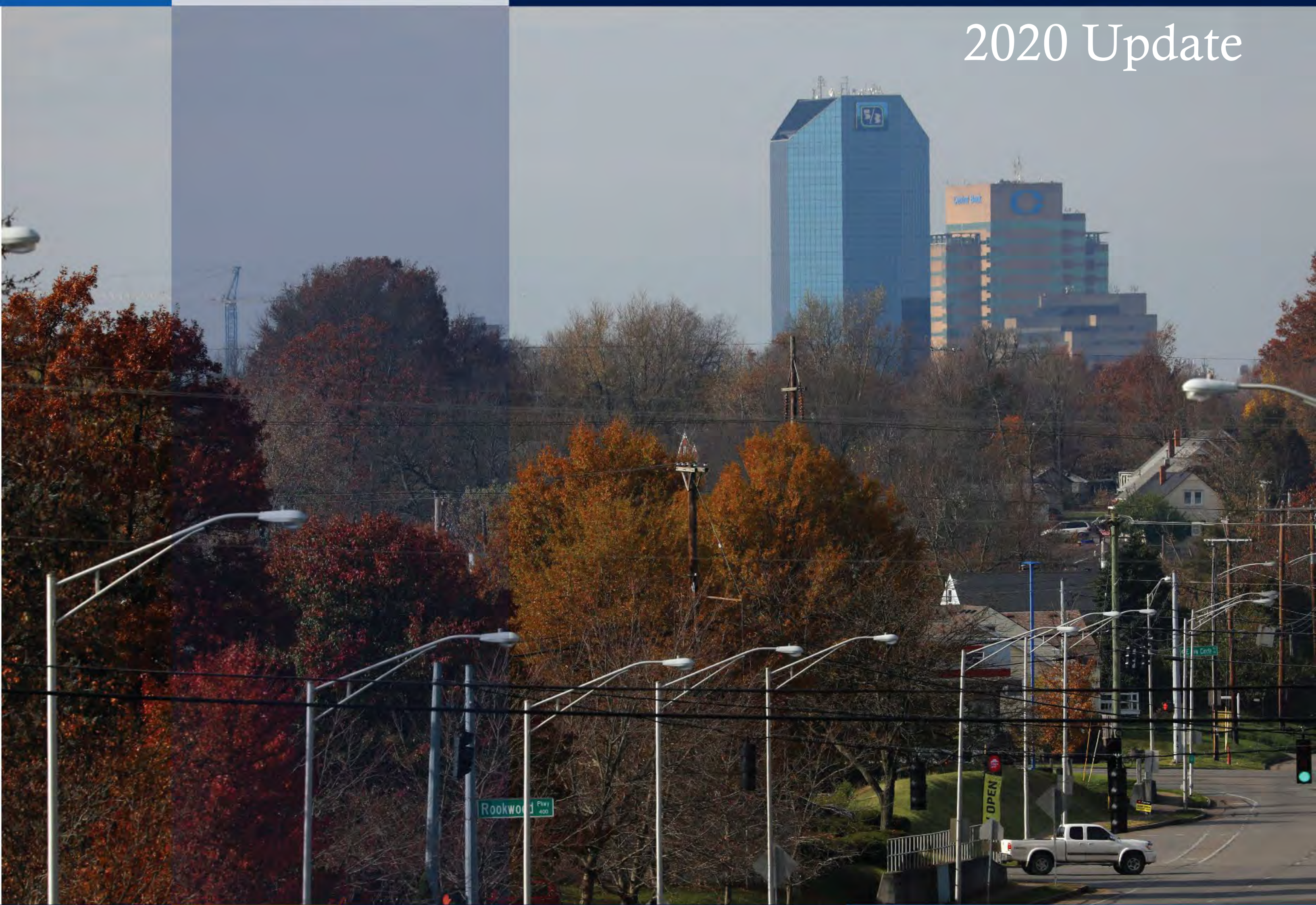
HAZARD MITIGATION PLAN

Lexington Fayette County

2020 Update



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Stantec

LEXINGTON

Contents

1. Executive Summary

Disasters can cause loss of life; damage buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being. Hazard Mitigation reduces disaster damages and is defined as a sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

Proactive mitigation policies and actions help reduce risk and create safer, more disaster resilient communities. Hazard mitigation and floodplain management is an investment in the community's future safety and sustainability.

Hazard mitigation activities may be implemented prior to, during, or after an event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act enacted under the Disaster Mitigation Act of 2000 (DMA 2000) established revitalized approaches to mitigation planning with a new requirement for Local Mitigation Plans. The Lexington Fayette County Urban (LFUCG) Hazard Mitigation Plan was developed and funded through the Pre-Disaster Mitigation (PDM) grant program which is a part of the Hazard Mitigation Assistance (HMA) grants program of the Federal Emergency Management Agency (FEMA).
The DMA 2000 emphasizes greater interaction between State and Local mitigation planning entities highlighting the need for improved linkages of hazard assessment and capability analyses. This can be accomplished through comprehensive risk assessments that form a solid foundation for decision-making, input from a wide range of stakeholders who play a key role in the implementation of mitigation actions, and who have committed to a mitigation strategy that is organized, easily referenced, and functions as a tool for tracking progress toward community resilience.

The purpose of the LFUCG Hazard Mitigation Plan is to set a strategy for building a more resilient community that will mitigate damages and losses caused by hazard events. The plan is the result of a systematic evaluation of the nature and extent of the vulnerability posed by the effects of hazards (risk assessment) and includes a five-year action plan to minimize future vulnerability (mitigation strategy), accompanied by a schedule that outlines a method for monitoring and evaluating plan progress (plan maintenance).

The LFUCG Hazard Mitigation Plan contains the following sections, plus appendices:

- Introduction
- Planning Process
- Risk Assessment
- Capability Assessment
- Mitigation Strategy
- Plan Maintenance
- Plan Adoption

The **Planning Process** includes a narrative of how the plan was produced, who was involved, and what other policies and programs were reviewed to inform the plan. Key stakeholders were identified and organized into a Stakeholder Group and were invited to attend four meetings, two publicly advertised. Input provided during these meetings, work sessions, and other individual stakeholder meetings drove the formation of the risk assessment, mitigation strategy, and plan maintenance sections of the plan.

The **Risk Assessment** includes developing a profile for the 15 identified hazards as well as the identification, compilation, and integration of the existing hazard databases into one managed, database contained in Geographical Information Systems (GIS). These maps provided the necessary information for the Stakeholder Group to examine past occurrences of hazards and assess probabilities to determine appropriate mitigation strategies to pursue in the future.

The **Capability Assessment** helps determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects.

The **Mitigation Strategy** includes the determination of hazard mitigation goals and actions as identified during the planning process and based on a review of the risk assessment results. The plan developers also took inventory of LFUCG's current capabilities and marked mitigation successes over the past five years.

The **Plan Maintenance** section outlines the steps for plan implementation which includes monitoring, evaluating, and updating the plan. The plan will be maintained through collaborative efforts of the LFUCG departments to allow for better incorporation of existing planning mechanisms.

The **Plan Adoption** demonstrates LFUCG's commitment to fulfilling the mitigation strategy. This section provides a description of the Plan Adoption process.

2. Introduction

2.1 Overview

This policy document demonstrates Lexington Fayette Urban County Government's (LFUCG) commitment to reducing the risks from natural and man-made hazards and should serve as a guide for all levels of local decision makers.

In accordance with the "Local Mitigation Plan Review Crosswalk" the LFUCG Hazard Mitigation Plan includes the following basic requirements:

- A well-documented and open planning process that includes opportunity for public comment during draft plan development and prior to approval;
- The opportunity for involvement of neighboring communities,
- The review and incorporation of existing plans, studies, reports and technical information;
- A risk assessment that provides the factual basis for activities proposed in the mitigation strategy;
- A mitigation strategy that provides LFUCG's blueprint for reducing potential losses identified in the risk assessment.

44 CFR Part 201
Mitigation Planning

§201.1 Purpose.

(a) The purpose of this part is to provide information on the policies and procedures for mitigation planning as required by the provisions of section 322 of the Stafford Act, 42 U.S.C. 5165.

(b) The purpose of mitigation planning is for State, local, and Indian tribal governments to identify the natural hazards that impact them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the plan, taking advantage of a wide range of resources.

In summary, the LFUCG Hazard Mitigation Plan seeks to provide the overall guidance to weave together the planning efforts of all local agencies, private and non-profit organizations into one viable, comprehensive, local mitigation program.

2.2 Community Profile

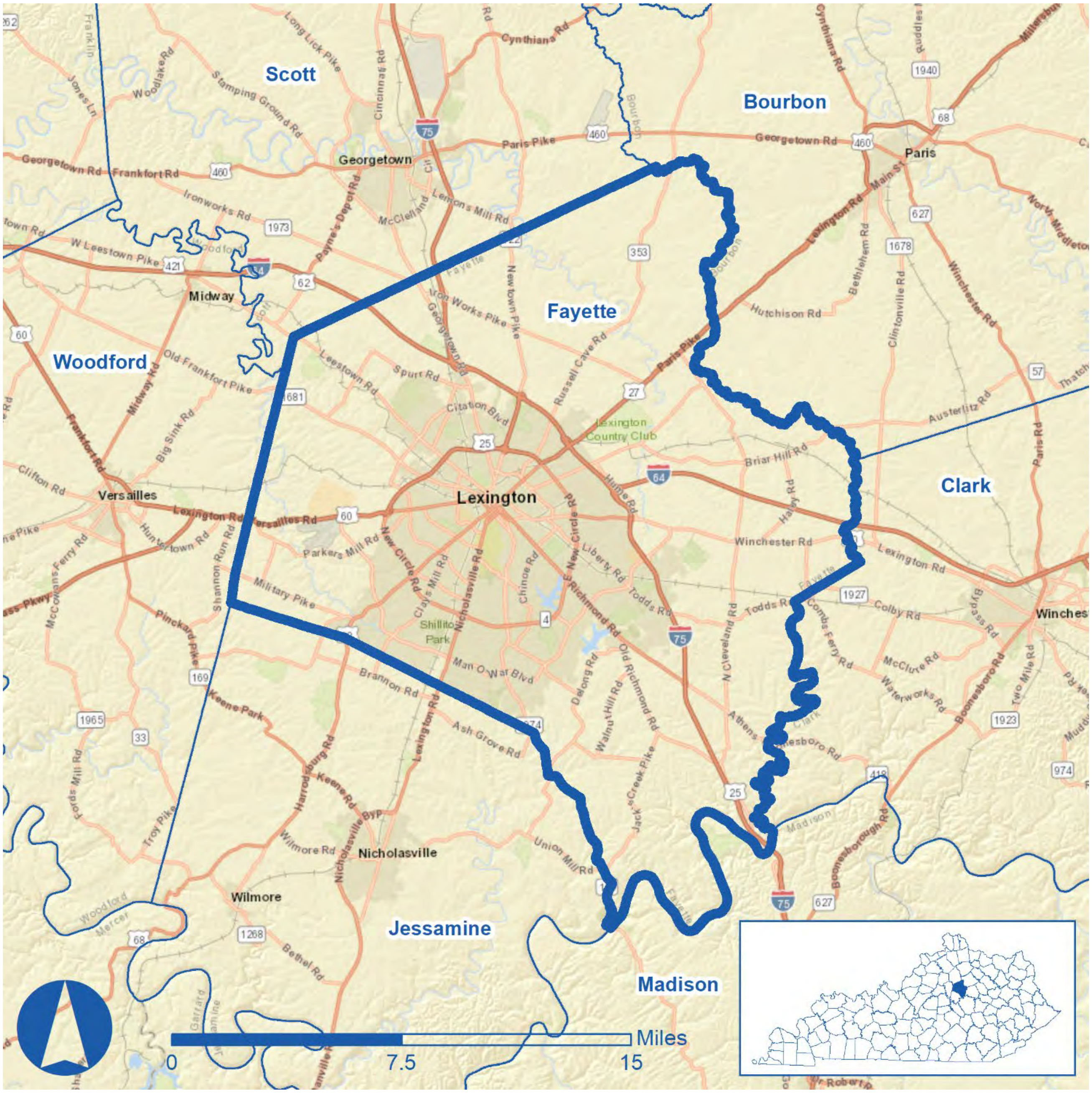
The first step in developing a mitigation plan is to profile the community in respect to history, population, land and geography, climate, environment, land use, economy and transportation. The following subsections outline each of these profile attributes

History

The City of Lexington developed from a campsite established in 1775 and was named after the opening battle of the Revolutionary War. In 1781 the Virginia Legislature ratified the establishment of a town, and in 1792 when Kentucky became the fifteenth state, Lexington was selected as the temporary state capitol. It was formally incorporated as a city in 1832. In 1972, the community voted to merge its city and county governments; this merger became effective in January 1974. Currently, the government format consists of a Mayor and The Urban County Council – the legislative branch of the Lexington Fayette Urban County (LFUCG).

Government

The Urban County Council holds the power to establish budgets, set policy and levy taxes, subject to limits set by the Charter and state laws. It consists of 12 Council District members and 3 At-Large members.



Population Size

The populations of Lexington Fayette County and the Census Bureau's Metropolitan Statistical Area (MSA) have increased steadily over the past four decades. The population of Lexington Fayette County grew by 136% from 131,906 in 1960 to 311,529 in 2016, with an increase of 5.3% from 2010 to 2016.

In the seven-county (Fayette, Jessamine, Woodford, Scott, Bourbon, Clark, Madison) MSA, the population has increased from 555,015 in 2010 to 589,378 in 2016, a 6.2% increase for the area. Fayette County, as a percentage of the MSA population, has declined from 56.3% in 1970 to 53.3% in 2010. Fayette County, as a percentage of the regional population, is anticipated to continue to decline slightly as Fayette County's Urban Service Area Boundary and Rural Land Management program guide future population growth and location. This has held true with the Census American Community Survey (ACS) 2016 data showing Fayette County population comprising 52.9% of the MSA population.

Taste of Beaumont at Moondance Amphitheater.
Oct. 2017. Photo by Barry Barrows

At 52.6% and 58.9%, both Fayette County and the entire metro area have grown more rapidly than the percentage growth of the state as a whole (21.1%) from 1980 to 2016. Based on 2010 Census data, projections used in Lexington Fayette County's 2013 Comprehensive Plan Update[1] estimates the future population of the urban county to increase to 334,733 in 2020 and 375,986 in 2030.

Population Growth in Fayette County & the Fayette Metro Area					
	1980	1990	2000	2010	2016
Fayette County	204,165	225,336	260,512	295,803	311,529
7 county metro area totals	370,981	405,936	479,198	555,015*	589,378*
Fayette Co. as % of metro	55.0%	55.5%	54.4%	53.3%	52.9%
State	3,660,777	3,685,296	4,041,769	4,339,367	4,436,974
Source: US Census Bureau, Census of Population, 1980-2010; U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates *The MSA was redefined to 6 counties sans-Madison. Madison county's Total Population has been added for continuity.*					

Population Composition

Paralleling trends throughout the United States, people in Fayette County have had fewer children over the last four decades; therefore, the percentage of the population in the under 17 age group has decreased in this time period from 32% of the population in 1970 to 21% of the population in 2016. The percentage of persons 18 to 64 years of age increased from 60% of the total population in 1970 to 67% of the 2016 population (slightly down from 68% in 2010). This reflects the aging of persons born during the postwar baby boom. Additionally, the percentage of persons over 65 years old has increased slightly from 8% of the population in 1970 to 12% of the 2016 population. This reflects increased longevity and the choice of Lexington as a place for retirement by many people.

[1] The 2013 Comprehensive Plan for Lexington Fayette County, Kentucky, pg. 13

According to the U.S. Department of Commerce, the population by race and Hispanic origin from 2016 shows 75.8% (236,242) white, 14.5% (45,319) black, and 3.5% Asian (9,688) to name the highest documented percentages. Of the total population, regardless of race, 6.8% or 21,322 individuals are of Hispanic Origin.

Population and Percent by Age Category - Lexington Fayette County, 1980-2016										
Age	Total Pop.	% Pop.	Total Pp.	% Pop.	Total Pop.	% Pop.	Total Pop.	% Pop.	Total Pop.	% Pop.
	1980		1990		2000		2010		2016	
0-17	51,667	25	55,533	21	55,533	21	62,633	21	65,945	21
18-64	134,952	66	181,146	70	181,146	70	202,032	68	209,282	67
65+	17,546	9	23,833	9	23,833	9	31,138	11	36,302	12
Total	204,165	100	260,512	100	260,512	100	295,803	100	311,529	100
Source: US Census, Bureau, Census Population, 1970-2010; American Community Survey, 5-Year Estimates, 2012-2016										

Foreign Language Distribution

From 2010 to 2016, the number of foreign language speakers in Fayette County has grown by 24%. According to data from the U.S. Census Bureau's American Community Survey (ACS), an estimated 21.1% of Fayette County's population spoke a language other than English at home, compared to 10.6% in 2010. Further, 5.2% of Fayette County's population[2] spoke English "less than very well," (14,003 persons) in 2010. In 2016, this estimate was up slightly, with an estimated 5.6% of the population (16,219 persons) speaking English "less than very well." Emergency preparedness and response efforts must be targeted to include this growth in the immigrant population and number of foreign languages.

Population Distribution

The distribution of urban to rural growth has also dramatically changed. In 1960, 83.6% of the urban population lived inside New Circle Road. In 2000, that had dropped to 43%[3].

Prior to 1974, Lexington was an incorporated city, but even as early as 1950, the area classified as urbanized by the Census included an urban fringe outside the city limits. In 1950, the population of Lexington itself was 55,534. However, the urbanized area included over 75,000 people. Construction of New Circle Road began in 1948 and was not completed for twenty years. The 1950 data, therefore, does not quantify the urbanized data in relation to New Circle Road. The Urban Service Area concept was adopted in 1958. Beginning in the 1960s, a significant portion of the city's urban growth began to occur outside New Circle Road but within the Urban Service Area. In 1974, the city of Lexington and Fayette County merged to form a unified Urban County Government. From a high in 1970, the numbers of people residing within New Circle Road declined over the last three decades, while the number and percent of the Lexington Fayette County population residing outside New Circle Road, (within the Urban Service Area) grew significantly.

After decades of a declining rural population, the percentage of the population in the county residing outside of the Urban Service Area decreased from 25.3% in 1950 to 5% in 2012. "The Urban Service Area boundary has

[2] Population over 5 years old.
[3] ibid, 252

expanded over the years and Zoning ordinances have restricted residential development within the Rural Service Area, which have reduced the percentage of the population living within the rural area."[4]

Climate

Monthly mean temperatures in Lexington Fayette County range from a high of 76.2 degrees in July to a low of 33.1 degrees in January. The area has a moderate climate, characterized by warm, moist conditions. Summers are usually warm, and winters cool. Much of the County's average annual 44.7 inches of precipitation falls in the spring and summer. Storms happen year-round; however, most storms occur between March and September.

Normal Climate & Average in Lexington Fayette County, Kentucky												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
*Average temperature (°F)	33.1	35.3	44.5	54.7	64.3	72.8	76.2	74.9	68.9	57.3	45.1	36.2
Days with precipitation	12	11	13	12	12	11	11	9	8	8	11	12
*Average precipitation (in)	3.8	3.2	4.4	3.8	4.2	4.2	4.6	3.6	3.0	2.6	3.3	3.8
Wind speed (mph)	10.5	10.5	10.8	10.4	8.6	7.9	7.2	6.8	7.6	8.1	9.9	10.2
Morning humidity (%)	81	79	77	76	81	84	86	88	88	85	81	81
Afternoon humidity (%)	69	64	58	55	58	58	59	59	58	57	63	68
Sunshine (%)	39	46	50	56	59	65	65	65	63	59	43	38
Days clear of clouds	6	6	6	6	7	7	8	9	10	12	7	6
Partly cloudy days	6	6	7	9	10	12	12	12	8	7	7	6
Cloudy days	20	17	18	15	14	11	11	10	11	12	17	19
*Average Snowfall (in)	5.5	4.7	2.8	0.3	0.1	0	0	0	0	0	0.9	3.1
*Western Regional Climate Center www.city-data.com												

Environment

A major environmental factor for Lexington Fayette County going into the 21st century is that the land available for future development has more overall physical problems than land developed in the past quarter of a century. Smart growth studies suggest that problematic physical characteristics should be carefully addressed before development occurs. It is easier to mitigate those problems before development occurs rather than after development has taken place. Controls for the development of environmentally sensitive land in Lexington Fayette County have been in place for years and are often upgraded and enhanced. An environmentally sensitive designation applies to any area that, due to its natural or physical setting, may have environmental problems that could be compounded if developed.

The citizens of Lexington Fayette County enjoy the benefits of past actions which ensured that the kind of unmanaged suburban sprawl which has devoured farm land across the nation in the post WWII growth explosion has been mitigated to a large extent. Unlike most other communities, however, Lexington Fayette County has taken positive action to ensure its rural heritage is preserved. In 1958, Lexington Fayette County embarked on a policy designed to manage urban growth and save surrounding farmland. The Urban Service Area approach to growth management divided the county into two parts 1) an Urban Service Area to accommodate all manner of urban growth and, 2) a Rural Service

[4] ibid, 252

Land Use and Planning

Lexington Fayette County is located in the heart of central Kentucky's Bluegrass Region. The terrain is rolling hills with some deep streambeds. Principal streams are the Kentucky River and Elkhorn Creek. The following subsections outline the County's rural preservation, housing, economy, tourism, and transportation. The following subsections outline the County's Land Use categories.

History of Rural Preservation

Like many urban areas, Lexington Fayette County is aware of the importance of agriculture in its history. The landscape of the countryside is perhaps the predominant element in the mixture of urban and rural values that define the essential character of the community. The unique blend of sharply defined urban boundaries, tree lined rural roads, world-renowned horse farms, riverine palisades, tobacco and other crops, livestock farms, structures, stone fences, historic rural settlements and countless other physical and social elements define the setting of Lexington's environment.

In 1958, Lexington Fayette County embarked on a policy designed to manage urban growth and save surrounding farmland. The Urban Service Area approach to growth management divided the county into two parts 1) an Urban Service Area to accommodate all manner of urban growth and, 2) a Rural Service Area primarily for agricultural uses. This policy clustered urban growth into a compact and contiguous area of the County. The relative size of the two areas has varied over the years – the size of each has at times been larger than the present ratio.

Sunrise Along Van Meter Rd. Oct. 2015

Lexington Fayette County, for the most part, is in the geographic area of the upland plains and does not have any significant streams with wide floodplains in the urban area. It has 565 miles of creeks that are tributaries draining into the Kentucky River located at the southeast border of the County. Lexington Fayette County has nine watersheds, seven of which have headwaters which originate in the Urban Service Area.

Most of Lexington Fayette County's 280 square miles lies within what is called the Inner Bluegrass Physiographic Region. The area is characterized by gently rolling hills, fertile soils and slow-moving streams. Broad, undulating, upland plains give way to wide, nearly level land along stream bottomlands.

The other region, the Hills of the Bluegrass, covers only a small area in the southeastern part of the County, and includes the tributaries that are adjacent to the Kentucky River. The landscape in this area is characterized by highly dissected, long and narrow ridge tops and moderately steep to very steep hillsides. The Palisades at the Kentucky River are limestone cliffs of 200 feet or greater. There is little elevation change over most of the County, except in the Hills of the Bluegrass, which has a fluctuation of some 400 feet. For the most part, the areas located in the Hills of the Bluegrass Region are not well suited for cultivation or large-scale development. These areas should be reserved for very low-density development unless innovative environmental and site design elements are created and implemented.

Currently, of the 280 square miles that comprise Fayette County, approximately 85 square miles (30%) of the county is in the Urban Service Area, and 200 square miles (70%) is in the Rural Service Area. In 1991, Lexington's

Urban Service Area approach to planning was recognized as a National Planning Landmark. *Lexington Fayette County Zoning Categories* is a combined version of land use zoning categorization based on 2011 zoning data. Here, the Urban Service Area and Rural Service Areas are distinguishable.

The most recent existing land use study was completed in 2011. At that time, approximately 6,700 acres, or 12% of the land, in the Urban Service Area were undeveloped. About 13% of this, or 870 acres, is environmentally sensitive with floodplains, areas of steep slopes, sinkholes, or other land that is undevelopable due to geologic hazards. Geologic hazard areas include areas of excessive flooding, clusters of sinkholes, cliffs and caves near the surface. These areas will either require extensive geotechnical analysis before development or they will need to be left as open space. Based on the 2013 Lexington Fayette Comprehensive Plan, land absorption within the Urban Services Area was approximately 590 acres per year from 2000 to 2011, indicating that there a high demand for developable land within the Urban Services Area.

Housing

According to the 2010 U.S. Census, Lexington Fayette County has a total of 138,858 housing units, 12,419 (8.9%) of which are recorded as vacant. Of the total occupied units, 67,730 (53.6%) are owner-occupied and 58,703 (46.4%) are renter-occupied. In 2016, the average household size for owner-occupied dwellings was 2.5 persons per unit, and the average for renter-occupied dwellings was 2.3 persons per unit.

Housing values are mixed throughout Lexington Fayette County. There are eight Census Tracts in the County that have housing values in the highest range (greater than $2 million). While these Census Tracts are located throughout different parts of the county, the two tracts with by far the greatest number of homes over $2 million (50 homes and 60 homes) are located in the city center (southwest of East Main Street) and the westernmost part of the county, where there are many thoroughbred horse and racing farms.

Figure 1. Gratz Park Historic District. Dec. 2015

There are 13 Census Tracts that have median home values less than $100,000. While the location of these tracts varies, most of these tracts are concentrated in the north and northeastern region of Lexington, within New Circle Road. The only Census Tract with a median home value of less than $50,000 is located north of downtown Lexington, within West New Circle Road. The southwestern and southeastern regions of Lexington Fayette County have median home values mostly ranging from $94,000 to $400,000. Overall, the median housing value for the Lexington- Fayette County area was $170,800 in 2016

Economy

Lexington Fayette County is noted as one of the world's largest burley tobacco markets, a center for breeding and selling high quality horses, and as a growing commercial, industrial, and transportation focal point.

Colleges, Universities and Technical Schools of Lexington Fayette County*
University of Kentucky
Transylvania University
Sullivan University, Lexington Campus
Strayer University – Lexington Campus
Spencerian College, Lexington Campus
Bluegrass Community & Technical College; Cooper, Leestown, and Regency Campuses
Indiana Wesleyan University, Lexington Education Center
Lexington Theological Seminary
National College of Business and Technology, Lexington Campus
Eastside Technical Center
Southside Technical Center
* Source: Kentucky Cabinet for Economic Development. Website: http://www.thinkkentucky.com/EDIS/cmnty/EducTrain.aspx?cw=053

Lexington Fayette County is home to several Universities and Technical Schools that provide thousands of jobs and the training ground for future employable Lexingtonian's. Lexington, the primary urban center of Central Kentucky, supports four universities, in addition to five other post-secondary educational institutions, 90 schools[5] (63 public and 27 private), ten hospitals, 80 shopping centers, 12 nursing homes, and approximately 140 daycare centers.

Lexington is home to the world headquarters of Lexmark International and Toyota's largest manufacturing facility in the US is nearby in Georgetown, KY. Industry heavyweights IBM, Schiender Electric, Trane, and Link-Belt also have a presence in Lexington. Additionally, Lexington is home to a thriving biosciences sector and is actively supporting a vibrant entrepreneurial community.

Major Employers in Lexington Fayette County*		
Company	Description	Full-Time Employees
University of Kentucky	Higher Education	13,500
Fayette County Public Schools	Local Education	7,983
Lexington Fayette Urban County Government	Local Government	2,945
Conduent	Outsourcing	2,500
Lexmark International Inc.	Global Headquarters	2,100
Veterans Medical Center	Healthcare	1,757
Baptist Healthcare System Inc.	Healthcare	1,558
Amazon.com	Distribution	1,200
Lockheed Martin	Manufacturing	1,100
Trane Lexington	Manufacturing	800
Webasto Roof Systems	Manufacturing	725
Ashland Consumer Markets (Valvoline)	Headquarters	700
Link-Belt Construction	Headquarters	675
Big Ass Solutions	Headquarters	668
Gall's Inc.	Headquarters	537
Federal Bureau of Prisons	Federal Government	509
Cardinal Hill Rehabilitation Hospital	Healthcare	508
Schiender Electric	Manufacturing	500
TOTAL		40,265
*Source: Commerce Lexington Inc. Economic Development. Web Address: http://locateinlexington.com/Data-Facts-Figures-Major-Employers.aspx		

[5] Lexington Fayette County 2017 District Facilities Plan.

Geologic Resources in Fayette County

According to the Kentucky Geological Survey (KGS), limestone is the chief geologic resource in the county, with three mines currently in operation. One large quarry even occurs near downtown Lexington. The limestone from these mines is used mostly as aggregate construction materials (concrete, asphalt).

Tourism

Tourism continues to be a significant part of Lexington Fayette County's economy. The County's status as the "horse capital of the world" has brought national and international recognition to the central Bluegrass Region, which has helped boost the tourism and hospitality industry. Just minutes from the center of town are acres and acres of manicured pastureland, miles of white fences, magnificent barns, dozens of ways to see horses, the 1,200-acre Kentucky Horse Park, the Thoroughbred Training Center, Keeneland Race Course and more.

Lexington is also located in the heart of Bourbon country and the world-famous Kentucky Bourbon Trail. The Bourbon tourism industry has garnered roughly 2 million visitors over the last five years. Lexington is also home to multiple arts, entertainment and recreation jobs as seen in the table below.

Arts, Entertainment, and Recreation Statistics in Fayette County (2016)				
2012 NAICS Code	Meaning of NAICS Code	Number of Establishments	Annual Payroll ($1,000)	Number of Paid Employees
71	Arts, entertainment, and recreation	164	84,209	2,943
711	Performing Arts, spectator sports, and related industries	65	54,483	1,185
712	Museums, historical sites, and similar institutions	10	1,200	52
713	Amusement, gambling, and recreation industries	89	1,706	28,346
Source: U.S. Census Bureau, 2016 County Business Patterns. Location: www.census.gov				

Transportation

Lexington Fayette County's central location and transportation system have been major factors in the city's growth and development. Major highways and routes include I-75, I-64, US 60, US 27, US 25, US 421, US 68, Man-O-War Boulevard and New Circle Road. Lexington's location at the intersection of two major interstate highways (interstates 64 and 75) places it within a day's drive of 70% of the U.S. markets. CSX Transportation, RJ Corman, and Norfolk Southern Corporation maintain rail lines through the county. Blue Grass Airport also serves as a regional airport with a 7,000-foot runway. The Lexington Transit Authority (LexTran) provides public transit to many areas of Lexington. Lexington Fayette County includes approximately 1,170 miles of urban, county, and state-maintained roads as outlined in the map.

3. Planning Process

> **Local Mitigation Planning Process**
>
> **§201.6(b): The plan shall include a description of the planning process used to develop the plan, including how it was prepared, who was involved in the process and how local agencies participated.**

The following section demonstrates the achievement of the Lexington Fayette Urban County (LFUCG) Hazard Mitigation Plan development process by describing the LFUCG Planning Team, LFUCG Stakeholder Group and public participation, and the incorporation of existing planning mechanisms. Capturing in a narrative what is accomplished during the planning process is very important for three reasons

- By documenting the steps as they are completed and referring to the planning timeline, team members can quickly determine what needs to be done.
- The narrative becomes a record of how and why the plan was prepared.
- Documenting the planning process is a requirement under the Disaster Mitigation Act of 2000

A comprehensive description of the planning process informs citizens and other readers about the plan's development. Leadership, staffing, and in-house knowledge in local government may fluctuate over time. Therefore, the description of the planning process serves as a permanent record that explains how decisions were reached on a strategy to reduce losses, and that it was developed with stakeholder input in a methodical and reasonable way. Leaders can then continue to make decisions in a pre- and post-disaster environment to decrease vulnerability to community hazards Additionally, the Planning Process sets up the method for the Stakeholder Committee to continue to make decisions in a pre- and post-disaster environment to decrease vulnerability to community hazards.

The Planning Team used the following guidance to complete the 2016 Plan Update:

- FEMA Local Mitigation Planning Handbook (2013);
- FEMA National Flood Insurance Program Community Rating System Coordinators Manual (2017)
- FEMA Hazard Mitigation Assistance Guidance (2015)

3.1. Stakeholder and Public Engagement

3.1.1. LFUCG Planning Team

The Plan's planning/project team (**LFUCG Planning Team**) included representatives from LFUCG Division of Emergency Management (DEM) and Stantec Consulting. Members of this team have worked together on all three of LFUCG's Hazard Mitigation Plan's. The LFUCG Planning Team was responsible for the planning schedule, meeting locations, and stakeholder invitations. The team also provided key guidance to the overall development of the Plan, including decisions on what mitigation strategies and actions were included in the Plan update and how the Plan will be maintained.

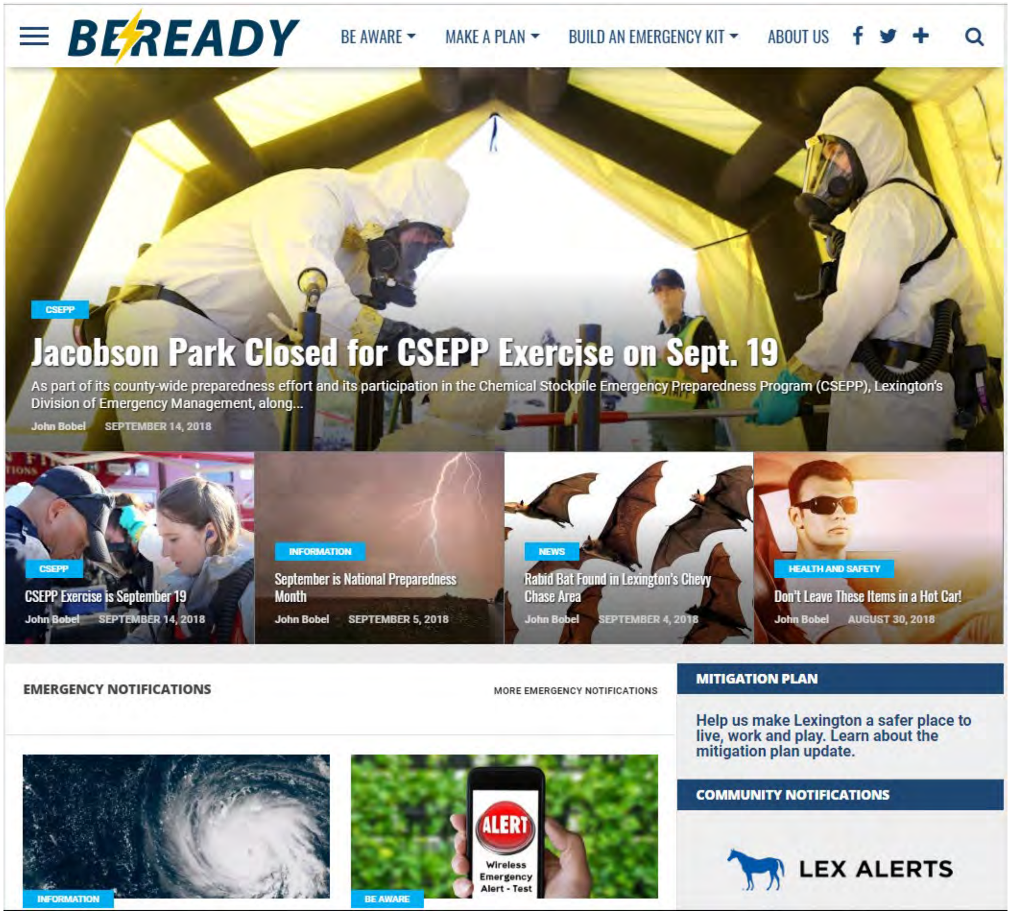
Member	Organization
Tim Brandewie	LFUCG Division of Emergency Management
Patricia L. Dugger	LFUCG Division of Emergency Management
John Bobel	LFCUG Division of Emergency Management
Josh Human	Stantec
John Bucher	Stantec
Luisa Trujillo	Stantec

3.1.2. Stakeholders and the Public

LFUCG planning process provided an opportunity for the public to comment on the Plan during its formation as well as an opportunity for any neighboring communities, local and regional agencies, businesses, and other interested parties to participate in the planning process. This public involvement, along with the review of any existing plans, studies, reports, and technical information, assisted in the development of a comprehensive approach to reducing losses from multiple disaster scenarios.

Stakeholders were identified based on previous participation in related planning efforts, and their agency's/organization's role in the community. These stakeholders were further identified as the LFUCG Hazard Mitigation 'Stakeholder Group'. The Stakeholder Group received personal email invitations to all meetings from the Director of LFUCG Emergency Management. Press releases, to encourage public involvement were issued prior to each meeting with the date, time, location, and topics to be covered. All press releases and meeting invitations can be found in Appendix A.

Through "Be Ready", LFUCG Division of Emergency Management's website, information was distributed regarding meeting details, contact information, and updates about the planning process. This webpage was also used to promote the process to the public, allowing every member in the community access to the process.



It is important to note that not only were local members of the community invited but also important state and regional partners including the emergency management agencies from surrounding counties and the State.

A complete list of LFUCG Stakeholders Group who were invited and participated in the planning process may be found in Appendix B.

Stakeholder Meetings

The following describes the four Stakeholder workshops and individual meetings used to develop the LFUCG Hazard Mitigation.

Meeting	Date
Stakeholder Kick-off Meeting	Feb. 15, 2018
Stakeholder and Public Risk Assessment Meetings	April 18, 2018
Stakeholder Mitigation Strategy Meeting	June 21, 2018
Stakeholder and Public Draft Plan Meeting	March 7, 2019

Stakeholder Kick-Off Meeting – February 15, 2018

The meeting took place at the Public Safety Operations Center and over twenty-five people representing a wide array of stakeholders attended. Sign-in sheets and meeting notes for the meeting may can be found in Appendix A.

After attendees' introductions, the Stantec team gave a detailed introduction to hazard mitigation planning. The Stantec Team led a hazard ranking exercise that helped rank the hazards and helped prioritize mitigation actions in the Plan.

The stakeholders raised questions about FEMA funding, inclusion of Extreme heat/cold as one of the hazards that should be included. Additionally, the audience raised questions concerning cyber terrorism and technological hazards. It was discussed that these types of hazards are not directly covered by FEMA hazard mitigation plans, but can be addressed, because some of their consequences and prevention/response capabilities overlap with some natural hazards.

The meeting finalized by announcing the data needs to complete the risk assessment and introducing the capability assessment information distributed by email.

Stakeholder and Public Risk Assessment Meetings – April 18, 2018

These meetings took place at the Fayette County Agricultural Extension Office and over fifteen people attended representing a variety of stakeholders. The sign-in sheets and meeting notes for the meetings may be found of Appendix A.

The Stantec team started the meeting with a presentation that introduced the methodology used by Stantec for the Risk Assessment. The Stantec Team expanded upon these details about the methodology and explained the use of the 100 Military grid with the purpose of avoiding data bias occurring with Census blocks or Census tracts that are not all the same size. The Stakeholder group was encouraged to review the maps and provide feedback to the Planning Team.

Another item discussed in the meeting was the Capability Assessment, this section of the Plan compiles and describes plans, ordinances, and other resources that are already in place. The participants offered suggestions to contribute in the Capability Assessment:

- Look at the Greenways Plan as a natural resource plan - includes conservation of floodways
- Flood response – Included in EOP, also includes recommendations for planning and projects around WWTPs
- Look at the 6-year Traffic Improvement plan involves transportation planning projects such as a bridge replacement. These projects typically include flooding studies.
- The Tree protection program/ordinance is in the development process. The city's zoning ordinance has a tree coverage requirement.
- LFUCG Grants and Special Projects Office oversees and supports other city departments in the applications for grants and administers CDBG funds.
- The city's Budget's Office maintains a list of capital improvement projects
- Some funding options include the Sanitary Sewer Fund through the Impermeable fee, the Water Quality Management Fee (WQMF), and the Urban Service Tax.
- The WQMF (consent decree) funds storm water projects
- All the Public Works Departments have GIS capabilities.
- LFUCG has some mutual aid agreements with surrounding counties and an intergovernmental Storm Water agreement with Jessamine County.
- The city uses exaction fees on new development to fund required infrastructure improvements within designated expansion areas.
- Agreement with KYTC for snow removal, also has a Snow and Ice Removal Plan
- Royal Springs Aquifer Committee – intergovernmental committee to protect water quality
- Purchase of Development Rights (PDR) Program used to protect open space and included in the floodplain management plan

Finally, the Mitigation Strategy was briefly discussed by mentioning the type of projects including Prevention, Property, Protection, Structural Projects, Natural Resource Protection, Emergency Services. Public Education and Awareness. In addition, the Mitigation Strategy review process was introduced. The Stantec Team showcased how the Stakeholder Group was going to supply information on the Mitigation Action Workbook. Post meeting the Planning Team sent out the LFUCG_Mitigation_Action_Workbook_2013_Update excel file along with the Mitigation_Action_Workbook_Instructions document (See Appendix C). These documents provided instructions and the feedback avenue to capture implementation and new ideas for the 2020 Mitigation Strategy.

The Risk Assessment public meeting was held at the same location and was attended by one citizen. During this meeting the Stantec team presented the methodology used by Stantec for the Risk Assessment. The Stantec Team expanded upon these details about the methodology and explained the use of the 100 Military grid with the purpose of avoiding data bias occurring with Census blocks or Census tracts that are not all the same size. The public group was encouraged to review the maps and provide feedback to the Planning Team.

Stakeholder Mitigation Strategy Workshop – June 6, 2018

Stantec Team gave an update on the planning process and a brief recap of the history of mitigation planning in LFUCG.

The Stantec Team gave an overview of the public survey results: 392 views, 137 started, 50 complete.

The mitigation strategy was introduced, describing the mitigation goals, action items, and the action plan. There was a question about goal #4 and it was reworded as "Increase public and private understanding of hazard mitigation through mitigation education and awareness of natural and man-made hazards."

An overview of the types of actions typically found in mitigation plans was provided:

1. Prevention
2. Property Protection
3. Natural Resource Protection
4. Structural Projects
5. Emergency Services
6. Public Education and Awareness

The group then discussed the status of actions from the 2013 plan and considered inclusion of newly proposed actions from the stakeholder group. The discussion and decisions were captured in the updates to the Five-Year Mitigation Action Workbook. There was a question about funding goals or actions. FEMA funds actions, as long as they relate to the goals. Actions can be written broad enough to include projects not yet identified. Question/comment about whether daylighting Town Branch could be covered under a mitigation action and funded by FEMA. If the project includes flood or other mitigation, FEMA funding is possible if included in a mitigation action.

Lastly, the next steps were discussed including finalizing the risk assessment and mitigation strategy before creating the draft plan to be introduced at upcoming stakeholder group and public meetings.

Stakeholder and Public Draft Plan Meeting – March 7, 2019

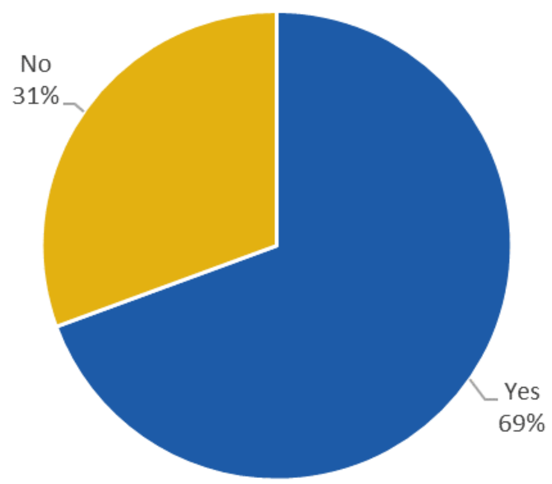
The Stantec Team provided a deep overview of each section of the plan. Several discussions were had about the future of Hazard Mitigation Planning and the Stakeholder group and how they would be maintained. Several discussions were had about the potential Mitigation Actions the group were interested in pursuing. This meeting will be used as a spring board toward accomplishing further mitigation opportunities over the next five years. At the end of the meeting the next steps were discussed, and the group was looking forward to adopting the document.

The final draft was posted to the LFUCG DEM's website for public review and comment (See Appendix A).

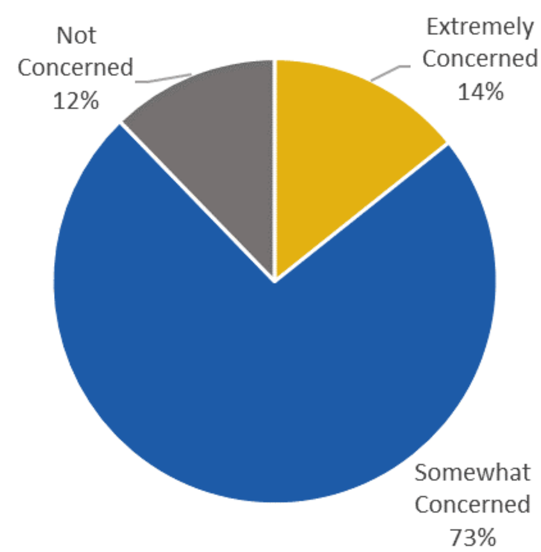
Public Survey

The Public Participation Survey was designed to capture data and information from residents of Lexington Fayette County who might not be able to attend public meetings or participate through other means in the mitigation planning process. A total of 50 survey responses were received. The following provides valuable feedback collected from the public survey.

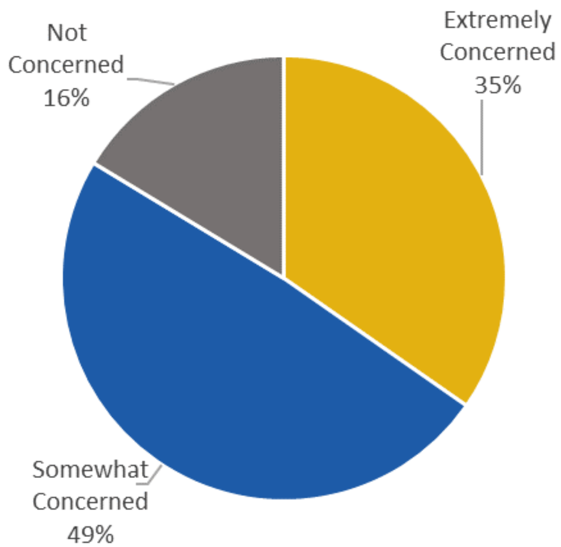
Have you ever experienced or been impacted by a disaster?



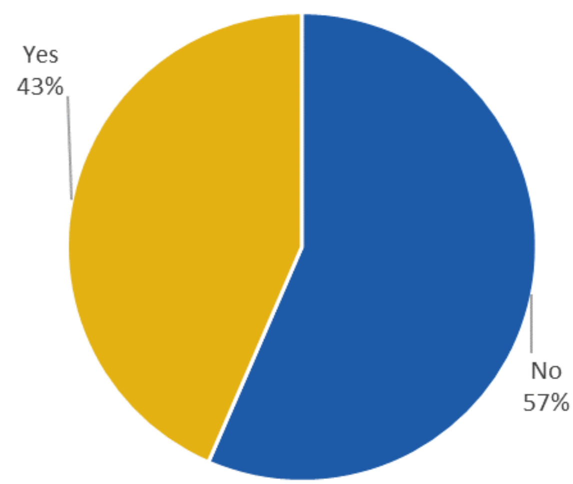
How concerned are you about the possibility of your community being impacted by a future disaster?



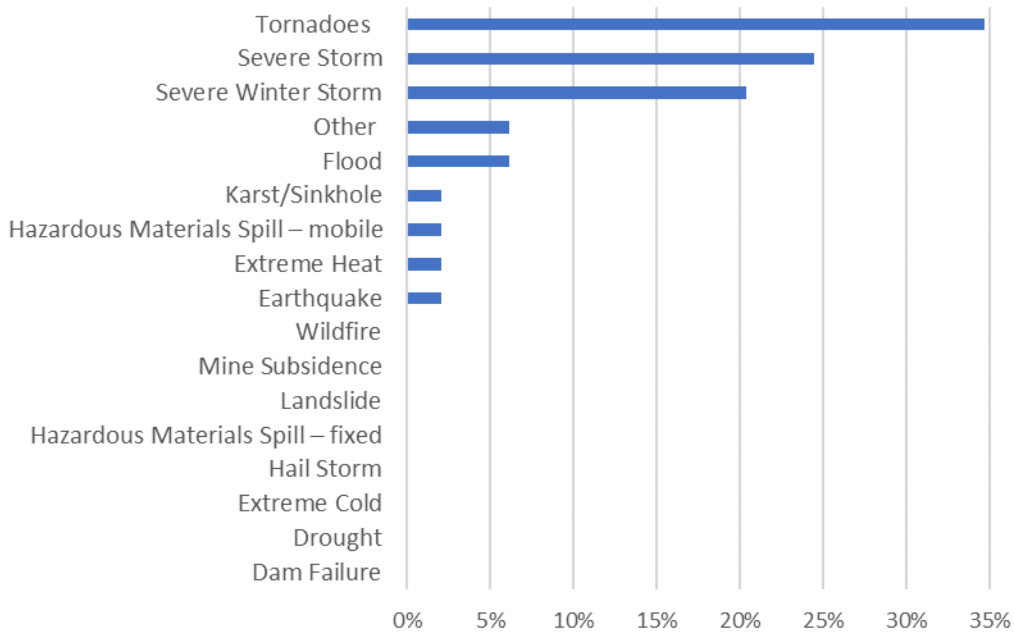
How concerned are you about the possibility of your community being impacted by climate change?



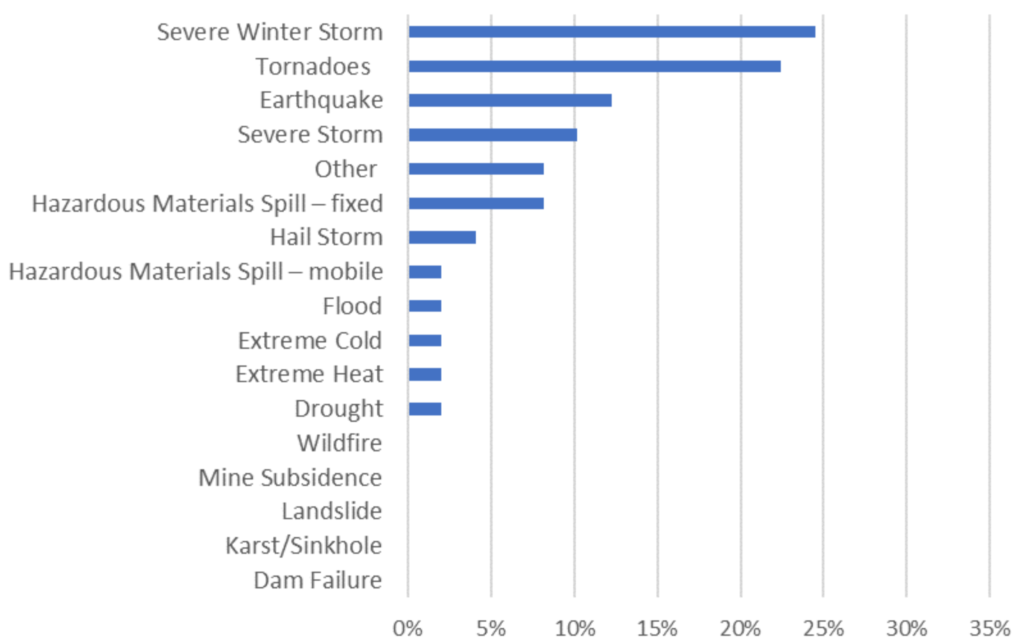
Are you interested in making your home or business more resistant to hazards?



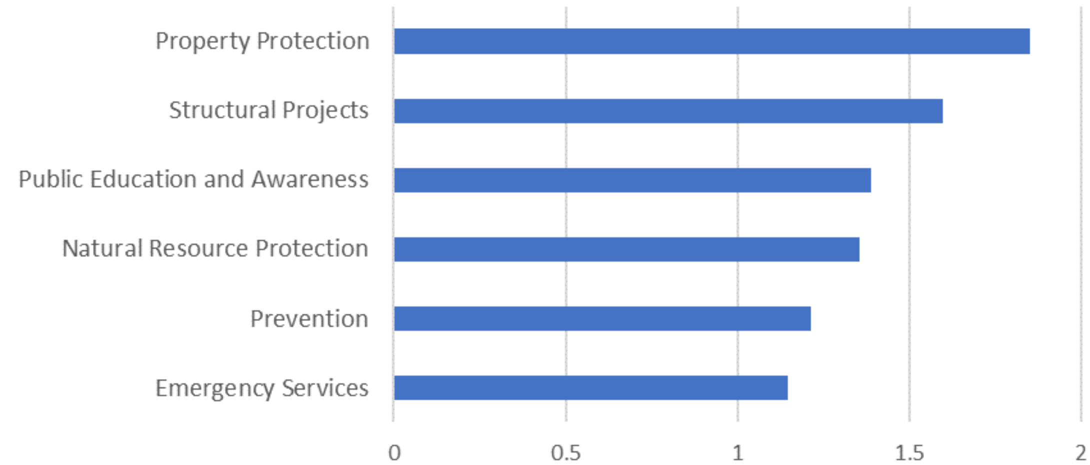
Please select the one hazard you think is the highest threat to your community:



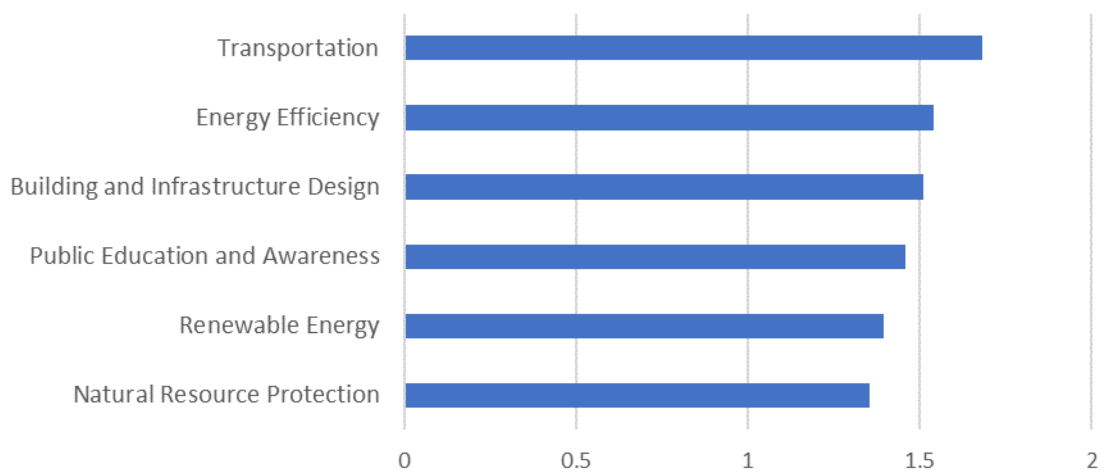
Please select the one hazard you think is the second highest threat to your community:



A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for our community to pursue.



A number of community-wide activities can help reduce the impacts of climate change. In general, these activities fall into one of the following categories. Please tell us how important you think each one is for the County to pursue.



4. Risk Assessment

The 2020 Lexington Fayette County (LFUCG) Hazard Mitigation Plan Risk Assessment assesses the community's risk and vulnerability to the hazards identified. This section is to be used as the blueprint for the mitigation strategy. The assessment uses best available data, including the first-hand knowledge of individual stakeholders; local, state and national datasets; and the use of Geographic Information System (GIS). GIS provides the capabilities to perform an accurate risk assessment and to indicate specific spatial areas of vulnerability to each identified hazard

Risk Assessment

§201.6(c)(2) requires local jurisdictions to provide sufficient information from which to develop and prioritize appropriate mitigation actions to reduce losses from identified hazards.

This includes detailed descriptions of all the hazards that could affect the jurisdiction along with an analysis of the jurisdiction's vulnerability to those hazards. Specific information about numbers and types of structures, potential dollar losses, and an overall description of land use and development trends should be included in this analysis.

This section of the Plan follows the "Local Mitigation Plan Review Tool" section "Hazard Identification and Risk Assessment" element B. The requirements for this section are described below:

- Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))
- Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))
- Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
- Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

While FEMA terminology requires naming this section the "Risk Assessment" the model used for this plan update is a hazard vulnerability assessment and utilizes updated hazard risk and exposure data to assess vulnerability. In addition to this new data, the updated model also utilizes a more refined geospatial unit of assessment: 100-meter grid cells versus Census Block boundaries. To complete the elements required for the Risk Assessment section, the review of each hazard is divided into three areas of examination:

1. Identify Hazard;
2. Profile Hazard; and
3. Assessing Vulnerability.

This format provides an independent review of each hazard and allows the end users the ability to review all facets of each hazard's complete risk assessment within one section

GIS and spatial data provide the architecture for the inventory of assets and hazards as well as the capability to calculate geographic based hazard vulnerability. The maps developed through the vulnerability assessment are used whenever possible to convey where spatially defined risks and vulnerable areas are located to support identification of mitigation actions and opportunities to make the community more resilient. These maps also display the potential extent of the hazards and where the LFUCG could experience more estimated losses. It is important to note that the GIS data and layers resulting from the assessment may be used by other LFUCG departments and partners for additional planning efforts. Thus, making the Vulnerability Assessment data and maps, a tool for integration into other local planning mechanisms.

To capture changes in development, updated infrastructure, population, and building data were included in the vulnerability assessment. For infrastructure and buildings, the new data incorporated updated information from local sources of information. To identify changes in population geography, new population and social vulnerability numbers were taken from the American Community Survey 2016 5-year estimates.

4.1 Identifying Hazard Overview

This section provides a complete overview and definition of each hazard that could potentially affect the Lexington Fayette County community. An understanding of the causes of, potential damages contributed to, and possible scenarios for each hazard better prepares leaders, local agencies, and residents to make decisions about mitigation actions.

The plan includes natural hazards where there is a historical record of damage caused to people and property or where the potential for such damage exists. Due to Lexington Fayette County's climate, geology, and geographical setting, the county is vulnerable to a wide array of natural hazards that threaten life and property. Hazardous Materials (HAZMAT) was added as an identified hazard in the 2013 LFUCG plan. The Mine Subsidence and Landslide hazards were dropped from 2020 LFUCG plan, as it was determined by DEM and stakeholders that these hazards posed little to no risks to the community. In addition, these hazards are not identified in other DEM planning documents, such as the Emergency Operations Plan (EOP).

Through research of historic impacts, probability rates, dollar losses to date, review of the past State and Local Hazard Mitigation Plans and discussions with key agencies, the following thirteen hazards are assessed in the 2020 LFUCG Hazard Mitigation Plan

- Dam Failure
- Drought
- Earthquake
- Extreme Cold
- Extreme Heat
- Flood
- Hail
- HAZMAT
- Karst/Sinkhole
- Severe Storm
- Severe Winter Strom
- Tornado
- Wildfire

4.2 Profile Hazard Overview

As noted in the last section, due to Lexington Fayette's geology, climate, and geographical setting, the area is vulnerable to a wide array of hazards (see section titled, Identify Hazards Overview) that threaten life and property. The Profiling Hazards section describes each hazard's past, present and future effects on the community through completing an extensive overview

Public input was an invaluable local resource in the planning process. Stakeholder members attended stakeholder meetings and discussed information gathered from the sources listed above as well as their own general knowledge. Stakeholder members also discussed issues such as, past events and significant occurrences that did not warrant a declared disaster and how those events impacted the community.

Lexington Fayette County Presidential & Emergency Declarations		
Date	**Hazards**	**Disaster Number**
05/11/2010	Severe Storms, Flooding, Mudslides, and Tornadoes	DR-1912
02/05/2009	Severe Winter Storm and Flooding	DR-1818
01/28/2009	Severe Winter Storm	EM-3302
02/21/2008	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-1746
06/10/2004	Flooding, Severe Storm	DR-1523
03/14/2003	Flooding, Ice, Snow & Tornadoes	DR-1454
03/04/1997	Flooding	DR-1163
03/16/1994	Severe Weather, Freezing Rain, Sleet, Snow	DR-1018
02/24/1989	Severe Storms & Flooding	DR-821
12/12/1978	Severe Storms & Flooding	DR-568
Source: http://www.fema.gov/news/disasters.fema		

The Table above displays past presidential declaration occurrences which provides background on the type, of natural disasters which have affected Lexington Fayette County. There have been no additional Disaster Declarations for Lexington Fayette County since the 2013 LFUCG Hazard Mitigation Plan.

4.2.1 Profiling Hazards

The profile section of the plan provides historical context and develops future probabilities for each of the identified Hazards. In order to streamline, the dissemination of this information the LFUCG Planning Team developed a common format for each Hazard. Each Hazard Profile will contain the following information:

- A description of each identified hazard and potential impact.
- Historical background on each identified hazard and a brief description of known events.
- Profile Maps, if applicable, of the locations and areas affected by Hazard events.

In order to streamline the dissemination of hazard specific information to the end users of this plan, the LFUCG Planning Team created a standardized "Summary of Risk Factors Table" for each of the identified hazards. These tables provide a common format within the profile section and display multiple layers of important information, including information on previous occurrences, probabilities, types, locations and information on extent. These tables are meant to provide a general summary and "standardized snapshot" of hazard specific information and a general understanding of each hazard and its potential effects on the community. The following table describes the "Summary of Risk Factors Table" along with an explanation of each data variable.

SUMMARY OF RISK FACTORS	
Period of occurrence:	When does this hazard typically occur (Ex. Summer months)
Number of events:	Number of recorded events, including date range if data permits
Annualized Probability:	Probability of the event occurring, calculated using sourced data occurrence and time range
Warning time:	Average warning time for this type of hazard
Potential impact:	The potential impact this hazard could produce
Potential of injury or death:	The potential impact this hazard could cause injury or death
Potential duration of facility shutdown:	The potential duration that this hazard could cause a facility to shut down
Past Damages:	Record of damages in NCEI Storm Events Database and or other potential data sources
Extent (Date, Damages, Scale/Size):	The worst anticipated strength or magnitude of each identified hazard

It is important to note that the data captured (such as # of events & past damages) within the Summary of Risk Factors Tables was derived from the National Centers for Environmental Information (NCEI) Storm Events Database, when available, to provide a standardized source of data. Hazard information not coming from the NCEI include the following; HazMat (Local data sources), karst/sinkhole (KGS data sources), and Wildfire (Kentucky Division of Forestry data sources). It is recognized that this data can vary from other sources identified in the plan (FEMA worksheets, news articles, personal accounts, etc.), but to show a snap shot view of each hazard for the Summary of Risk Factors Tables, the project team decided to use a recognized and standard national data set.

Understanding risk and each hazard's potential effect on the LFUCG community is imperative to the mitigation strategy and provides the information needed to understand the overall risk for the County. The following "Risk Matrix" table provides quantitative data that portrays Risk (Probability x Consequence) and time period for collected hazard data, frequency of the event, total losses to-date, the probability of the hazard occurring today, the average consequences of the hazard and the overall annual risk.

The source of data for the loss matrix, where applicable, was the National Centers for Environmental Information (NCEI) Storm Events Database, which as mentioned above provides a consistent source of data. Hazard information not coming from the NCEI include the following; HazMat (Local data sources), karst/sinkhole (KGS data sources), and Wildfire (Kentucky Division of Forestry data sources).

Lexington Fayette County Risk Matrix							
Hazard	Time Period	Range –Years of Data Collection	Frequency	Total Losses	Probability	Average Consequences	Average Annual Risk
Dam Failure	N/A	0	0	N/A	0.00	$0	$0
Drought	1960-2017	57	104	$11,248	1.84	N/A	$197
Extreme Heat	1996-2017	21	1	N/A	.05	$0	$0
Extreme Cold	1996-2017	21	3	N/A	.14	$0	$0
Earthquake	1811-2017	206	0	N/A	0.00	$0	$0
Flooding	1996-2017	21	41	$2,263,000	1.95	$55,195	$107,762
Hail	1955-2017	62	61	$50,000	0.98	$820	$806
HAZ-MAT	1986-2017	31	1,429	$ 967,273	46.10	$17,196	$31,202

Lexington Fayette County Risk Matrix							
Hazard	Time Period	Range –Years of Data Collection	Frequency	Total Losses	Probability	Average Consequences	Average Annual Risk
Karst/Sinkhole	1991-2015	25	42	N/A	1.68	N/A	N/A
Severe Storm	1955-2017	62	268	$75,322,000	4.32	$281,052	$1,214,871
Severe Winter Storm	1996-2017	21	29	$18,100,000	1.38	$624,138	$861,905
Tornado	1955-2017	62	8	$33,075,000	0.13	$4,134,375	$533,468
Wildfire	2001-2017	16	3	$500	0.19	$167	$31
TOTAL DAMAGES				**$129,789,021**	--	**$5,112,943**	**$2,750,242**

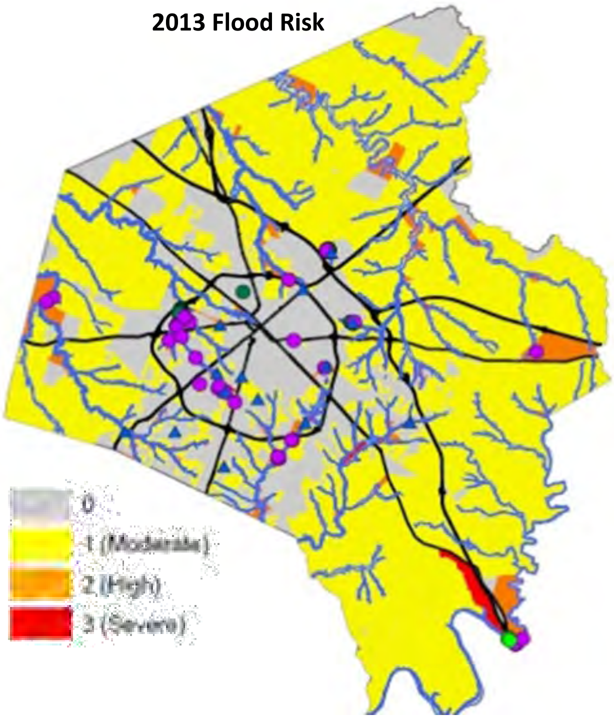
4.3 Assessing Vulnerability Overview

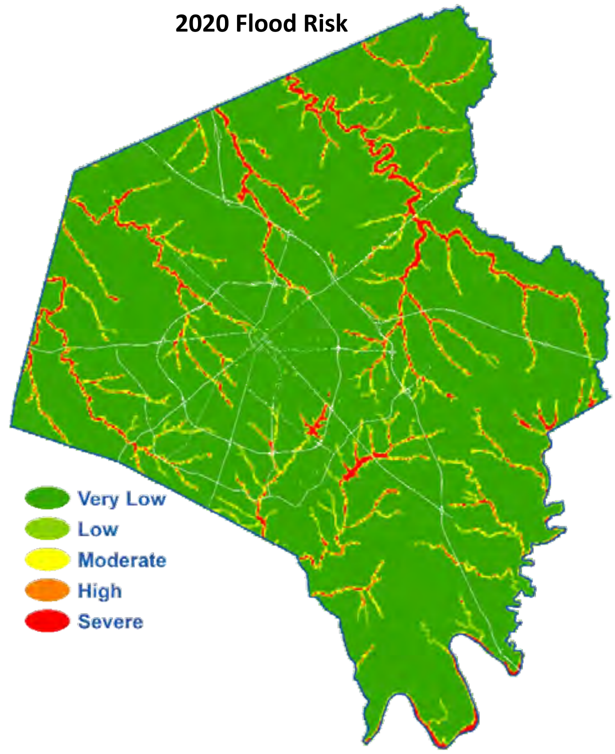
FEMA requires State and local partners to assess the jurisdiction's overall vulnerability as well as the vulnerability of population, property, infrastructure, critical facilities, and government owned facilities. The vulnerability assessment model uses best available data from national, state, and local data sources. The model is very flexible and can be adjusted to fit the data and needs of multiple users. Uncertainties are inherent in any vulnerability/risk assessment and loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural and man-made hazards and their effects on the built environment. Uncertainties can also result from approximations and simplifications that are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters).

One of the most important steps in the model is to define the planning area. During the creation of the 2006 Plan, the LFUCG Planning Team used a Census Tract level assessment. The Census Tract level modeling technique provided detailed assessments for highly populated areas of the County, but this approach still left some deficiencies in less populated areas of the county. The 2013 Plan refined the data analysis to the Census Block level, which increases the granularity of the data from 61 planning areas (Tracts) to 4,151 planning areas (Blocks), but still lacked consistency in granularity across the county. The 2020 plan refines the analysis even further, to 100-meter grid cells and 74,965 planning areas (Grid Cells). The 100-meter grid level of analysis produced the following improvements:

- Equal area calculations based on each unit being equal sized;
- Allows better comparisons between planning areas in different parts of the County;
- Improved visual interpretations of risk and vulnerability;
- Potential for better policy decisions and dollar allocation;
- Granular data enhances the potential usage for other planning processes; and
- Military grid provides enhanced usage during response and recovery

The images below demonstrate the differences between a census block level assessment model versus 100M grid assessment model. While both are displaying relative flood risk, one can clearly see the better distribution of spatial definition and therefore better understanding of vulnerability found using the 100-meter grid assessment model. This data will be much more useful for the LFUCG Stakeholders Group in understanding where mitigation should occur as well as being useful for future response and recovery efforts. In addition, these maps can be used to display where potential losses can occur to LFUCG's assets (people, property and infrastructure).





4.3.1 Vulnerability Assessment Methodology

There are multiple models that attempt to determine risk and hazard vulnerability. The Planning Team relied heavily on the Stantec staff's knowledge of "Risk Assessment" research and previous experience to develop the vulnerability assessment model used for the Plan. This model is the same used for the FEMA approved 2016 Louisville Metro Hazard Mitigation Plan update and the last two LFUCG Hazard Mitigation Plans.

The revised 100M grid model relies heavily on GIS spatial analyses and provides the user with several layers of integrated information which can be used individually to display different variables, such as densities of total population, socially vulnerable populations, buildings and infrastructure. As mentioned, to facilitate data collection and analysis, the Planning Team aggregated data at 100M grid level. This approach enabled the creation of a Hazard Vulnerability Score for each hazard at the 100M grid level.

Hazard Vulnerability Score = Exposure Score + Risk Score

4.3.1.1 Exposure Score

In order to define LFUCG's vulnerability, it is critical to complete an inventory of the assets that can be potentially **exposed** to a hazard. These identified assets comprise the Exposure Score. Each 100M grid received an Exposure Score rank from 0-1. Where 1 = the highest value for that category and 0 = the lowest value for that category. The following is a complete description of each of the six exposure variables that created the Exposure Score.

Exposure Score = Population Score + Socially Vulnerable Score + Property Score + Critical Facilities Score + Infrastructure Score + Government Facilities Score

Score = (Cell Total – Minimum Cell Total) / Range

Population Score

To calculate the population score, people were assigned to each primary building in the address shapefile obtained from LFUCG. The total population of each Block Group was divided by the number of addresses in the Block Group. The populations per address were then aggregated to the 100-meter grid and a 0-1 score was calculated for each grid cell. Population data was obtained from the American Community Survey 2016 5–year Estimates.

Social Vulnerability Score

Social Vulnerability was calculated similarly to population. Census Block Group totals for each of the variables listed below were divided by the number of addresses in the Block Group and then aggregated to the 100-meter grid for each variable and the grid cells were given a 0-1 score for all social vulnerability variables. All these scores were added together, and a new 0-1 score was calculated based on the total score for each grid cell. Social vulnerability data was obtained from the American Community Survey 2016 5–year Estimates

Social Vulnerability Variables	
Poverty	total in poverty
Disability	total with a disability
Education	total with less than bachelor's degree
Employment	total unemployed
Linguistically Isolated	total that speak English "not well" or "not at all"
Age	total under 5 and over 65
Health Insurance	total without health insurance

Property Score

The Property Score includes the total number of buildings in each grid cell and the combined value of all properties in the grid cell. A 0-1 score was calculated for the total number of buildings and a 0-1 score was calculated for the total value of the properties in the grid cell. Those two scores were added together, and a new 0-1 score was calculated resulting in the Property Score. Property data was obtained from LFUCG and the Fayette County PVA

Critical Facilities Score

The Critical Facilities Score includes the total number of critical facilities located within each grid cell. A 0-1 score was calculated for each type of facility based on the total number of facilities in each cell. The scores for all types of facilities were added together and a new 0-1 score was calculated for the total score. Critical facility locations were obtained from LFUCG.

Critical Facility Types	
Airports	Police Stations
Daycares	Schools
Fire Stations	Special Needs Facilities
Hospitals	Race Tracks
Libraries	Colleges
Parks	Daycares
Post Offices	

Government Facilities Score

The Government Facilities Score includes the total number of government owned facilities in each grid cell (minus those captured in critical facilities) and a 0-1 score was calculated. Property values for the publicly owned facilities was not available. Government facilities data was obtained from LFUCG.

Infrastructure Score

The infrastructure Score includes utility and transportation infrastructure. The amount of infrastructure in each cell was calculated by adding up facilities, such as pump stations, and adding up the total linear feet of utility lines, such as sewer lines. A 0-1 score was calculated for each infrastructure type. Those scores were added together, and a new 0-1 score was calculated for each grid cell, resulting in the Infrastructure Score. Infrastructure data was obtained from LFUCG and the Kentucky Infrastructure Authority.

Infrastructure Types
Bridges
Dams
Electric Facilities
Electric Lines
Rail Lines
Sanitary Sewer Facilities
Sanitary Sewer Lines
Storm Sewer Facilities
Storm Sewer Lines
Streets
Water Lines
Communications Facilities

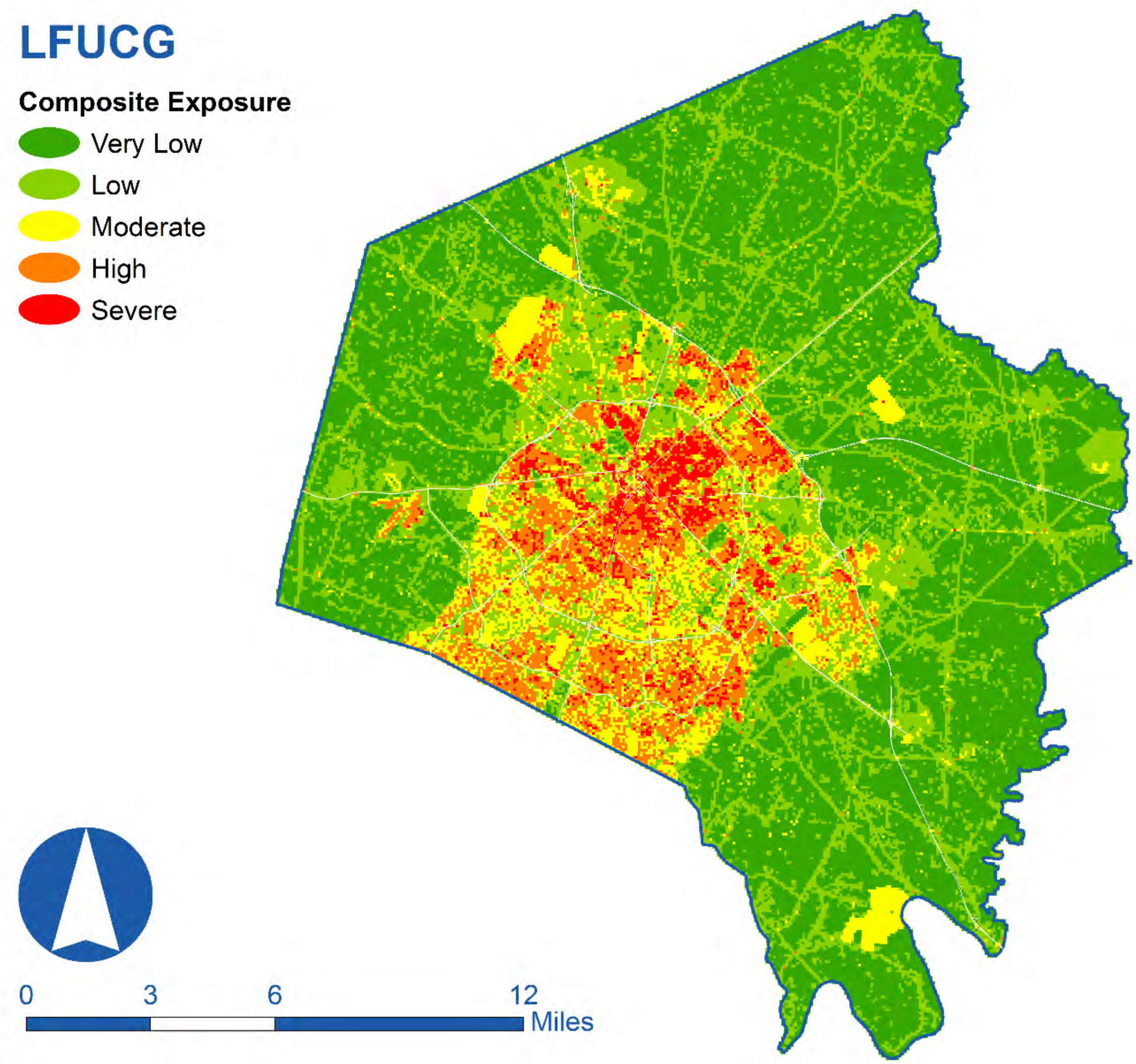
Exposure Score

To finalize the Exposure Score, the scores for all six variables were added together and a new 0-1 score was calculated for each cell. Jenks Natural Breaks methodology was used to divide the scores into categories of Very Low, Low, Moderate, High, and Severe Exposure.

The Exposure Score reveals where you have assets that could be vulnerable and thus **damaged or lost** to a hazard within a specific area/grid cell. This data is critical for emergency managers and the stakeholder community to use to comprehend where high concentrations of need could arise during and/or before a disaster. These data layers can also be used individually for multiple planning purposes, such as identifying socially vulnerable populations and high concentrations of infrastructure. Each Exposure Score Map can be found in Appendix D for evaluation.

Maps are used whenever possible to display data in a visual representation which provides the end user a comprehensive view of where there is potential Vulnerability. The following map displays the composite Exposure Score.

Figure 4.1: Composite Exposure



4.3.1.2 Risk Score

The second variable created for the Hazard Vulnerability Score is the Risk Score. The Risk Score demonstrates how a hazard affects an area, either based on past occurrences and or a scientifically based study (i.e. flood study DFIRM). The Risk Score should be used to visually display locations of the hazards and hazard **extent**. The Risk Score is particularly useful for land use planning and future development decisions. It also can be used to display where **potential losses** could occur within the county.

Risk Score = Occurrence Score + Geographic Extent Score

It is important to note, each hazard's Risk Score, is calculated based on the best available data. Some hazards have an Occurrence Score and Geographic Extent Score. While others, may only have a Geographic Extent Score. The goal is to continue to capture hazard data and to create a more refined Risk Score for future plans using the 100-meter grid. Each one of the hazard's specific Risk Scores will be detailed within their Assessing Vulnerability sections.

Occurrence Score

The Occurrence Score includes the total number of known occurrences for each grid cell. Occurrences were counted, and a 0-1 score was calculated for each cell. Occurrence data is different for each hazard and will be explained in more detail in each hazard's Assessing Vulnerability section.

Occurrence Score = (# of Occurrences - Minimum # of Occurrences)/Range

Geographic Extent Score

A Geographic Extent Score was calculated for each grid cell for each hazard, where data was available. Geographic extent was determined by either calculating the percent of the grid cell in the hazard area (flood, dam/levee, wildfire), or by assigning the identified risk level to the cell based on scientific hazard area research (karst, earthquake). Geographic Extent Scores were calculated for each grid cell and then scored on a 0-1 scale.

Geographic Extent Score = (% affected - minimum % in affected)/Range

4.3.1.3 Vulnerability Score

After the Exposure Score and the Risk Score were determined, a Hazard Vulnerability Score was calculated for each hazard. The two scores were added together, and a new 0-1 score was calculated for each cell. Where cells had a Risk Score of zero (0) the vulnerability score was also zero, as the Risk Score displays the potential for the hazard to affect an area. This score reflects the combination of exposure and risk, so cells with high levels of exposure combined with high levels of risk will have a high level of vulnerability. Alternatively, cells with a low level of exposure and a low level of risk will have a low level of vulnerability.

The Hazard Vulnerability Scores may appear to contain some bias toward the more populated areas in the county. This is due to a correlation between density of population and density of infrastructure, properties, and critical facilities. This resulted in densely populated areas having greater exposure in general. The goal of this model was to assess the most vulnerable areas throughout Fayette County. Given the most populated areas have the most at risk, this model achieved that goal.

4.1.1.4 Average Annualized Loss Model

A key piece to any Risk Management system is to understand a community's potential losses. This is accomplished by calculating a community's average annualized for individual hazards, using probability and past consequence data (See Loss Matrix Table). Probability is based on past occurrences and consequences are based on past losses. For purposes of this plan, the probability of a future event occurring in any given year is calculated based upon the number of past events divided by the number of years of record. For example, if there have been 127 flooding occurrences throughout the county over the last 20 years, there is an annual occurrence ratio of 6.35 (probability). Next, the average consequences of each event are calculated by dividing the total losses ($251,915,000) by the frequency (20) of the event, giving an Average Consequence of $1,983,583.

Knowing both the "annual occurrence probability ratio" and the "average consequences per occurrence" produces the ability to predict an Average Annualized Loss for any given year by multiplying the two values together. Therefore, for any given year, it is likely that somewhere in the county, approximately $12,595,750 worth of damages will result from Flooding events.

This model provides a suitable understanding of general loss for a community. The model relies on capturing historical event data and therefore it is fundamental that future hazard occurrence data is captured (Occurrence and Loss Data), which currently is not as strong as it could be. Capturing better information is a Mitigation Action item for this plan. Using the Average Annualized Loss model, LFUCG can predict which Hazards will potentially occur more often as well as identify which Hazards can cause the most damage on an annual basis. In addition, one should also review the Hazard Vulnerability Score maps to understand where potential losses could occur.

Lexington Fayette County Risk Matrix							
Hazard	Time Period	Range –Years of Data Collection	Frequency	Total Losses	Probability	Average Consequences	Average Annual Risk
Dam Failure	N/A	0	0	N/A	0.00	$0	$0
Drought	1960-2017	57	104	$11,248	1.84	N/A	$197
Extreme Heat	1996-2017	21	1	N/A	.05	$0	$0
Extreme Cold	1996-2017	21	3	N/A	.14	$0	$0
Earthquake	1811-2017	206	0	N/A	0.00	$0	$0
Flooding	1996-2017	21	41	$2,263,000	1.95	$55,195	$107,762
Hail	1955-2017	62	61	$50,000	0.98	$820	$806
HAZ-MAT	1986-2017	31	1,429	$ 967,273	46.10	$17,196	$31,202
Karst/Sinkhole *	1991-2015	25	42	N/A	1.68	N/A	N/A
Severe Storm	1955-2017	62	268	$75,322,000	4.32	$281,052	$1,214,871
Severe Winter Storm	1996-2017	21	29	$18,100,000	1.38	$624,138	$861,905
Tornado	1955-2017	62	8	$33,075,000	0.13	$4,134,375	$533,468
Wildfire	2001-2017	16	3	$500	0.19	$167	$31
TOTAL DAMAGES				**$129,789,021**	--	**$5,112,943**	**$2,750,242**

4.4 Dam Failure

4.4.1 Identify: Dam Failure

While dams have many benefits, they can pose great risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if there are people downstream of the dam. The National Dam Safety Program is dedicated to protecting the lives of American citizens and their property from the risks associated with the development, operation, and maintenance of America's dams.

Types of Dams

Kentucky Revised Statute (KRS) 150.100 defines a dam as any artificial barrier including appurtenant works that do, or can, impound or divert water and:

- Is 25 feet high or more from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the Natural Resources and Environmental Protection Cabinet; and
- Has or will have an impounding capacity of 50-acre feet or more at the maximum water storage elevation.

Since 1948, anyone in Kentucky proposing to construct a dam has been required to submit a plan to the state for review in order to obtain a permit. In 1966, Kentucky adopted a set of guidelines for evaluating dams. In 1974, the permit system was revised to include regular state inspection of dams. KRS 150.295 directs the Secretary of the Natural Resources and Environmental Protection Cabinet to inspect dams and reservoirs on a regular schedule.

Manmade dams may be classified by:
1) the type of materials used;
2) the methods used in construction;
3) the slope or cross-section of the dam;
4) the way the dam resists water pressure forces;
5) the means for controlling seepage; and/or
6) the purpose of the dam.

Materials used for dams may include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, and/or miscellaneous materials (such as plastic or rubber). All of Lexington Fayette County's dams are classified as earth, or embankment dams:

Embankment dams are the most common type of dam in use today. Materials include natural soil or rock, or waste materials obtained from mining or milling operations. An embankment dam is termed an "earth-fill" or "rock-fill" dam depending on whether it is comprised of compacted earth or of dumped rock. The ability of an embankment dam to resist the reservoir water pressure is primarily a result of the mass weight, type and strength of the materials from which the dam is made.
Dams are classified based on the evaluation of damage possible downstream. The FEMA guide to dam classifications uses the following system:

Dams are classified based on the evaluation of damage possible downstream. The FEMA guide to dam classifications uses the following system:

Classification of Dams	
Classification	**Description**
Class A (Low)	No loss of human life is expected, and damage will only occur to the dam owner's property.
Class B (Moderate / Significant)	Loss of human life is not probable, but economic loss, environmental damage, and/or disruption of lifeline facilities can be expected.
Class C (High)	Loss of one or more human life is expected.

Source: FEMA 333; Federal Guidelines for Dam Safety, Hazard Potential Classifications for Dams, October 1998

Signs of Potential Dam Failure

- Seepage. The appearance of seepage on the downstream slope, abutments, or downstream area is cause for concern. If the water is muddy and is coming from a well-defined hole, material is probably being eroded from inside the embankment and a potentially dangerous situation can develop.
- Erosion. Erosion on the dam and spillway is one of the most evident signs of danger. The size of erosion channels and gullies can increase greatly with slight amounts of rainfall.
- Cracks. Cracks are of two types: traverse and longitudinal. Traverse cracks appear perpendicular to the axis of the dam and indicate settlement of the dam. Longitudinal cracks run parallel to the axis of the dam and may be the signal for a slide, or slump, on either face of the dam.
- Slides and Slumps. A massive slide can mean catastrophic failure of the dam. Slides occur for many reasons and their occurrence can mean a major reconstruction effort.
- Subsidence. Subsidence is the vertical movement of the foundation materials due to failure of consolidation. Rate of subsidence may be so slow that it can go unnoticed without proper inspection. Foundation settlement is the result of placing the dam and reservoir on an area lacking suitable strength, or over collapsed caves or mines.
- Structural. Conduit separations or ruptures can result in water leaking into the embankment and subsequent weakening of the dam. Pipe collapse can result in hydraulic failures due to diminished capacity.
- Vegetation. A prominent danger signal is the appearance of "wet environment" types of vegetation such as cattails, reeds, mosses and other wet area vegetation. These types of vegetation can be a sign of seepage.
- Boils. Boils indicate seepage water exiting under some pressure and typically occur in areas downstream of the dam.
- Animal Burrows. Animal burrows are a potential danger since such activity can undermine the structural integrity of the dam.
- Debris. Debris on dams and spillways can reduce the function of spillways, damage structures and valves, and destroy vegetative cover

Types of Failures

- *Hydraulic Failure*. Hydraulic failures result from the uncontrolled flow of water over the dam, around the dam and adjacent to the dam, and the erosive action of water on the dam and its foundation. Earth dams are particularly vulnerable to hydraulic failure since earth erodes at relatively small velocities.
- *Seepage Failure*. All dams exhibit some seepage that must be controlled in velocity and amount. Seepage occurs both through the dam and the foundation. If uncontrolled, seepage can erode material from the foundation of an earth dam to form a conduit through which water can pass. This passing of water often leads to a complete failure of the structure, known as piping.
- *Structural Failure*. Structural failures involve the rupture of the dam and/or its foundation. This is particularly a hazard for large dams and for dams built of low strength materials such as silts, slag, fly ash, etc. Dam failures generally result from a complex interrelationship of several failure modes. Uncontrolled seepage may weaken the soils and lead to a structural failure. Structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may lead to structural or piping failures.

Potential Damage by Dam Failure

Dam Failure flooding is potentially the worst type of flood event. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. When a dam fails, an excess amount of water is suddenly let loose downstream, destroying anything in its path. Many dams and levees are built for flood protection and usually are engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, that structure may be overtopped. If during the overtopping the dam fails or is washed out, the water behind it is released and becomes a flash flood. Failed dams can create floods that are catastrophic to life and property because of the tremendous energy of the released water.

4.4.2 Profile: Dam Failure

SUMMARY OF DAM FAILURE RISK FACTORS	
Period of occurrence:	At any time
Number of events:	0
Annualized Probability:	0 (Based on previous occurrences)
Warning time:	Minimal. Can depend on the frequency of inspection.
Potential impact:	Impacts human life and public safety. Economic loss, environmental damage, and/or disruption of lifeline facilities. High Hazard-classified dam failure would cause loss of life, serious damage to homes, industrial or commercial buildings, important utilities, main highways Moderate Hazard-failure would cause significant damage to property, homes, highways, utilities but no loss of life. Low Hazard-failure would cause loss of dam, little or no damage to other structures or loss of life.
Potential of injury or death:	Injury and risk of multiple deaths
Potential duration of facility shutdown:	30 days or more
Past Damages:	Unknown
Extent (Date, Damages, Scale/Size):	Scale Class C Dam Failure

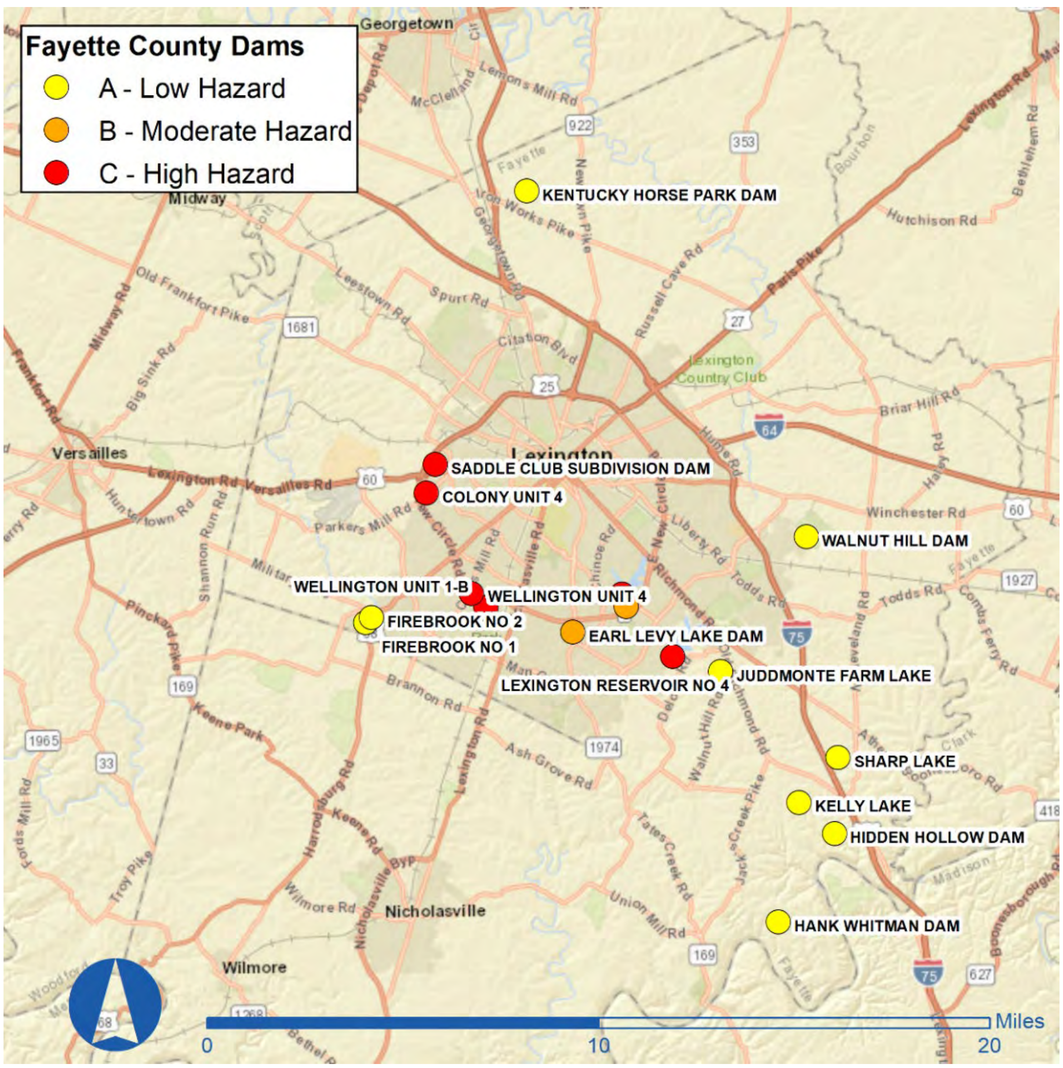
Historical Impact

Currently, there are no reported dam failures within Lexington Fayette County. As seen in the Dam Locations map below, the County does contain at least 17 dams throughout the County. A dam failure could lead to flooding, death, and injuries as well as property damage. Repairs to infrastructure failure would cost the dam owners a significant amount.

Continued growth of the built environment downstream of these dams exposes more structures and population to a dam failure. When a dam is moved into a higher risk class the owner is responsible for improvements and maintenance as required by state guidelines. Downstream growth and required improvements to dams should be continually monitored.

Inventory of Dams in Lexington Fayette County

Based on data received from LFUCG, there are 17 dams within the County. The following map demonstrates the 17 locations and classes of all dams in the LFUCG area.



Outside of Lexington Fayette County there is also a dam that has the potential to impact the county. The Dix Dam is a dam on the Dix River located between Mercer and Garrard County, Kentucky. It was constructed to generate hydroelectricity and prevent flooding of the Kentucky River but is better known for creating Herrington Lake. When the dam was built in 1927 it was the largest rock filled dam in the world and still holds a large capacity of water and therefore poses a large risk if it were to fail to the south side of Lexington Fayette county as seen on the maps below.

4.4.3 Assessing Vulnerability: Dam Failure

Dam Failure Vulnerability Score = Exposure Score + Risk Score

Risk Score = Geographic Extent Score + Occurrence Score

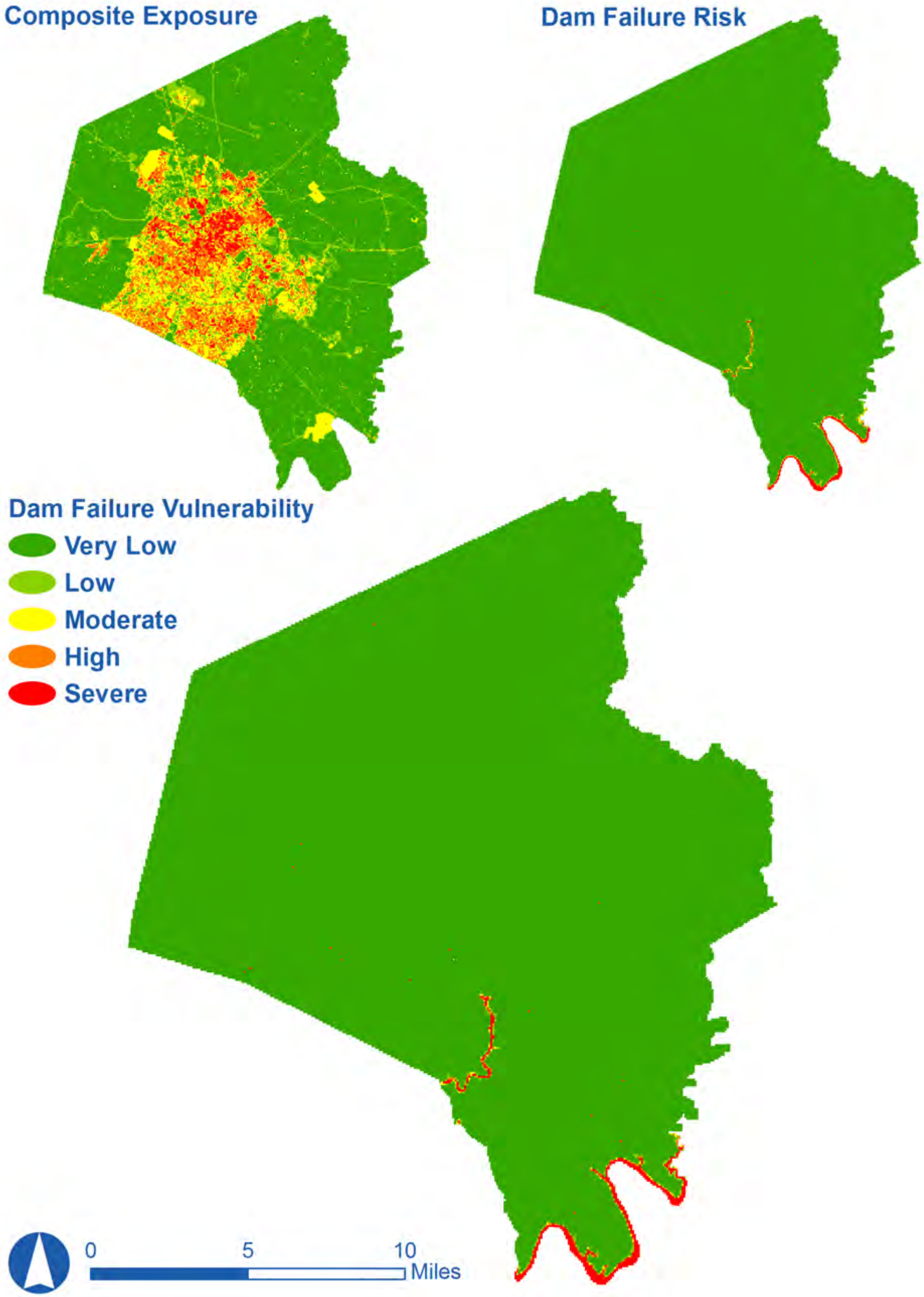
Geographic Extent Score = % of grid cell in dam inundation. Geographic Extent was calculated for each grid cell and then scored on 0-1 scale. It should be noted that currently LFUCG has two inundation models to calculate the geographic extent score.

Occurrence Score = the number of dams in each grid cell. Dams were counted in each grid cell and the total was converted to a 0-1 score for each cell. It should be noted that once LFUCG has better dam inundation mapping the occurrence score will be converted to a geographic extent score to provide a more accurate display of potential risk.

The Geographic Extent Score and the Occurrence Score were added together, and the new total was converted to a 0-1 score resulting in the Dam Failure Risk Score.

The Dam Failure Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Dam Failure Vulnerability Score (Figure 4.2).

Figure 4.2: Dam Failure Vulnerability



4.5 Drought

4.5.1 Identify: Drought

Description

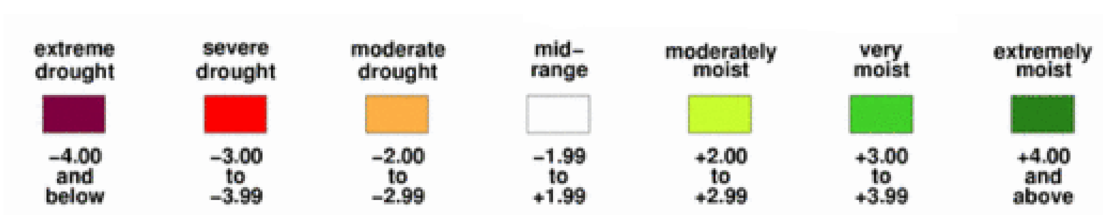
A drought is defined as the cumulative deficit of precipitation relative to what is normal for a region over an extended period of time. Unlike other natural hazards, a drought is a non-event that evolves as a prolonged dry spell. It may be difficult to determine when a drought begins or ends. A drought can be short, lasting just a few months, or persist for years before climatic conditions return to normal. Drought conditions can occur at any time throughout the year but are most apparent during the summer months.

Because the impacts of a drought accumulate slowly at first, a drought may not be recognized until it has become well-established. The many aspects of drought reflect its varied impacts on people and the environment. While the impacts of that deficit may be extensive, it is the deficit, not the impacts, that defines a meteorological drought.

Classifications System: Palmer Drought Severity Index (PDSI)	
+4.0 in. or more	extremely wet
3.0 in to 3.99 in	very wet
2.0 in to 2.99 in	moderately wet
1.0 in to 1.99 in	slightly wet
0.5 in to 0.99 in	incipient wet spell
0.49 in to -0.49 in	near normal
-0.5 in to -0.99 in	incipient dry spell
-1.9 in to -1.99 in	mild drought
-2.0 in to -2.99 in	moderate drought
-3.0 in to -3.99 in	severe drought
-4.0 in or less	extreme drought
Source: National Oceanic and Atmospheric Association (NOAA)	

Types

Drought is measured in the PDSI according to the level of recorded precipitation against the average, or normal, amount of precipitation for a region.



Facts

- High temperatures, prolonged high winds, and low relative humidity can aggravate drought conditions.
- Droughts can lead to economic losses such as unemployment, decreased land values, and Agro-business losses.

- ❖ The drought and associated heat wave of 1988 was considered one of the most devastating disaster events we had in the United States, costing over $40 billon.

Primary Effects

Crop failure is the most apparent effect of drought in that it has a direct impact on the economy and, in many cases, health (nutrition) of the population that is affected by it. Due to a lack of water and moisture in the soil, many crops will not produce normally or efficiently and, in many cases, may be lost entirely.

Water shortage is a very serious effect of drought in that the availability of potable water is severely decreased when drought conditions persist. Springs, wells, streams, and reservoirs have been known to run dry due to the decrease in ground water, and, in extreme cases, navigable rivers have become unsafe for navigation as a result of drought.

Secondary Effects

Fire susceptibility is increased with the absence of moisture associated with a drought. Dry conditions have been known to promote the occurrence of widespread wildfires.

Tertiary Effects

- ❖ Environmental degradation in the forms of erosion and ecological damage can be seen in cases of drought. As moisture in topsoil decreases and the ground becomes dryer, the susceptibility to windblown erosion increases. In prolonged drought situations, forest root systems can be damaged and/or destroyed resulting in loss of habitat for certain species. In addition, prolonged drought conditions may result in loss of food sources for certain species.
- ❖ In prolonged drought situations the soil surrounding structures subsides, sometimes creating cracks in foundations and separation of foundations from above ground portions of the structure.

4.5.2 Profile: Drought

SUMMARY OF DROUGHT RISK FACTORS	
Period of occurrence:	Summer months or extended periods of no precipitation
Number of events:	104
Annualized Probability:	1.84
Warning time:	Weeks to Months
Potential impact:	Droughts can lead to economic losses such as unemployment, decreased land values, and Agro-business losses. Minimal risk of damage or cracking to structural foundation, due to soils.
Potential of injury or death:	Slight chance of injury and risk of deaths
Potential duration of facility shutdown:	Days to Months
Past Damages:	$11,248
Extent (Date, Damages, Scale/Size):	1952-55, Unknown Damages, -5.74 (PDSI)

Historical Impacts

LFUCG experiences drought conditions due to heat, high winds, and low rainfall. Vulnerability will be according to severity of the drought, which depends upon the degree of moisture deficiency and the duration and the size of the affected area.

Although Lexington/Fayette County has ample water resources (surface and ground water), the region can and has experienced severe drought. However, due to natural water resources it is more resilient than other portions of the country. However, the area is somewhat acceptable to moderate drought conditions. Preventive measures have been and will continue to be implemented as future droughts threaten the water supply of Lexington Fayette County. Recent climate predictions indicate that droughts may continue to occur in the future

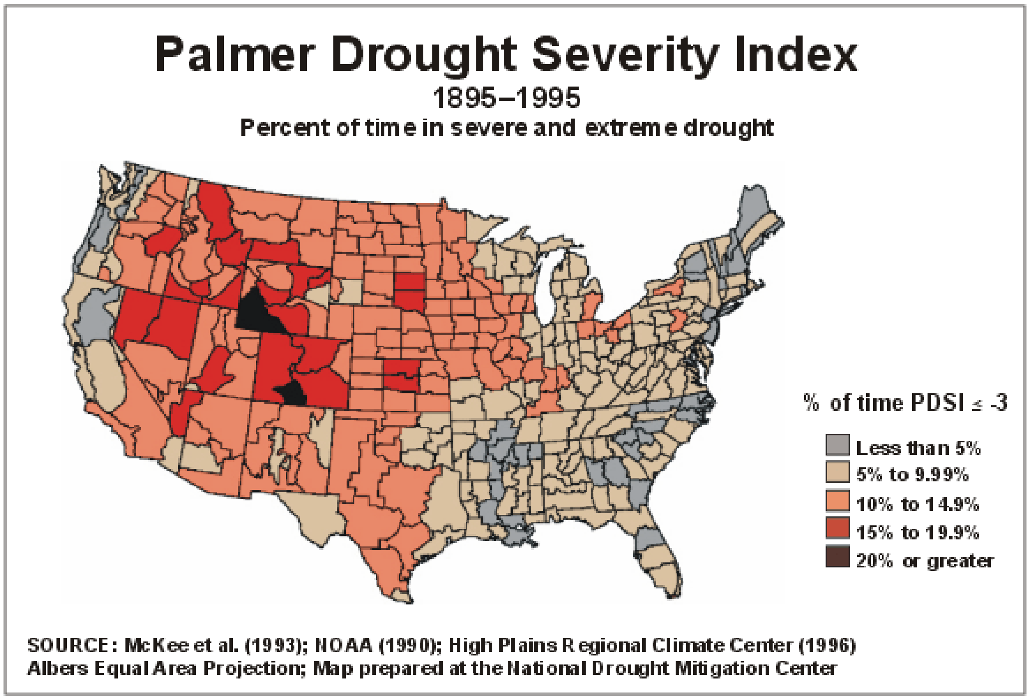
According to the Kentucky Climate Center, there have been 4 major recorded drought occurrences in Lexington/Fayette County since 1930. There were no injuries or deaths reported as a result of these droughts. Following are examples of other drought conditions in the Lexington Fayette County area

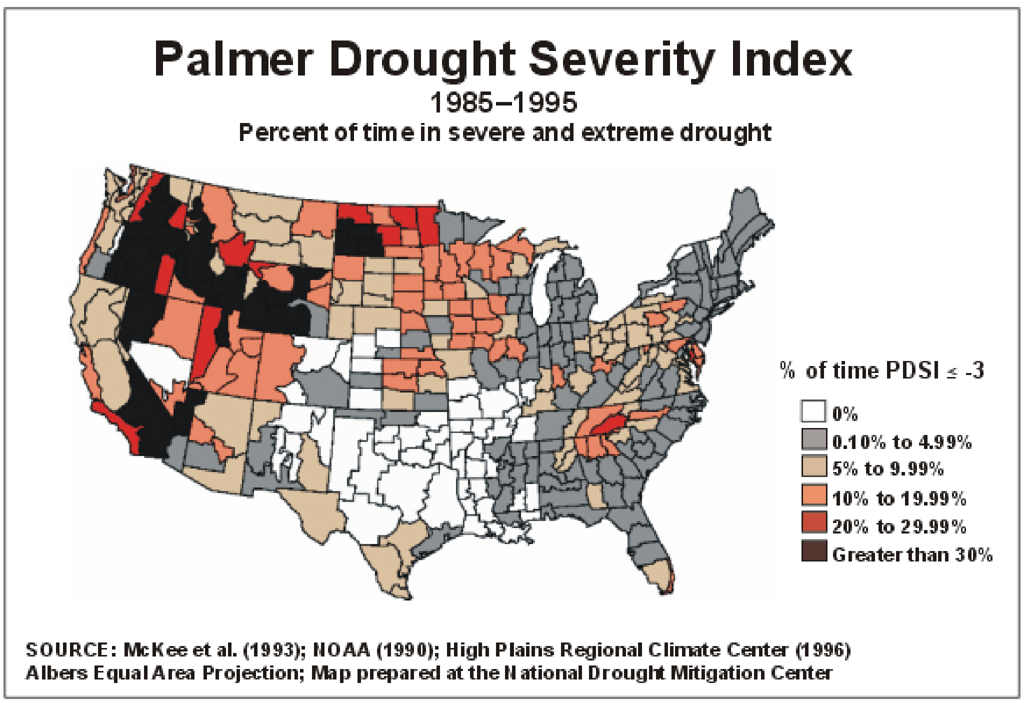
Historically Significant Drought Events	
Time Period	**PDSI Rating**
May 1930 – December 1931	-4.73
Fall 1939 – Spring 1942	-3.97
1944	-4.35
Summer 1952 - Winter 1955	-5.74
1963 – 1964	-3.43
1988	-4.27
1999 – 2001	-5.27
2007	-3.64
Source: http://www.kyclimate.org/graphlets/ddsg.html	

- In 1999, Governor Paul Patton declared a state of emergency due to extreme drought conditions throughout the state. The drought damaged crops and forced communities, including Lexington, to drastically reduce water usage. Dry ground resulted in damage to foundations and weakened tree roots across the state.
- The drought of 1953-1954 was another long period of dry conditions. In the Central and Bluegrass regions, this drought reached moderate conditions in July 1952 and fluctuated in and out of severe conditions without escaping the moderate category until January 1955.
- The drought of 1939-1942 when the average PDSI value for the entire Commonwealth was -3.97, which was in the severe category just barely missing the extreme range. It began about the fall of 1939 and ended May 1942 for the Bluegrass Region (two and one-half years).
- The drought of 1930-1931 was the worst drought to affect Kentucky. This drought began in all regions of Kentucky during the spring of 1930. For the entire year, this drought was severe in the Bluegrass Region. During 1931, conditions continued to be very dry. In the Bluegrass Region where the annual mean PDSI values were in the extreme category with -4.73 rating. The drought recovery in the Bluegrass Region began around December of 1931.

According to the NWS, Lexington Fayette County has experienced 68 separate months in **moderate**, 27 months in **severe**, and 9 months in **extreme** drought conditions from 1960-2010. A moderate, severe, and extreme drought conditions are defined as the region having a PDSI of -2.0, -3.0, -4.0 or greater, respectively.

Months in Drought for Lexington Fayette County 1960-2017 (NWS)													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total M S E
1960													2 0 0
1963													1 1 0
1964													2 2 0
1965													3 0 0
1970													1 0 0
1977													1 0 0
1980													1 0 0
1981													2 0 0
1983													2 0 0
1986													4 1 0
1987													2 2 2
1988													3 6 1
1991													1 0 0
1992													1 0 0
1998													3 0 0
1999													3 1 5
2000													2 4 1
2001													5 1 0
2002													1 0 0
2005													3 2 0
2006													5 1 0
2007													2 2 0
2008													4 0 0
2009													3 1 0
2010													3 0 0
2011													1 0 0
2012													5 1 0
2013													0 0 0
2014													0 0 0
2015													2 0 0
2016													0 2 0
2017													0 0 0
	Moderate: 68				Severe: 27				Extreme: 9				68 27 9
Source: http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers.php; http://droughtmonitor.unl.edu/Data/DataTables.aspx													**Total: 104**





As evident in the Palmer Drought Severity Index maps:

- In the 100-year map for 1895 to 1995, one may observe that the Bluegrass climate zone in Kentucky (which includes Lexington Fayette County) is within the 5% to 9.99% range.

- For the 10-year interval of 1895 to 1995 the Bluegrass climate zone had a severe drought rating of 5% to 9.99% as was the western part of the state. The remaining state climate zones were in the 0.10% to 4.99% range.

Potential Drought Impacts

During periods of drought in Lexington/Fayette County, some activities that rely heavily on high water usage may be impacted significantly. These activities include agriculture, tourism, wildlife protection, municipal water usage, commerce, recreation, wildlife preservation, and electric power generation.

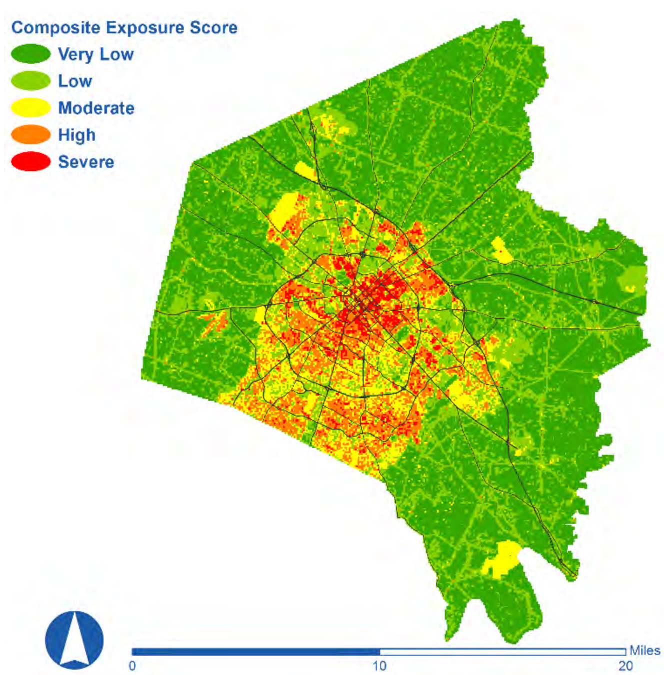
4.5.3 Assessing Vulnerability: Drought

Drought Vulnerability Score = Exposure Score

The Drought Vulnerability Score is currently difficult to calculate based on our current methodology of using Exposure + Risk to calculate Vulnerability. Currently LFUCG has no real spatial data that can be used to calculate the Risk Score variable in order to determine vulnerable areas to drought. Drought is the type of hazard that typically affects a county the size of Fayette County from a geographic standpoint equally. It was also determined that drought has the potential to affect all of our Exposure variables (Population, Socially Vulnerable, Property, Critical Facilities, Infrastructure, Government Facilities). Therefore, at this point it was determined to use the following Exposure Score Map to display higher potentials of hazard vulnerability for the Drought hazard, until better data can be developed.

The Exposure Score provides a visual display of areas that could be harder hit by drought based on the exposure that is within each grid cell (Figure 4.3).

Figure 4.3: Drought Vulnerability



4.6 Extreme Heat

NOAA's National Weather Service

Heat Index

Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

4.6.1 Identify: Extreme Heat

Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat.

Our bodies dissipate heat by varying the rate and depth of blood circulation, by losing water through the skin and sweat glands, and as a last resort, by panting, when blood is heated above 98.6°F. Sweating cools the body through evaporation. However, high relative humidity retards evaporation, robbing the body of its ability to cool itself.

NOAA's Watch, Warning, and Advisory Products for Extreme Heat

Each NWS Weather Forecast Office can issue the following heat-related products as conditions warrant:

- Excessive Heat Outlooks are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management, and public health officials.
- Excessive Heat Watch is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.
- Excessive Heat Warning/Advisory is issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

As an example, if the air temperature is 96°F (top of the table) and the relative humidity is 65% (left of the table), the heat index--how hot it feels--is 121°F. The NWS will initiate alert procedures when the Heat Index is expected to exceed 105°- 110°F (depending on local climate) for at least 2 consecutive days.

Important: Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F.

Heat Index

The Heat Index Chart indicates that temperatures exceeding 105°F may cause increasingly severe heat disorders with continued exposure and/or physical activity. Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When the body heats too quickly to cool itself safely, or when you lose much fluid or salt through dehydration or sweating, your body temperature rises, and heat-related illness may develop.

Heat disorders share one common feature: the individual has been in the heat too long is exercised too much for his or her age and physical condition. Studies indicate that, other things being equal, the severity of heat disorders tend to increase with age. Conditions that cause heat cramps in a 17-year-old may result in heat exhaustion in someone 40, and heat stroke in a person over 60. Sunburn, with its ultraviolet radiation burns, can significantly retard the skin's ability to shed excess heat.

Heat Disorder Symptoms

- Sunburn: Redness and pain. In severe cases swelling of skin, blisters, fever, headaches. First Aid: Ointments for mild cases if blisters appear and do not break. If breaking occurs, apply dry sterile dressing. Serious, extensive cases should be seen by physician.
- Heat Cramps: Painful spasms usually in the muscles of legs and abdomen. Heavy sweating. First Aid: Firm pressure on cramping muscles or gentle massage to relieve spasm. Give sips of water. If nausea occurs, discontinue water.
- Heat Exhaustion: Heavy sweating, weakness, skin cold, pale and clammy. Fainting and vomiting. First Aid: Get victim out of sun. Once inside, the person should lay down and loosen clothing. Apply cool, wet cloths. Fan or move victim to air-conditioned room. Offer sips of water. If nausea occurs, discontinue water. If vomiting continues, seek immediate medical attention.
- Heat Stroke (or sunstroke): High body temperature (106° F or higher). Hot dry skin. Rapid and strong pulse. Possible unconsciousness. First Aid: heat stroke is a severe medical emergency. Summon emergency medical assistance or get the victim to a hospital immediately. Delay can be fatal.

4.6.2 Profile: Extreme Heat

SUMMARY OF EXTREME HEAT RISK FACTORS	
Period of occurrence:	Summer months
Number of events:	1 (1996-2017)
Annualized Probability:	.05
Warning time:	Days
Potential impact:	Extreme Heat can cause heat stroke and death
Potential of injury or death:	Extreme Heat has a high potential for injury or death in Lexington
Potential duration of facility shutdown:	1-3 days
Past Damages:	$0 publicly recorded
Extent (Date, Damages, Scale/Size):	Unknown damages, 10-day heat wave from June 28-July 7, 2012 with high temperature of 103 on June 29.

Temperatures that hover 10 degrees or more above the average high temperature for the region are defined by NOAA as extreme heat. A temperature of 90°F is significant in that it ranks at the "caution" level of the NOAA's Apparent Temperature chart even if humidity is not a factor.

Kentucky Historical Impact

The 1952 heat wave lacked the intensity of other heat waves, but it did have duration. According to the Kentucky Division of Forestry, numerous acres burned in 1952 due to the lack of precipitation.

1990 and 1991 saw consecutive heat waves in which 1991 caused a statewide drought. 1991 is the third warmest year on record and contained the third warmest summer as well as the second warmest spring.

The average temperature for August in Kentucky is around 77 degrees, give or take a few points per location. In 2007, the average was 85 degrees. During 2007, there were 67 days of temperatures over 90 degrees and 5 reaching over 100 degrees recorded. A federal disaster designation by the U.S. Department of Agriculture was declared allowing farmers in the state's $4 billion-a-year industry to seek emergency assistance, including low-interest loans to help pay for essential farm and living expenses.

History of Extreme Heat in Lexington Fayette County

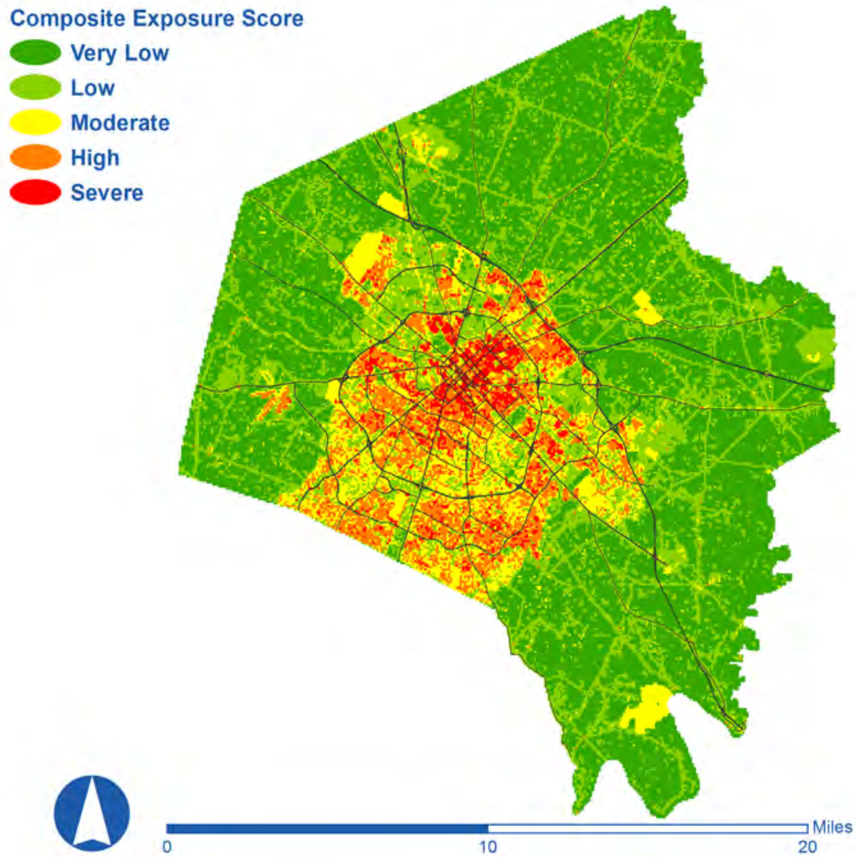
From June 28 to July 7, 2012, Lexington experienced a 10-day heat wave. On June 29, the official high temperature recorded at the airport was 103°. September 2018, Lexington EMA declared a phase 1 heat emergency, which means temperatures exceeded 90 degrees for over 3 days in a row.

4.6.3 Assessing Vulnerability: Extreme Heat

The Extreme Heat Vulnerability Score is currently difficult to calculate based on our current methodology of using Exposure + Risk to calculate Vulnerability. Currently LFUCG has no real spatial data that can be used to calculate the Risk Score variable in order to determine vulnerable areas to Extreme Heat. Extreme Heat is the type of hazard that typically affects a county the size of Fayette County from a geographic standpoint equally. It was also determined that extreme heat has the potential to affect all of our Exposure variables (Population, Socially Vulnerable, Property, Critical Facilities, Infrastructure, Government Facilities). Therefore, at this point it was determined to use the following Exposure Score Map to display higher potentials of hazard vulnerability for the Extreme Heat hazard, until better data can be developed.

The Exposure Score provides a visual display of areas that could be harder hit by extreme heat based on the exposure that is within each grid cell (Figure 4.4).

Figure 4.4: Extreme Heat Vulnerability

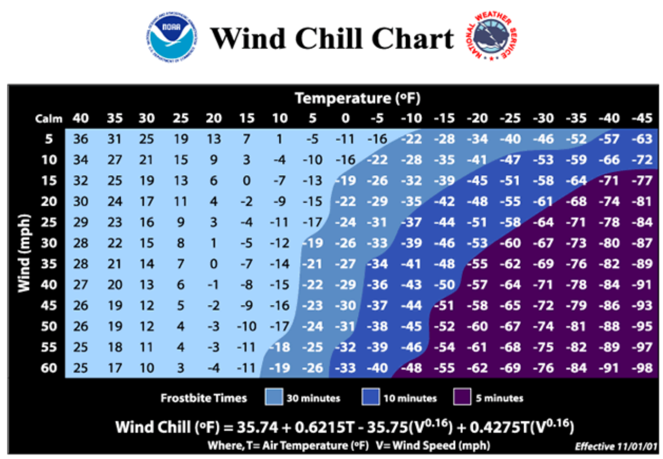


4.7 Extreme Cold

4.7.1 Identify: Extreme Cold

The term "extreme cold" can have varying definitions in hazard identification. It may or may not be associated with a winter storm. Generally, extreme cold events refer to a prolonged period of time (days) with extremely cold temperatures. An extreme cold event to the National Weather Service can refer to a single day of extreme or record-breaking day of sub-zero temperatures. Extended or single day extreme cold events can be hazardous to people and animals, and cause problems with buildings and transportation.

The Wind Chill Index is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature. Exposure to extreme wind chills can be life threatening. The NOAA chart shows the Wind Chill Index as it corresponds to various temperatures and wind speeds. As an example, if the air temperature is 5°F and the wind speed is 10 miles per hour, then the wind chill would be -10°F. As wind chills edge toward - 19°F and below, there is an increased likelihood that continued exposure will lead to individuals developing cold-related health impacts.


Wind Chill Chart

Temperature (°F)

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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

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

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

Effective 11/01/01

Frostbite and hypothermia are both extreme cold-related impacts that result when individuals are exposed to extreme temperatures and wind chills, in many cases as a result of severe winter storms. The following describes the symptoms associated with each.

During exposure to extremely cold weather, the body reduces circulation to the extremities (e.g., feet, hands, nose, cheeks, ears, etc.) in order to maintain its core temperature. If the extremities are exposed, then this reduction in circulation coupled with the cold temperatures can cause the tissue to freeze. Frostbite is characterized by a loss of feeling and a white or pale appearance. At a wind chill of -19°F, exposed skin can freeze in as little as 30 minutes. Seek medical attention immediately if frostbite is suspected. It can permanently damage tissue and in severe cases can lead to amputation.

Hypothermia occurs when the body begins to lose heat faster than it can produce it. As a result, the body's temperature begins to fall. If an individual's body temperature falls below 95°F, then hypothermia has set in and immediate medical attention should be sought. Hypothermia is characterized by uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and exhaustion. Left untreated, hypothermia will lead to death. Hypothermia occurs most commonly at very cold temperatures but can occur at cool temperatures (above 40°F) if an individual isn't properly clothed or becomes chilled.

Cold weather can also affect crops. In late spring or early fall, cold air outbreaks can damage or kill produce for farmers, as well as residential plants and flowers. A freeze occurs when the temperature drops below 32°F. Freezes and their effects are significant during the growing season. In addition, extreme cold temperatures can have adverse effects on transportation and infrastructure. Buried water pipes can burst causing massive ice problems and loss of water pressure in metropolitan areas. This can also pose a variety of public health and public safety problems within the water systems. Energy consumption can rise significantly during extreme cold events causing stress to the utility grids and resources. Diesel engines can be stressed and fuel gels in extreme cold weather can impact trucking and rail traffic. Rivers and lakes can freeze, stopping barge and shipping traffic. Subsequent ice jams threaten bridges and can close major highways. Lastly, cold temperatures can take a toll on vehicle batteries and put stress on metal bridge structures.

4.7.2 Profile: Extreme Cold

SUMMARY OF EXTREME COLD RISK FACTORS	
Period of occurrence:	Winter months
Number of events:	3 (1996-2017)
Annualized Probability:	.14
Warning time:	Days
Potential impact:	Extreme Cold can cause frost bite, hypothermia, and death
Potential of injury or death:	Extreme Cold has a high potential for injury or death in Lexington
Potential duration of facility shutdown:	1-3 days
Past Damages:	$0 publicly recorded
Extent (Date, Damages, Scale/Size):	Unknown damages, multiple day cold spell in 2016 with low temperature of -18° on February 15.

History of Extreme Cold in Lexington Fayette County

In February of 2015, an arctic outbreak brought frigid air to central Kentucky, which not only resulted in one of the heaviest snowfalls in a decade for the state but led to several hypothermia fatalities as well. Several record low temperatures occurred early on February 20th when clear skies, calm winds and a fresh snowpack in excess of 6 inches led to early morning lows near 20 degrees below zero, as measured by some Kentucky Mesonet locations. The ASOS site at Lexington Airport reached -18 degrees. Ten hypothermia deaths were recorded in Kentucky during the period, with two in Fayette County.

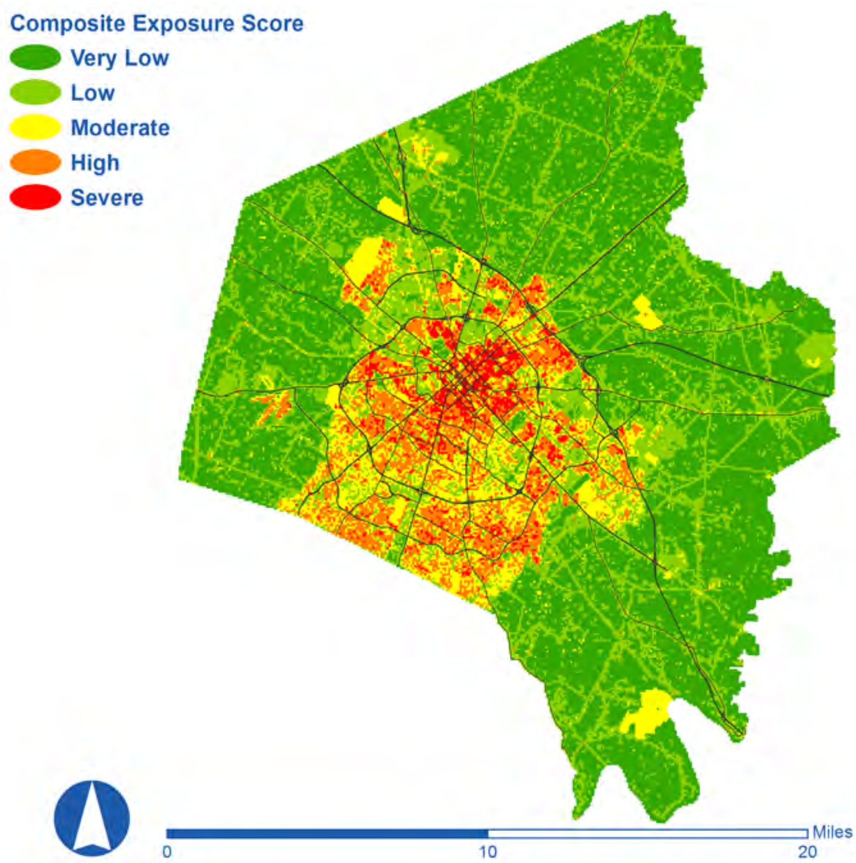
In January of 2016, a weather system brought a quick inch or less of snow to much of central Kentucky during the early morning hours of January 10 and then was followed by bitter cold temperatures and strong winds. Temperatures fell throughout the day, crashing into the teens by afternoon. Brisk winds caused wind chill values to fall into the single digits by late afternoon. Clearing skies set the stage for a cold night and Lexington fell to 10 degrees during the early morning hours of January 11. One hypothermia death was recorded in Fayette County.

4.7.3 Assessing Vulnerability: Extreme Cold

The Extreme Cold Vulnerability Score is currently difficult to calculate based on our current methodology of using Exposure + Risk to calculate Vulnerability. Currently LFUCG has no real spatial data that can be used to calculate the Risk Score variable in order to determine vulnerable areas to Extreme Cold. Extreme Cold is the type of hazard that typically affects a county the size of Fayette County from a geographic standpoint equally. It was also determined that extreme cold has the potential to affect all of our Exposure variables (Population, Socially Vulnerable, Property, Critical Facilities, Infrastructure, Government Facilities). Therefore, at this point it was determined to use the following Exposure Score Map to display higher potentials of hazard vulnerability for the Extreme Cold hazard, until better data can be developed.

The Exposure Score provides a visual display of areas that could be harder hit by extreme cold based on the exposure that is within each grid cell (Figure 4.5).

Figure 4.5: Extreme Cold Vulnerability



4.8 Earthquake

4.8.1 Identify: Earthquake

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free releasing the stored energy and producing seismic waves generating an earthquake. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. However, some earthquakes occur in the middle of plates.

Ground motion, the movement of the earth's surface during earthquakes or explosions, is the catalyst for most of the damage during an earthquake. Produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source, ground motion travels through the earth and along its surface. Ground motions are amplified by soft soils overlying hard bedrock, referred to as ground motion amplification. Ground motion amplification can cause an excess amount of damage during an earthquake, even to sites very far from the epicenter.

Earthquakes strike suddenly and without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach $200 billion

Ground shaking from earthquakes can collapse buildings and bridges, disrupt gas, electric, and phone service, and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter Scale. These earthquakes were felt over the entire eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

Types

Earthquakes are measured in terms of their magnitude and intensity using the Richter Scale and Modified Mercalli Scale of Earthquake Intensity.

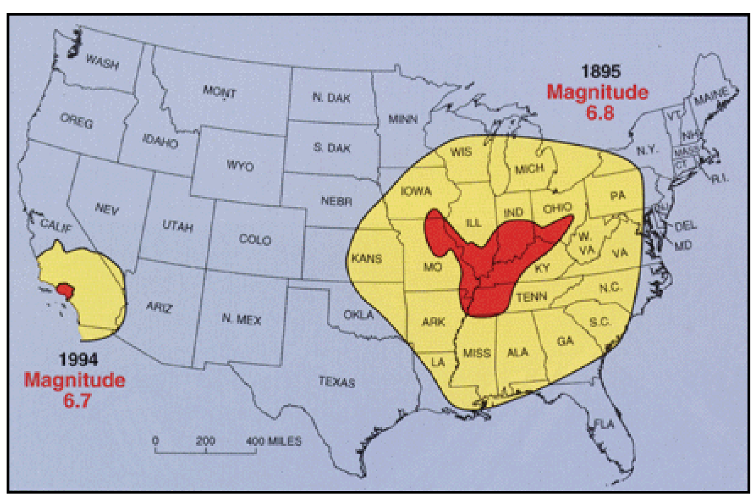
The Richter magnitude scale measures an earthquake's magnitude using an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. The earthquake's magnitude is expressed in whole numbers and decimal fractions. Each whole number increase in magnitude represents a 10-fold increase in measured wave amplitude, or a release of 32 times more energy than the preceding whole number value.

The Modified Mercalli Scale measures the effect of an earthquake on the Earth's surface. Composed of 12 increasing levels of intensity that range from unnoticeable shaking to catastrophic destruction, the scale is designated by Roman numerals. There is no mathematical basis to the scale; rather, it is an arbitrary ranking based on observed events. The lower values of the scale detail the manner in which the earthquake is felt by people, while the increasing values are based on observed structural damage. The intensity values are assigned after gathering responses to questionnaires administered to postmasters in affected areas in the aftermath of the earthquake.

The Modified Mercalli Intensity Scale				
Scale	**Intensity**	**Description of Effects**	**Maximum Acceleration (mm/sec)**	**Corresponding Richter Scale**
I	**Instrumental**	Detectable only on seismographs	<10	
II	**Feeble**	Some people feel it	<25	<4.2
III	**Slight**	Felt by people resting (like a truck rumbling by)	<50	
IV	**Moderate**	Felt by people walking	<100	
V	**Slightly Strong**	Sleepers awake; church bells ring	<250	<4.8
VI	**Strong**	Trees sway; suspended objects swing; objects fall off shelves	<500	<5.4
VII	**Very Strong**	Mild alarm; walls crack; plaster falls	<1000	<6.1
VIII	**Destructive**	Moving cars uncontrollable; masonry fractures; poorly constructed buildings damaged	<2500	
IX	**Ruinous**	Some houses collapse; ground cracks; pipes break open	<5000	<6.9
X	**Disastrous**	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7500	<7.3
XI	**Very Disastrous**	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<9800	<8.1
XII	**Catastrophic**	Total destruction; trees fall; ground rises and falls in waves	>9800	>8.1
Source: North Carolina Emergency Management www.dem.dcc.state.nc.us/mitigation/earthquake.htm				

Facts

Earthquakes in the central or eastern United States affect much larger areas than earthquakes of similar magnitude in the western United States. For example, the San Francisco, California earthquake of 1906 (magnitude 7.8) was felt 350 miles away in the middle of Nevada, whereas the New Madrid earthquake of December 1811 (magnitude 8.0) rang church bells in Boston, Massachusetts, 1,000 miles away. Differences in geology east and west of the Rocky Mountains cause this strong contrast.

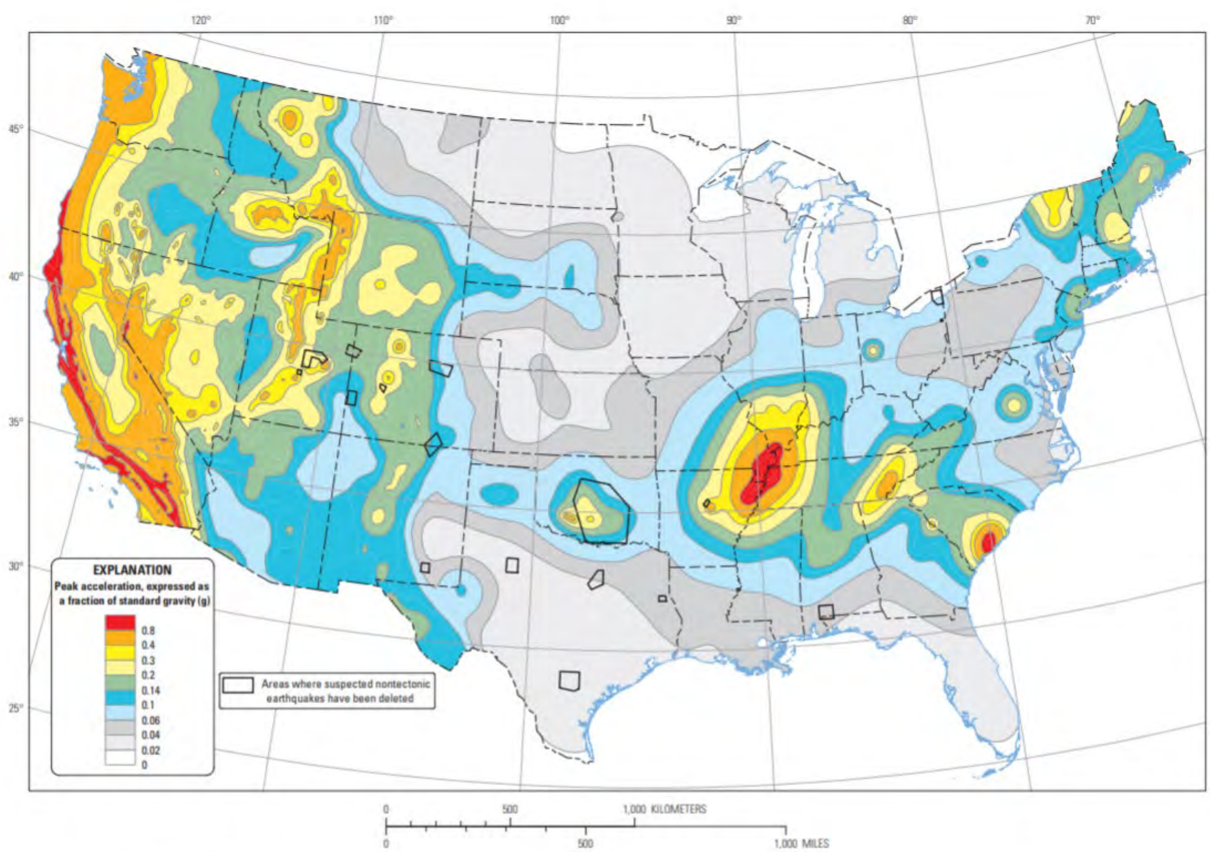


Ten Largest Earthquakes in Contiguous United States		
Magnitude	**Date**	**Location**
7.9	February 7, 1812	New Madrid, Missouri
7.9	January 9, 1857	Fort Tejon, California
7.8	March 26, 1872	Owens Valley, California
7.8	February 24, 1892	Imperial Valley, California
7.7	December 16, 1811	New Madrid, Missouri area
7.7	April 18, 1906	San Francisco, California
7.7	October 3, 1915	Pleasant Valley, Nevada
7.6	January 23, 1812	New Madrid, Missouri
7.5	July 21, 1952	Kern County, California
7.3	November 4, 1927	west of Lompoc, California
7.3	December 16, 1954	Dixie Valley, Nevada
7.3	August 18,1959	Hebgen Lake, Montana
7.3	October 28, 1983	Borah Peak, Idaho
Source: www.disasterrelief.org/Library/WorldDis/wde2_txt.html#cont		

Although earthquakes in the central and eastern United States are less frequent than in the western United States, they affect much larger areas. This is shown by two areas affected by earthquakes of similar magnitude, the 1895 Charleston, Missouri, earthquake in the New Madrid seismic zone and the 1994 Northridge, California, earthquake. Red indicates minor to major damage to buildings and their contents. Yellow indicates shaking felt, but little or no damage to objects, such as dishes.

The following figure in the next page corresponds to the 2014 U.S. Geological Survey National Seismic Hazard Maps. This figure shows a probabilistic ground motion map for Peak Ground Acceleration (PGA), 1Hz (1.0 second SA [spectral accelerations]), and 5Hz (0.2 second SA). Peak ground acceleration tells how hard the earth shakes within the geographic area. This is vital in understanding the impact to structures. The size and magnitude are important, but the PGA will demonstrate expected damages in a finer manner

The U.S. Geological Survey (USGS) National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. This update of the maps incorporates new findings on earthquake ground shaking, faults, seismicity, and geodesy. The resulting maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the frequency of exceeding a set of ground motions.



Two-percent probability of exceedance in 50 years map of peak ground acceleration

Likelihood of Occurrence

The goal of earthquake prediction is to give warning of potentially damaging earthquakes early enough to allow appropriate response to the disaster, enabling people to minimize loss of life and property. The U.S. Geological Survey conducts and supports research on the likelihood of future earthquakes. This research includes field, laboratory, and theoretical investigations of earthquake mechanisms and fault zones. Scientists estimate earthquake probabilities in two ways: by studying the history of large earthquakes in a specific area, and by the rate at which strain accumulates in the rock.

Scientists study the past frequency of large earthquakes in order to determine the future likelihood of similar large shocks. For example, if a region has experienced four magnitude 7 or larger earthquakes during 200 years of recorded history, and if these shocks occurred randomly in time, then scientists would assign a 50 percent probability (that is, just as likely to happen as not to happen) to the occurrence of another magnitude 7 or larger quake in the region during the next 50 years.

Another way to estimate the likelihood of future earthquakes is to study how fast strain accumulates. When plate movements build the strain in rocks to a critical level, like pulling a rubber band too tight, the rocks will suddenly break and slip to a new position. Scientists measure how much strain accumulates along a fault segment each year, how much time has passed since the last earthquake along the segment, and how much strain was released in the last earthquake. This information is then used to calculate the time required for the accumulating strain to build to a level resulting in an earthquake. This simple model is complicated by the fact that such detailed information about faults is rare. In the United States, only the San Andreas fault system has adequate records for using this prediction method.

The University of Memphis estimates that, for a 50-year period, the probability of a repeat of the New Madrid 1811-1812 earthquakes with:

- a magnitude of 7.5 - 8.0 is 7 to 10%
- a magnitude of 6.0 or larger is 25 to 40%

Earthquakes can be experienced in any part of Kentucky, putting Kentucky's entire population and building stock at risk. Each county has at least one fault running beneath it.

4.8.2 Profile: Earthquake

SUMMARY OF EARTHQUAKE RISK FACTORS	
Period of occurrence:	Not Applicable
Number of events: (1811- March 2018)	0 Epicenter based events; however the area has experienced the effects of Earthquakes from events with Epicenters outside of the County boundary.
Annualized Probability:	0 epicenter probability Probability of earthquake with M>5.0 within 500 years & 50 km is 0.1. (Based on USGS calculations)
Warning time:	None
Potential impact:	Impacts human life, health, and public safety. Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Can cause severe transportation problems and make travel extremely dangerous. Aftershocks and secondary events could trigger landslides, releases of hazardous materials, and/or dam and levee failure and flooding.
Potential of injury or death:	Slight chance of injury and risk of deaths
Potential duration of facility shutdown:	None to slight chance
Past Damages:	Unknown
Extent (Date, Damages, Scale/Size):	02/07/1811, Unknown Damages, VI Intensity

Historical Impacts

Kentucky is affected by earthquakes from several seismic zones in and around the state. The most important one is the New Madrid Seismic Zone, in which at least three great earthquakes, each estimated to have been greater than magnitude 8 on the Richter scale, occurred from December 1811 to February 1812. Other major earthquakes have occurred in this region in 1811-12, 1843, and 1895. Fayette County lies within 300 miles of the New Madrid Seismic Zone. See the table below for more information on the earthquake extent.

Earthquakes Affecting LFUCG

Date	Intensity (Modified Mercalli)	Magnitude (Richter Scale)	Origin
12/16/1811	V		New Madrid Seismic Zone
12/16/1811	F		New Madrid Seismic Zone
01/23/1812	IV		New Madrid Seismic Zone
2/07/1812	VI		New Madrid Seismic Zone
01/04/1843		6.0	New Madrid Seismic Zone
02/28/1854			Lexington, Fayette Co.
02/20/1869	IV		Lexington, Fayette Co.
10/31/1895		6.2	New Madrid Seismic Zone
07/27/1980	V	5.2	Sharpsburg, Bath Co
08/23/1980		3.1	Lawrenceburg, Anderson Co
09/07/1988		4.6	Sharpsburg, Bath Co
09/08/1990		3.3	Olympia
09/05/2005		2.5	Sharpsburg, Bath Co
11/10/2012	V	4.2	Hazard, Perry Co
08/20/2012	I	2.8	Lawrenceburg, Anderson Co
10/06/2015	III	2.7	Shelbyville, Shelby Co
11/14/2017	III	2.6	Wilmore, Jessamine Co
01/21/2018	IV	2.6	Wilmore, Jessamine, Co
Source: http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_circ.php			

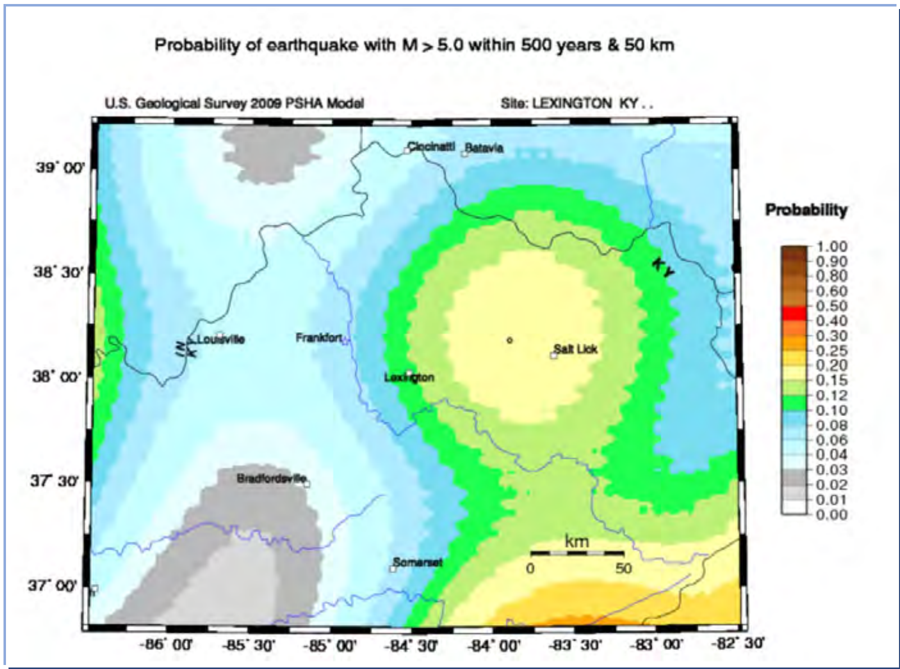
Earthquakes Affecting Lexington Fayette County

On December 15, 1811 an earthquake struck at the New Madrid fault in western Kentucky. The following quote is taken from newspaper articles published after the December 16, 1811, quake. Lexington. "About half after two o'clock, yesterday morning, a severe shock of an earthquake was felt at this place: the earth vibrated two or three times in a second, which continued for several minutes, and so great was the shaking that the windows were agitated equal to what they would have been in a hard gust of wind" (Kentucky Gazette, Lexington, Ky.).

Another large earthquake originating from the New Madrid Seismic Zone occurred February 7, 1812. The effects in Lexington were described as severe, but not as having caused any material damage. In 1980, central Kentucky experienced an earthquake measuring 5.2 on the Richter scale. The epicenter of the quake occurred in Bath County near Sharpsburg, about 30 miles from Lexington. Most of the damage occurred in Maysville, estimated at about $3 million. Reports from Lexington include an account of the ceiling cracking in a wood-frame brick-veneer house, items falling from retailer’s shelves, and pictures falling from walls at several locations. The fault that generated the quake was previously unknown.

Lexington Fayette County is on and near numerous fault lines. There is a moderate risk of minor earthquake activity within this region at any time. Specific damages from an earthquake in Lexington Fayette County would vary greatly depending on the magnitude of the earthquake and the location of its epicenter. The I-75 Kentucky River Bridge, the KAWC pipeline to Richmond Road, and a major natural gas pipeline are all on faults.

The damage in Lexington from a quake on the New Madrid fault is expected to be minor except for disruption of natural gas and petroleum pipelines which originate in western Kentucky. Earth scientists estimate that enough energy has built up in the New Madrid Zone to produce an earthquake of 7.5 on the Richter scale. Such a quake could be felt by half of the population of the United States and by everyone in Kentucky. In Lexington the ground would shake very strongly resulting in walls cracking and plaster falling and could result in minor structural damage particularly to older or poorly designed buildings, bridges, and roads.



While Lexington Fayette County lies within 300 miles of the New Madrid Seismic Zone there are also many smaller fault lines running throughout the state and the county. An earthquake in this zone or in central Kentucky could damage structures, cause injuries, and impact the economy in the long-term, including disruption of bridges, rail lines, communications, power, gas, water utilities, food and medical supplies, natural gas, and oil lines. According to the USGS the probability of an earthquake of a magnitude 5.0 occurring within 500 years in Lexington is 0.1

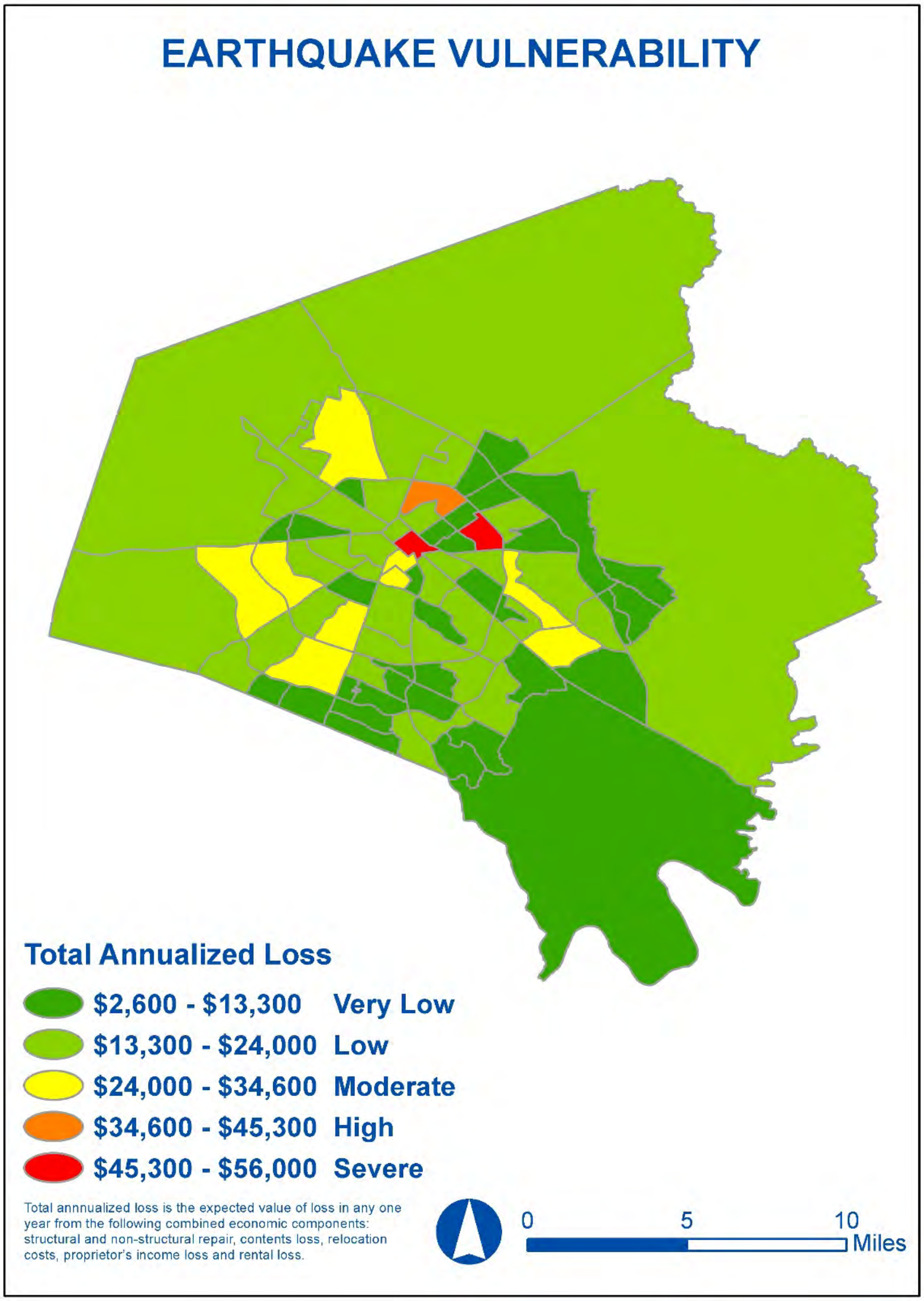
4.8.3 Assessing Vulnerability: Earthquake

Currently LFUCG does not have a good hazard layer to develop a functional Hazard Vulnerability Score as was done for other hazards. Due to this reason the Planning Team decided to use Federal Emergency Management Agency or FEMA's HAZUS-MH model to assess the Earthquake hazard's vulnerability for LFUCG. The HAZUS-MH is a regional earthquake loss estimation model that was developed by FEMA and the National Institute of Building Sciences. The primary purpose of HAZUS-MH is to provide a methodology and software application to develop multi-hazard losses at a regional scale, which display where potential vulnerabilities are located. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The HAZUS-MH software allows the end-user to calculate vulnerability through a variety of scenarios. One can replicate a previous event or run probabilistic models. The Planning Team decided it was best to run a probabilistic model that calculated annualized loss.

The following map (Figure 4.6) depicts an annualized probabilistic return period that identifies potential losses throughout the county. For a deeper review of the HAZUS-MH report and information please see Appendix E for the HAZUS Earthquake report.

Figure 4.6: Earthquake Vulnerability



4.9 Flood Identification

4.9.1 Identify: Flood

A flood is a natural event for rivers and streams and is caused in a variety of ways. Winter or spring rains, coupled with melting snows, can fill river basins too quickly. Torrential rains from decaying hurricanes or other tropical systems can also produce flooding. The excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers, lakes, and oceans that are subject to recurring floods. Currently, floodplains in the U.S. are home to over nine million households.

A flood, as defined by the NFIP is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area, or of two or more properties from:

- overflow of inland or tidal waters;
- unusual and rapid accumulation or runoff of surface waters from any source;
- a mudflow; or,
- a collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood.

Frequency of inundation depends on the climate, soil, and channel slope. In regions without extended periods of below-freezing temperatures, floods usually occur in the season of highest precipitation.

Types

Floods are the result of a multitude of naturally occurring and human-induced factors, but they all can be defined as the accumulation of too much water in too little time in a specific area. Types of floods include regional floods, river or riverine floods, flashfloods, urban floods, ice-jam floods, storm-surge floods, dam- and levee-failure floods, and debris, landslide, and mudflow floods. The following information is specific to the mid-west, especially, Kentucky:

- *Regional Flooding* can occur seasonally when winter or spring rains coupled with melting snow fill river basins with too much water too quickly. The ground may be frozen, reducing infiltration into the soil and thereby increasing runoff. Extended wet periods during any part of the year can create saturated soil conditions, after which any additional rain runs off into streams and rivers, until river capacities are exceeded. Regional floods are many times associated with slow-moving, low-pressure or frontal storm systems including decaying hurricanes or tropical storms.
- *River* or *Riverine Flooding* is a high flow or overflow of water from a river or similar body of water, occurring over a period of time too long to be considered a flash flood.

Flash Floods are quick-rising floods that usually occur as the result of heavy rains over a short period of time, often only several hours or even less. Flash floods can occur within several seconds to several hours and with little warning. They can be deadly because they produce rapid rises in water levels and have devastating flow velocities. Several factors can contribute to flash flooding. Among these are rainfall intensity, rainfall duration, surface conditions, and topography and slope of the receiving basin. Urban areas are susceptible to flash floods because a high percentage of the surface area is composed of impervious streets, roofs, and parking lots where runoff occurs very rapidly. Mountainous areas also are susceptible to flash floods, as steep topography may funnel runoff into a narrow canyon. Floodwaters accelerated by steep stream slopes can cause the flood-wave to move downstream too fast to allow escape, resulting in many deaths

Flash floods can also be caused by ice jams on rivers in conjunction with a winter or spring thaw, or occasionally even a dam break. The constant influx of water finally causes a treacherous overflow; powerful enough to sweep vehicles away, roll boulders into roadways, uproot trees, level buildings, and drag bridges off their piers.

Urban Flooding is possible when land is converted from fields or woodlands to roads and parking lots; thus, losing its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise very rapidly and peak with violent force. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

Dam-Failure floods are potentially the worst flood events. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. When a dam fails, an access amount of water is suddenly let loose downstream, destroying anything in its path. Dams and levees are built for flood protection. They usually are engineered to withstand a flood with computed risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure will be overtopped. If during the overtopping the dam or levee fails or is washed out, the water behind it is released and becomes a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the tremendous energy of the released water.

Debris, Landslide, and Mudflow Flooding is created by the accumulation of debris, mud, rocks, and/or logs in a channel, forming a temporary dam. Flooding occurs upstream as water becomes stored behind the temporary dam and then becomes a flash flood when the dam is breached and rapidly washes away. Landslides can create large waves on lakes or embayments and can be deadly.

Most lives are lost when people are swept away by flood currents, whereas most property damage results from inundation by sediment-laden water. Flood currents also possess tremendous destructive power as lateral forces can demolish buildings and erosion can undermine bridge foundations and footings leading to the collapse of structures.

Facts

The community should be informed that:

- 80% of flood deaths occur in vehicles, and most happen when drivers try to navigate through flood waters.
- Only six inches of rapidly moving flood water can knock a person down.
- A mere two feet of water can float a large vehicle.
- One-third of flooded roads and bridges are so damaged by water that any vehicle trying to cross stands only a 50% chance of making it to the other side.
- 95% of those killed in a flash flood tried to outrun the waters along their path rather than climbing rocks or going uphill to higher grounds.

- Most flood-related deaths are due to flash floods.
- Homeowners' insurance policies do not cover floodwater damage.
- Six to eight million homes are located in flood-prone areas.
- Flooding has caused the deaths of more than 10,000 people since 1900.
- More than $4 billion is spent on flood damage in the U.S. each year.
- On average, there are about 145 deaths each year due to flooding.
- About one-third of insurance claims for flood damages are for properties located outside identified flood hazard areas.
- Under normal conditions floods do not cause damage. Damage occurs when structures are built in flood-prone areas.

Common Flood-Related Terms

- *100-Year Flood Plain*. The area that has a 1% chance, on average, of flooding in any given year. (Also known as the Base Flood or the 1.0% Annual Chance Flood Hazard).
- *500-Year Flood Plain*. The area that has a 0.2% chance, on average, of flooding in any given year (Also known as the 0.2% Annual Chance Flood Hazard).
- *Base Flood*. Represents a compromise between minor floods and the greatest flood likely to occur in a given area. The elevation of water surface resulting from a flood that has a 1% chance of occurring in any given year.
- *Floodplain*. The land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area, if left undisturbed, acts to store excess floodwater. The floodplain is made up of two sections: the floodway and the flood fringe.
- *Floodway*. The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved, in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties. Floodways are not mapped for all rivers and streams but are generally mapped in developed areas. Unlike floodplains, floodways do not reflect a recognizable geologic feature.
- *Flood Fringe*. The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. The fringe land area is outside of the stream or river floodway, but is subject to inundation by regular flooding

4.9.2 Profile: Flood

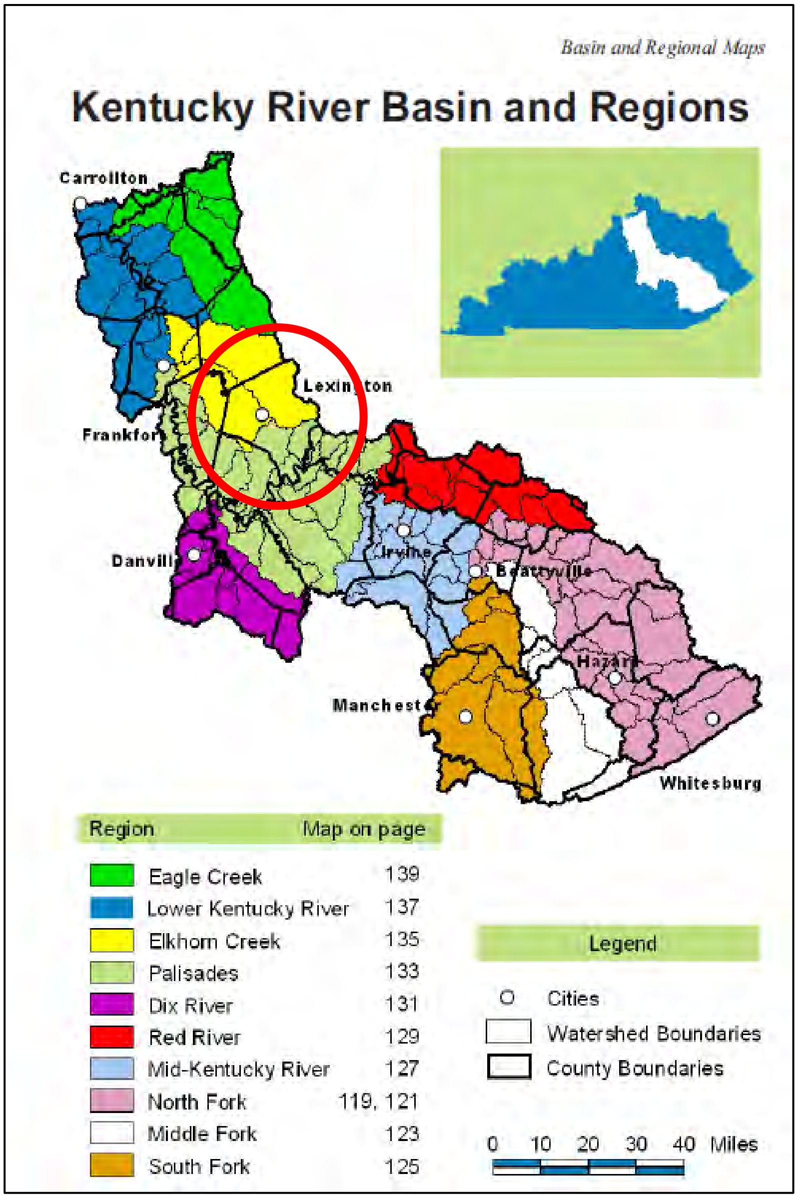
SUMMARY OF FLOOD RISK FACTORS	
Period of occurrence:	Riverine Flooding: any time but primarily January through May Flash floods: anytime, but primarily during Summer rains
Number of events: (1996-2017)	41
Annualized Probability:	1.95
Warning time:	River flooding – 3 to 5 days Flash flooding – Minutes to hours Out-of-bank flooding – several hours/days
Potential impact:	Impacts human life, health, and public safety. Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Can lead to economic losses such as unemployment, decreased land values, and Agro-business losses. Floodwaters are a public safety issue due to contaminants and pollutants.
Potential of injury or death:	Injury and risk of multiple deaths
Potential duration of facility shutdown:	Weeks to months
Past Damages (2017 dollars):	Total: $3,887,076 Property: $1,263,000 Crop: $1,00,000
Extent (Date, Damages, Scale/Size):	3/1/1997, $1,100,000, 500 Year Flood event

Historical Impact

Lexington Fayette County lies within the Kentucky River Basin watershed. The majority of flooding in Lexington Fayette County occurs during the winter and early spring. However, it should be noted via local experts that summer thunderstorms often produce flooding.

The older area of Lexington developed on a generally topographically high area. All streams that originate in Fayette County drain out away from the core area. This physiographic feature originally defined the orientation of the downtown grid layout and helped shape the development of the community. Urban Lexington does not experience widespread flooding from any one stream; however, due to the nature of stream distribution and the topography, flood problems are highly localized and, for the most part, respond very rapidly to a given storm event. This flash flooding occurs when the volume of rain exceeds the capacity of the storm water system. Urban flooding primarily impacts businesses, residential structures, streets and roads, and disrupts vital services.

A majority of the storm event flooding problems occur in the older developed areas of Lexington where storm sewer piping may experience a variety of problems that range from being non-existent, being undersized, or having collapse problems, to not being able to accommodate infill development, due to increased development and stormwater runoff

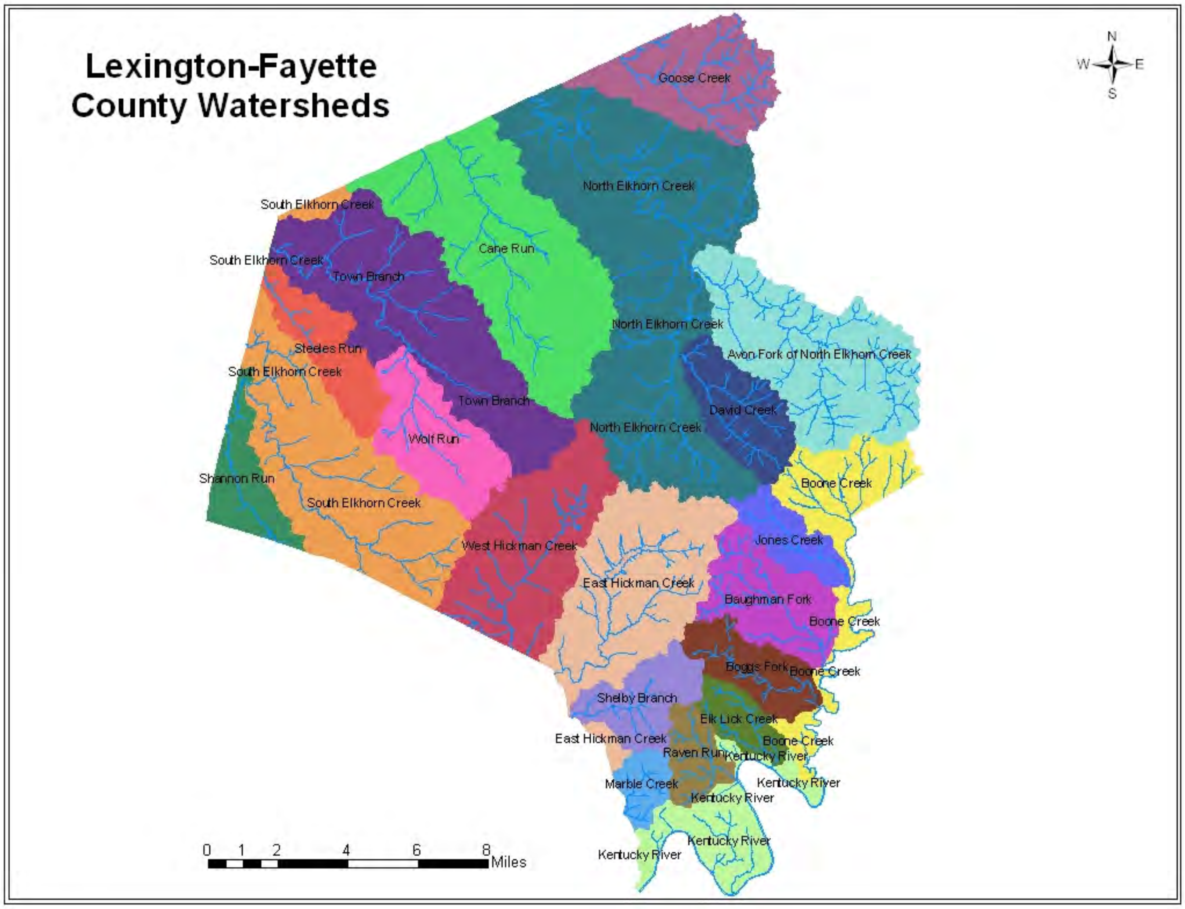


Flooding is exacerbated by urban encroachment into the floodplains, increased runoff from impervious surfaces and storm sewer problems. These conditions cause Lexington to experience flood damage from frequent storm events of low rainfall amounts, especially in the older parts of the City.

The topography of Lexington Fayette County is unique for an urban area of its size, because the urban development does not have a major waterfront area. (See 24 Lexington Fayette County Watersheds Map below). Seven of these watersheds impact the urban area and two are rural. Small streams constitute the majority of the floodplains, with a small percentage of riverine floodplain along the Kentucky River. There are 12,142 acres of floodplain within Lexington Fayette County, of which 8,477 acres are in the low-density rural service area and 3,665 acres (30%) fall within the Urban Service Area Boundary. As can be seen in the 24 Lexington Fayette County Watersheds Map, the County is located on a drainage divide with streams draining off in all directions. Cane Run and the Town Branch flow in a northerly direction, while South Elkhorn Creek flows generally westward. East and West Hickman drain to the south, and tributary streams to the North Elkhorn Basin flow generally to the east.

Generally, the headwater and floodplain of all streams inside the New Circle Road Belt are characterized by residential and commercial development. Of particular note in this area are the Town Branch, tributaries of Wolf Run, Vaughns Branch, along with the West Hickman tributaries of Tates Creek and Lansdowne Branch. Outside of New Circle Road the floodplains are predominantly rural in nature with an interspersing of commercial and residential units

A 1997



Reconnaissance Report by the Army Corps of Engineers identified flood prone areas around Wolf Run, Vaughns Branch, Big Elm, Cane Run, Town Branch, West Hickman Creek, South Elkhorn Creek, and North Elkhorn Creek. Most of these areas are narrow floodplains adjacent to residential areas, which can result in frequent basement flooding.

These streams are characterized by relatively small drainage areas and steep gradients which make them subject to flash floods caused by intense thunderstorms which can occur throughout the year. Their quick response to rainfall causes floods to rise rapidly, cresting shortly after the rainfall ceases, and then quickly receding.

Because of the nature of these streams, Lexington Fayette County does not have the classical flooding where houses and business are inundated with water. The County's flooding problems consist of backyard, basement, and street flooding. The flooding situation can also be compounded by a combination of excessive rainfall with other events. These include contributions of snowmelt runoff and
concurrent highwater on other major streams and the Kentucky River, which does not allow for normal runoff patterns.

LFUCG has been declared for flooding in the following Presidential Declarations

Lexington Fayette County Presidential Declarations for Flood
May 11, 2010, DR1912, severe storms, flooding, mudslides, and tornadoes
February 5, 2009, DR1818, severe winter storms and flooding
February 21, 2008, DR-1746, severe storms, tornadoes, straight-line winds, and flooding.
June 10, 2004, DR1523, flooding, severe storms, and landslides impacted the region.
March 14, 2003, DR1454, flooding, ice, snow, and tornadoes.
March 4, 1997, DR1163, flooding.
February 24, 1989, DR821, flooding and severe storms.
December 12, 1978, DR568, flooding and severe storms.

Several sources were consulted for flood event examples and descriptions. Details regarding significant flood events (damaging or resulting in casualties) provided by the NCEI Storm Events Database include

- **June 23, 2017**: Heavy rainfall caused flooding in Lexington and caused upwards of a dozen streets to be closed. In one case, local firefighters rescued a man stuck in his car on North Broadway and New Circle Road. The weather station on Winchester Road reported over 3.94 inches of rainfall.
- **July 13, 2015**: Severe thunderstorms and prior wet conditions led to flash flooding in several locations, resulting in closed and impassable roads, water rescues, and significant property damage. The most widespread and hardest hit areas were along and east of Interstate 65 in central Kentucky. Rainfall amounts over the period were in excess of 5 to 7 inches. Several rivers across the region went above flood stage, cresting several feet above flood stage. A Fayette County official reported a high-water rescue after rain flooded streets in the area.
- **September 4, 2014**: A Fayette County official relayed a report of a car stalled in the flooded intersection of Pink Pigeon Parkway and Star Shoot Parkway.
- **August 10, 2014**: The media reported that several feet of water flooded Polo Club Drive southeast of Lexington. Three cars became stranded with water up past their bumpers.
- **August 31, 2013**: The Lexington Fire Department reported a car swamped in shallow water at the intersection of Leestown and Dolan Roads as a series of scattered thunderstorms passed over the Bluegrass Region.
- **June 26, 2013**: Episodes of heavy thunderstorms contributed to localized flash flooding across north central Kentucky, including Louisville, Lexington, and in Madison County. Local Television media reported a water rescue at Elm Tree Road and East 2nd Street. For the entire day, the Lexington Airport measured 2.75 inches of rain. Most of this fell during the mid-evening hours.
- **May 1-4, 2010**: Six to seven inches of rain across Fayette County led to area flooding. The Lexington-Herald Leader reported that a two-day storm brought a significant rain that brought flooding to nearby Franklin and Harrison County. The Kentucky River reach a crest of 42.7 feet, above the flood stage of 31 feet.
- **September 23, 2006**: Two women were knocked down and swept away by rapidly flowing water, after trying to cross a flooded intersection. Sixty intersections in town were covered by high water, some with water depths up to three or four feet. Interstate 75 at mile marker 115 was flooded. Interstate 64 at mile marker 81 also had high water.
- **August 31, 2003**: Heavy rains caused area creeks and small streams to flow out of their banks. Roadways, underpasses, and low-lying areas were flooded. Several vehicles were stranded in water on Nicholasville and Richmond Roads in Lexington.

- **February 15, 2003**: A severe winter storm with freezing rain caused basement flooding.
- **March 20, 2002**: The intersection of New Circle Road and Richmond Road was closed by high water. The Winchester Road exit from Interstate 64 was closed. Eight to ten homes on Beach Road flooded.
- **July 20, 1998**: East central Kentucky saw widespread flooding as anywhere from 3 to 6 inches of rain fell over a three-hour span. Numerous roads were closed due to high water across this area, and many basements were flooded as well. Over 100 evacuations were made to residence of mobile homes and apartments, and a few rescues were also made as motorists were trapped in high water.
- **March 1, 1997**: Over 2 inches of rain fell on top of 3 to 7-inch 24-hour totals resulting in widespread flash flooding with many roads water covered and closed. Fayette County was declared a disaster area. Damage totals include all flooding and flash flooding from March 1 and March 2.
- Other examples of Lexington Fayette County flood events from State and local sources include:[6]
- The **summer of 1992** when several very localized storms swept through Lexington Fayette County (June, July, August) that had periods of very high intensity precipitation. Rainfall intensity estimates for the June 1992 event range from 2-year to 50-year rainfall events, but some isolated locations may have exceeded these intensities. These storms caused severe urban flash flooding by overloading the existing stormwater drainage system in the older areas of Lexington that were developed utilizing old development and stormwater management policies.
- **March 10, 1964**: The U.S. Weather Bureau at Blue Grass Field reported that a total of 2.87 inches of rain had fallen during a period beginning a 12:01 am Monday and ending at 1:00 pm March 10. Water and wind damage were more than $100,000.

The potential for floods includes the whole range of events, from the bankful conditions that are relatively common to the extreme 1% that would inundate the entire floodplain. Within this range, the 100-year flood has come to be recognized as a guideline for distinguishing between reasonable and unreasonable risks. But floods of magnitudes exceeding even the 500-year flood are possible, which would cause great damage and hardships to the community.

Mitigation Programs

Lexington Fayette County began their floodplain management program in 1972 when the community started participation in the NFIP. The only way that flood insurance is available is through the NFIP. As part of that program, the community adopted the Floodplain Conservation and Protection Ordinance to regulate development in the floodplain.

Additionally, Lexington Fayette County participates in the higher regulatory voluntary program under the NFIP called the Community Rating System (CRS), since its inception in 1991. Under the CRS program, communities gain points for flood prevention and reduction activities, higher regulatory standards, outreach projects, stormwater and floodplain management and other mitigation activities. The more points or credit the community receives, the lower the flood insurance premium cost for the residents of Lexington Fayette County. The NFIP places flood prone properties into three categories:

6 These examples are not factored into the "Number of Events" and "Annual Probability" calculations provided in the Flood Summary, as reporting prior to 1996 was sporadic, and using a reporting period of 1950-2017 would likely under-estimate the number and probability of flood events.

- **Repetitive loss** structure locations are a trigger to the community that other adjacent properties may be at-risk and can provide the community an opportunity to designate a repetitive loss area that reflects the vulnerability of a street or neighborhood. A Repetitive Loss (RL) property is A property for which two or more National Flood Insurance Program losses of at least $1,000 each have been paid within any 10-year rolling period since 1978.
- **Historical claims** data also helps a community identify flood prone areas. The repetitive loss and historic claims areas were identified as part of the Flood Risk Score so that appropriate enforcement, mitigation, and emergency measures are taken.
- **Severe repetitive loss** property as defined in the Flood Insurance Reform Act of 2004, those 1–4 family properties that have had four or more claims of more than $5,000 or two to three claims that cumulatively exceed the building's value. For the purposes of the CRS, non-residential buildings that meet the same criteria as for 1–4 family properties are considered Severe Repetitive Loss properties.

Lexington Fayette Urban County (CID 210067)	
Status	**Current**
CRS Entry Date	10/01/1991
Current Effective Date	12/21/2017
Current Class	7
% flood insurance discount for SFHA	15
% discount for non-SFHA	5

Fayette County currently has five severe repetitive loss properties, with no other historical claims or repetitive loss properties.

The 2020 LFUCG Hazard Mitigation Plan serves as the Floodplain Management Plan under the CRS program. A crosswalk of required elements in the Floodplain Management Plan included in this plan may be found in Appendix F.

4.9.3 Assessing Vulnerability: Flood

Flood Vulnerability Score = Exposure Score + Risk Score

Risk Score = Occurrence Score + Geographic Extent Score

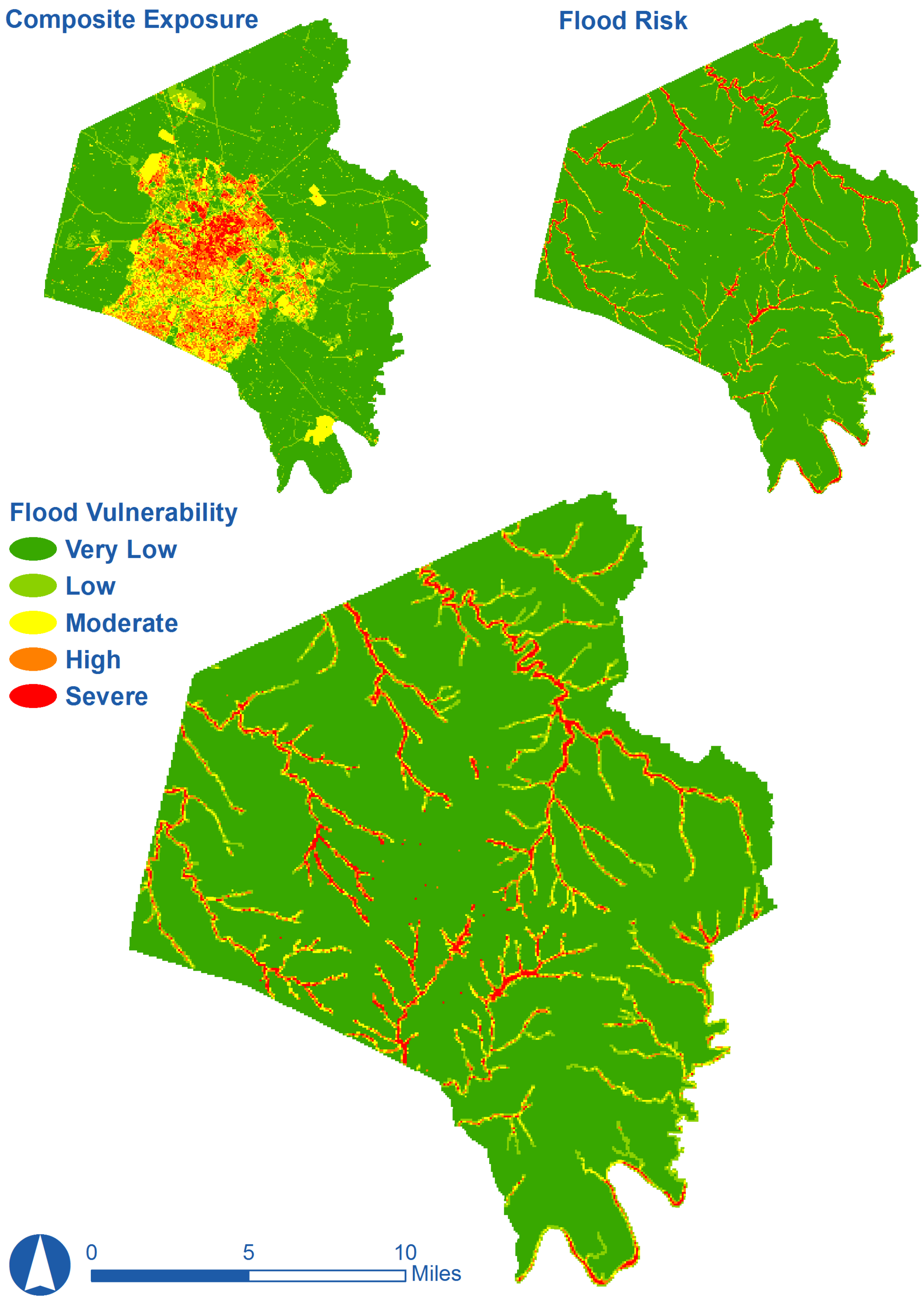
Occurrence Score = Hotspots (identified in risk assessment workshop) + SRL + RL + Historical Claims (from LFUCG Sources). Occurrences were totaled for each grid cell and then the totals were scored on a 0-1 scale.

Geographic Extent Score = % of grid cell in 1% regulatory floodplain. Geographic Extent was calculated for each grid cell and then scored on 0-1 scale.

The Occurrence Score was added to the Geographic Extent Score and a new 0-1 score was calculated resulting in the Flood Risk Score.

The Flood Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Flood Vulnerability Score (Figure 4.7).

Figure 4.7: LFUCG Flood Vulnerability



4.9.4 Repetitive Loss

LFUCG recognizes repetitive loss properties as prime targets for mitigation projects. Following are definitions for the two categories of repetitive loss

Repetitive loss property is defined as a residential property that is covered under an NFIP flood insurance policy and:

A property is considered repetitive loss when the structure has experienced more than one flood-related loss and received flood insurance for more than $1,000 in damages within a 10-year period **Severe repetitive loss** property is defined as a residential property that is covered under an NFIP flood insurance policy and:

a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart.

Repetitive Loss

§201.6(c)(2)(ii): The risk assessment in all plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods.

All Local Mitigation Plans approved by FEMA must address repetitive loss structures in the risk assessment by describing the types (residential, commercial, institutional, *etc.*) and estimate the numbers of *repetitive loss properties* located in identified flood hazard areas.

Repetitive Loss/Severe Repetitive Loss structure locations are a trigger to the community that other adjacent properties may be at-risk and can provide the community an opportunity to designate a repetitive loss area that reflects the vulnerability of a street or neighborhood.

Currently Lexington Fayette County has 0 Repetitive Loss properties and five Severe Repetitive Loss Properties.

4.10 Hail

4.10.1 Identify: Hail

Hail is precipitation in the form of spherical or irregular pellets of ice larger than 5 millimeters (0.2 inches) in diameter (American Heritage Dictionary).

Hail is a somewhat frequent occurrence associated with severe thunderstorms. Hailstones grow as ice pellets and are lifted by updrafts and collect super-cooled water droplets. As they grow, hailstones become heavier and begin to fall. Sometimes, they are caught by successively stronger updrafts and are re-circulated through the cloud growing larger each time the cycle is repeated. Eventually, the updrafts can no longer support the weight of the hailstones. As hailstones fall to the ground, they produce a hail-streak (i.e. area where hail falls) that may be more than a mile wide and a few miles long.

Types

Hail is a unique and fairly common hazard capable of producing extensive damage from the impact of these falling objects. Hailstorms occur more frequently during the late spring and early summer months. Most thunderstorms do not produce hail, and ones that do normally produce only small hailstones not more than one-half inch in diameter. However, hailstones can grow larger than the size of a golf ball before falling to the ground.

Facts

- Hailstones can fall at speeds of up to 120 mph.
- Hail is responsible for nearly $1 billion in damage to crops and property each year in the U.S.
- The largest hailstone ever recorded fell in Coffeyville, Kansas in 1970. It measured over 5.6 inches in diameter and weighed almost two pounds.

Hail Conversion Chart		
Diameter of Hailstones (inches)	**Diameter (nearest mm)**	**Description**
0.50	13	Marble
0.70	18	Dime
0.75	19	Penny
0.88	22	Nickel
1.00	25	Quarter
1.25	32	Half Dollar
1.50	38	Walnut
1.75	44	Golf Ball
2.00	51	Hen Egg
2.50	64	Tennis Ball
2.75	70	Baseball
3.00	76	Tea Cup
4.00	102	Grapefruit
4.50	114	Softball

	TORRO Hail Intensity Scale Intensity categories range from H0 to H10, with H10 being the most destructive indicating structural damage possible.			
	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m2	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		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

4.10.2 Profile: Hail

SUMMARY OF HAILSTORM RISK FACTORS	
Period of occurrence:	Year-round
Number of events: (1955-2017)	61
Annualized Probability:	0.98
Warning time:	Minutes to hours
Potential impact:	Large hailstorms can include minimal to severe property and crop damage and destruction.
Potential of injury or death:	Injury and slight chance of deaths
Potential duration of facility shutdown:	Days
Past Damages (2017 dollars):	Total: $50,000 Property: None Reported Crop: $50,000
Extent (Date, Damages, Scale/Size):	07/10/1966, TORRO: H10 (4-inch), No recorded damages

Historical Impacts

The effects of large hailstorms can include minimal to severe property and crop damage and destruction. According to the research, at least 48 reported hailstorms have fallen in Lexington Fayette County from 1955 to 2017. These storms of varying sized hail have caused an estimated $54,640 worth of total damage in adjusted 2017 dollars. It is highly likely damages from hail are underreported, as most damages are handled by individuals

through private insurance. No deaths or reported injuries have resulted from hail storms in Lexington Fayette County, but such incidents remain a possibility.
The following State and local data provide more detailed information on several recent hail storms that resulted in damage and/or injury.

- **April 5, 2017**: Severe thunderstorms developed across the region, resulting in large hail and damaging winds across central Kentucky. The hail resulted in a few broken home windows and damaged shingles.
- **July 27, 2014**: Widespread large hail up to golf-ball size damaged corn, soybean and tobacco crops at the University of Kentucky Agricultural Research Farm just north of Lexington. This hail fell from a supercell that brought a destructive microburst to Lexington.
- **March 2012**: Hail in the golf ball- and even tennis ball-size (Approximately 70 mm in diameter) range was seen in most regions of the state accompanying a tornadic event.
- **May 31, 2006**: Roof damage was reported, and power lines were downed in the Newtown Pike area. A cluster of thunderstorms produced widespread tree damage, minor structural damage, heavy rains, and some large hail in the Lexington area. Elsewhere over east central Kentucky, trees and power lines were downed. But the only other structural damage was reported in Greensburg, where a tool shed was rolled.
- **June 14, 2005**: Thunderstorms developed in an unstable air mass over central Kentucky, out ahead of an advancing cold front. Thunderstorm winds downed trees and power lines over much of the area, along with a few instances of hail and structural damage.

4.10.3 Assessing Vulnerability: Hail

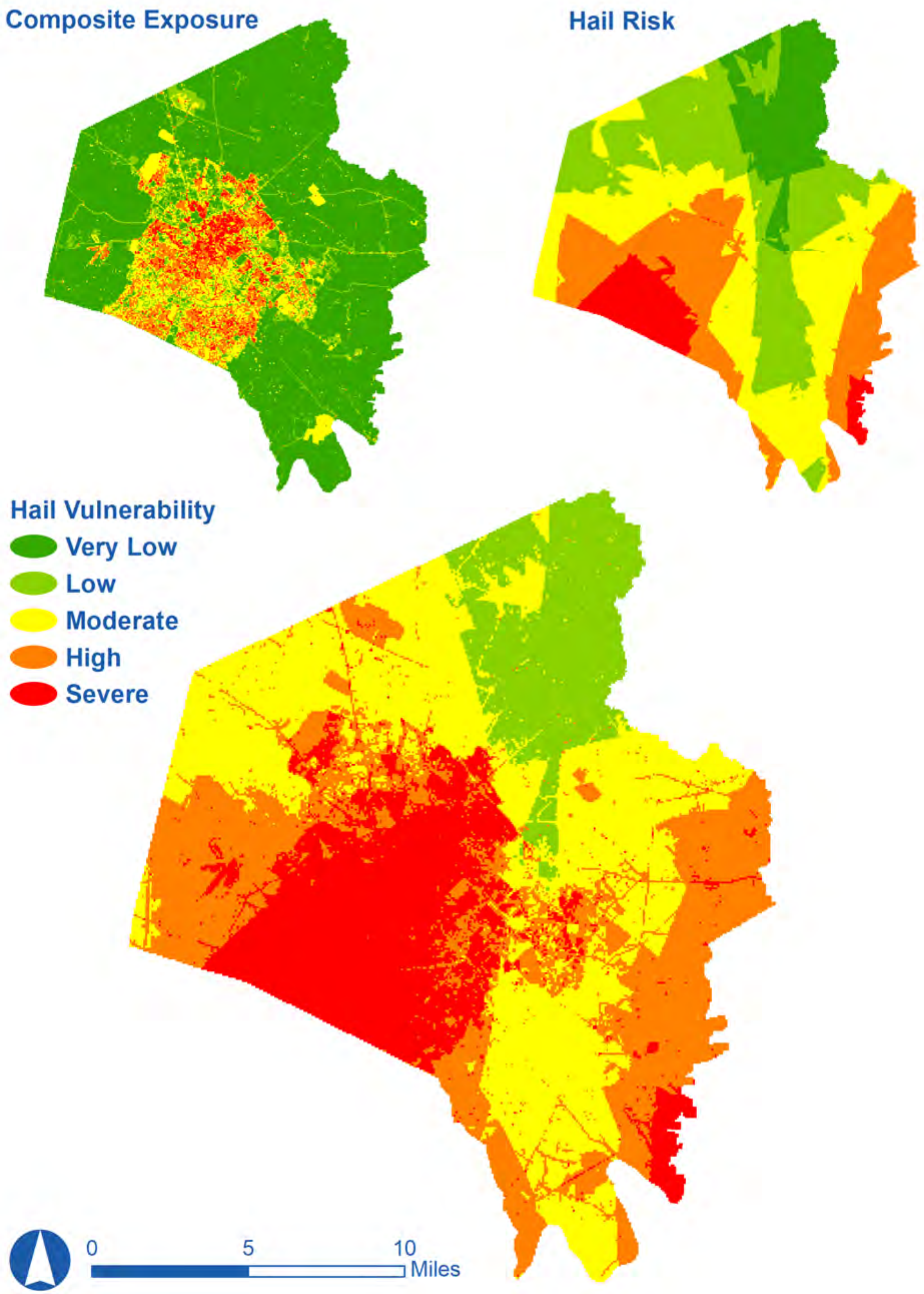
Hail Vulnerability Score = Exposure Score + Risk Score

Risk Score = Occurrence Score

Occurrence Score = Occurrences were calculated for each grid cell by identifying and counting all Hail events within 25 miles of each cell. Hail events included were all recorded events from 1950 – 2016 (NOAA Storm Prediction Center).

The Hail Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Hail Vulnerability Score (Figure 4.8).

Figure 4.8: LFUCG Hail Vulnerability



4.11 HAZMAT

4.11.1 Identify: HAZMAT

A hazardous material (HazMat) is a dangerous or potentially harmful substance that will impact human health or the environment. Hazardous materials can be found in the form of liquids, solids, or gasses. A HAZMAT release can range in impact by the very nature of the diversity of products in existence that are hazardous to humans. This hazard is not just a direct impact on health but can also cause secondary impacts in the form of making daily activities hazardous. An example of this would be a lubricant, such as hydraulic fluid, spill causing slick road conditions resulting in vehicular accidents. Hazardous materials generally fall into one of the following categories: chemical, biological, radiological, or nuclear. These four groups are known collectively as CBRNs.

The small capability for handling these types of events by the general public leads these events to be greatly dangerous and possibly deadly. Unlike a flood or winter storm, that generally has a warning time associated with it that allows citizens to escape safely from an event with a planned evacuation, HAZMAT releases do not follow this trend. They happen suddenly due to an infrastructure failure, facilities failure, or transportation accident. They are also usually very capable of initially being airborne due to an explosion or become airborne shortly after release due to interactions and fire. The airborne nature of many HAZMAT spills and the possibility of Toxic Inhalation Hazard (TIH) exposure makes this hazard unique to other hazards due to a reliance on special equipment when responding. In a case that the general population does not have access to Personal Protective Equipment (PPE) that would be vital for surviving a HAZMAT release, the damage to the population could be extensive.

For the reasons outlined above, it is imperative for the officials to respond quickly and efficiently to these types of hazards when they occur. The first reference guide that should be utilized by HAZMAT Teams is the 2016 Emergency response Guidebook. This is “A Guidebook for First Responders during the Initial Phase of a Dangerous Goods/ Hazardous Materials Transportation Incident.”

4.11.2 Profile: HAZMAT

SUMMARY OF HAZMAT RISK FACTORS	
Period of occurrence:	Year-Round
Number of events: (1986-2017)	1,429 (transportation)
Annualized Probability:	46.10
Warning time:	None
Potential impact:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases.
Cause of injury or death:	Injury and risk of multiple deaths
Potential duration of facility shutdown:	30 Days or More
Past Damages (2017 dollars):	$967,273
Extent (Date, Damages, Scale/Size):	1/10/2014, $109,273 in damages, 1,173 liquid gallons (LGA) of corrosive materials spilled off of Interstate 64

Historical Impacts

The most common occurrences of hazardous material leaks involve gas line breaks that supply homes with natural gas for heating and cooking. Gasoline tanks below ground at refueling stations also pose a risk of leakage and water contamination.

There is a chemical stockpile location to the south of Lexington Fayette County, in Madison County, that stores nerve agents such as sulfur mustard, GB, VX. The CSEPP (Chemical Stockpile Emergency Preparedness Program) is a partnership between the FEMA and the U.S. Department of the Army which regulates response efforts.

The other locations impacted by HAZMAT releases also vary widely, as follows.

Roadways

Many industrial components are transported via the extensive road network within the United States. This is truer today with the increase of commercial vehicular traffic now moving goods via interstate routes rather than by rail. The industrial components that move along the road and railways of the United States include those classified as explosives, gas, flammable, flammable solid/combustible, organic, poison, radioactive, corrosives, dangerous(other), and Toxic Inhalation Hazards. In Lexington Fayette County there are at least six different inbound locations for HAZMAT materials: I-75 North, I-75 South, I-64 East, I-64 West, Newtown Pike, and Versailles Road. See the Lexington Fayette County Local Emergency Planning Committee Emergency Response Plan[7] for a full listing of truck routes most commonly used to transport HAZMAT.

A survey completed within Fayette county by the KYTC and the UK College of Engineering in 2010 made several key observations:

- 683 different hazardous material vehicles were recorded over the survey.
- A total of 741 hazardous materials were observed.
- A total of 93 unique hazardous materials were observed.
- The highest average number of hazardous material vehicles was observed during the time frame from 12:00– 1:00 pm.
- 27 percent of the total hazardous material observations were on Newtown Pike.
- Over 45 percent of the total hazardous material observations were Class 3 hazardous materials.
- 36 percent of the total hazardous material observations would utilize the Emergency response Guide number 128 in the event of an incident.
- The most common hazardous material observed during the survey period was hazardous material ID number 12-3, commonly known as gasohol, gasoline, motor spirit, or petrol.

Railways

Despite the predominance of road transportation hazardous materials are transported via rail. Lexington Fayette County is not lacking in the rail lines existing within its boundaries. The following summarizes rail lines within Lexington Fayette County.

7 http://fayettelepc.com/PDF/ESF10AttachmentD2017.pdf

- In Lexington Fayette County a rail line approaches the County from the SW, heading NE, traveling parallel to RT 27, entering downtown Lexington, then heads N, NW out of the city.
- There are three additional rail lines emanating from downtown.
- The first is between Versailles Rd & Old Frankfort Pike,
- the second between Old Frankfort Pike & Leestown Rd and
- the third starting at N Broadway Rd exiting the city and following 64-E.

Areas of impact include the downtown area, but most concerning is the numerous residential areas that these tracks run through. In the case of a derailment, there is a possibility for loss of life and extensive property damage.

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) reports transportation-related hazardous materials incidents. Overall, PHMSA reported 1,429 incidents for Lexington Fayette County since 1986, 715 of which had reported damages. In total, these events resulted in no deaths, eight injuries, and 225 people being evacuated. On April 25, 2012, a construction crew nicked a medium-pressure gas line near Cromwell Way causing road closures and delayed public school bus service.

Fixed Facility

On June 11, 2018 a 3M Ceradyne facility had a crack in their ammonia facility. Upon arrival at work that morning, employees encountered emergency alarms indicating that ammonia had leaked out of the production line and was contaminating the facility. Lexington Fire responded with DEM. They Evacuated the area and set up boundaries around the facility. Utilized a HAZMAT entry team in LEVEL A PPE to investigate and transmit back live video from a tactical HAZMAT camera system. Upon exit from the facility, coordination with 3M subject matter experts occurred, and the best course of action was determined. The HAZMAT Team re-entered the building and shut off a variety of valves to stop the continued flow of Ammonia into the building. After exit from the hot zone, 3M purged the facility through specially designed filters to make the interior safe.

4.11.3 Assessing Vulnerability: HAZMAT

HazMat Vulnerability Score = Exposure Score + Risk Score

Risk Score = Geographic Extent Score + Occurrence Score

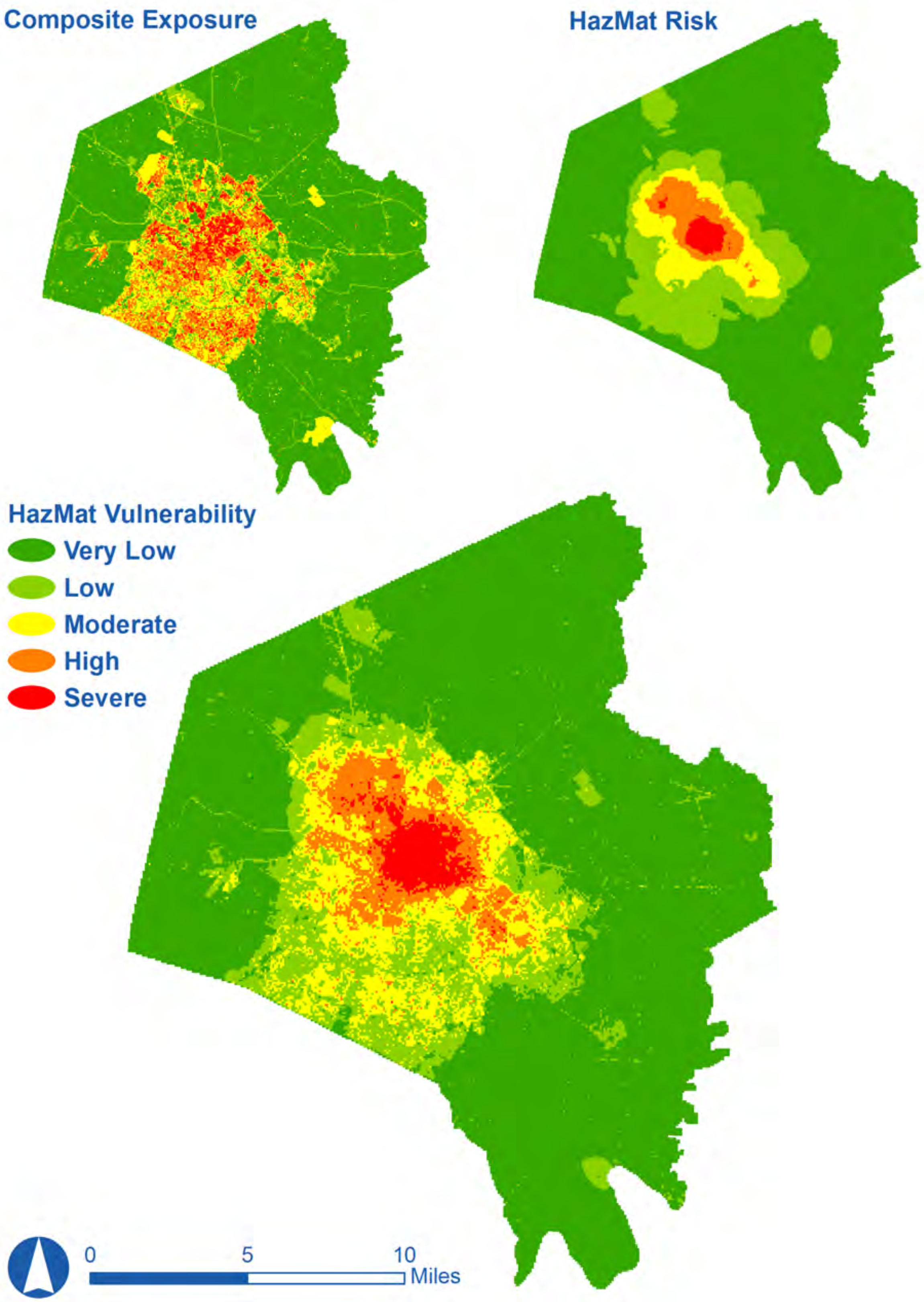
Geographic Extent Score = The number of rail lines, interstate highways, expressways, ramps, and major arterials that could transport hazardous materials were identified within one mile of each grid cell. The total count for each cell was converted to 0-1 score.

Occurrence Score = The number of sites/facilities in each grid cell with hazardous materials included in the EPA's Federal Registry Service.

Geographic Extent Score was added to Occurrence Score and the total was converted to 0-1, resulting in the HazMat Risk Score.

The HazMat Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final HazMat Vulnerability Score (Figure 4.10).

Figure 4.10: LFUCG HazMat Vulnerability



4.12 Karst & Sinkhole

4.12.1 Identify: Karst & Sinkhole

Karst is an area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns. A sinkhole is a natural depression in a land surface communicating with a subterranean passage, generally occurring in limestone regions and formed by solution or by collapse of a cavern roof (American Heritage Dictionary).

Karst refers to a type of topography formed in limestone, dolomite, or gypsum by dissolution of these rocks by rain and underground water. It is characterized by closed depressions or sinkholes, caves, and underground drainage. During the formation of Karst terrain, water percolating underground enlarges subsurface flow paths by dissolving the rock. As some subsurface flow paths are enlarged over time, water movement in the aquifer changes character from one where ground water flow was initially through small, scattered openings in the rock, to one where most flow is concentrated in a few, well-developed conduits. As the flow paths continue to enlarge, caves may be formed, and the ground water table may drop below the level of surface streams. Surface streams may then begin to lose water to the subsurface. As more of the surface water is diverted underground, surface streams and stream valleys become a less conspicuous feature of the land surface and are replaced by closed basins. Funnels or circular depressions called sinkholes often develop at some places in the low points of these closed basins.

Types

- *Collapse sinkholes* occur when the bridging material over a subsurface cavern cannot support the overlying material. The cover collapses into the cavern and a large, funnel-shaped depression forms.
- *Solution sinkholes* result from increased groundwater flow into higher porosity zones within the rock, typically through fractures or joints within the rock. An increase of slightly acidic surface water into the subsurface continues the slow dissolution of the rock matrix, resulting in slow subsidence as surface materials fill the voids.
- *Alluvial sinkholes* are older sinkholes that have been partially filled with marine, wetland or soil sediments. These features are common in places like Florida, where the water table is shallow, and typically appear as shallow lakes, cypress "domes" and wetlands.
- *Raveling sinkholes* form when a thick overburden of sediment over a deep cavern caves into the void and pipes upward toward the surface. As the overlying material or "plug" erodes into the cavern, the void migrates upward until the cover can no longer be supported and then subsidence begins.

Cover-Collapse Sinkholes occur in the soil or other loose material overlying soluble bedrock. Sinkholes that suddenly appear form in two ways. In the first way, the bedrock roof of a cave becomes too thin to support the weight of the bedrock and the soil material above it. The cave roof then collapses, forming a bedrock-collapse sinkhole. Bedrock collapse is rare and the least likely way a sinkhole can form, although it is commonly incorrectly assumed to be the way all sinkholes form. The second way sinkholes can form is much more common and much less dramatic. The sinkhole begins to form when a fracture in the limestone bedrock is enlarged by water dissolving the limestone. As the bedrock is dissolved and carried away underground, the soil gently slumps or erodes into the developing sinkhole. Once the underlying conduits become large enough, insoluble soil and rock particles are carried away too. Cover-collapse sinkholes can vary in size from 1 or 2 feet deep and wide, to tens of feet deep and wide. The thickness and cohesiveness of the soil cover determine the size of a cover-collapse sinkhole. Given the above described cover collapse categories, it's important to consider that these sinkholes will often occur in areas not recognized as depressions or solution sinks.

Sinkhole Flooding

Sinkhole flooding is a natural occurring event that usually follows the same storms that cause riverine flooding, so it is often not recognized as Karst-related. Flood events will differ not only because of the amount of precipitation, but also because the drainage capacity of individual sinkholes can change, sometimes very suddenly, as the Karst landscape evolves. Sinkholes can also flood when their outlets are clogged, preventing water from being carried away as fast as it flows in. Trash thrown into a sinkhole can clog its throat, as can soil eroded from fields and construction sites or a natural rock fall near the sinkhole's opening. Sometimes the conduit itself is too narrow because it has recently (in the geologic sense) captured a larger drainage basin. The reach of a conduit downstream from constriction could carry a higher flow than it is receiving were it not for this restriction

Sinkhole plain before a rain. Sinkhole plain after a rain.

Sinkholes flood more easily around development (roofs, parking lots, highways) which increases both the total runoff and the rapidity of runoff from a storm. Another reason that sinkholes flood is because of back-flooding, the outcome when the discharge capacity of the entire Karst conduit network is exceeded. Some up-gradient sinkholes that drain normally during the short, modest accumulation of storms may become springs that discharge water during prolonged rainfall. Sinkhole flooding is one of the more tragic hazards because it affects private residences the most.

Land Surface Indicators of Sinkhole Collapse

- Circular and linear cracks in soil, asphalt, and concrete paving and floors
- Depressions in soil or pavement that commonly result in ponds of water

- Slumping, sagging, or tilting of trees, roads, rails, fences, pipes, poles, sign boards, and other vertical or horizontal structures
- Downward movement of small-diameter vertical or horizontal structures
- Fractures in foundations and walls, often accompanied by jammed doors and windows
- Small conical holes that appear in the ground over a relatively short period of time
- Sudden muddying of water in a well that has been producing clear water
- Sudden draining of a pond or creek

Strategies to Avoid Sinkhole Collapse

- Karst areas should be mapped thoroughly to help identify buried sinkholes and fracture trends. Geophysical methods, aerial photography, and digitally enhanced multi-spectral scanning can identify hidden soil drainage patterns, stressed vegetation, and moisture anomalies in soils over sinkholes.
- Sinkhole collapses are commonly repaired by dumping any available material into the hole. This technique usually diverts water to other locations and lessons the likelihood of collapse. Mitigate by excavating collapses in the bedrock drain, then refilling the dug hole with material graded upward from coarse rocks to finer sediments to allow natural flow through the bedrock drain without the loss of sediments that cause collapse. If a storm-water drainage well is needed, its casing should extend into and be tightly sealed along the bedrock.
- In large sinkholes, use bridges, pilings, pads of rock, concrete, special textiles, paved ditches, curbs, grouting, flumes, overflow channels, or a combination of methods to provide support for roads and other structures. Large buildings should not be built above domes in caves.

4.12.2 Profile: Karst & Sinkhole

SUMMARY OF KARST/SINKHOLE RISK FACTORS	
Period of occurrence:	At any time. More common in May and June
Number of events (1991-2015) *:	42 Identified Cover-Collapse Sinkholes; 936 mapped sinkholes (KGS)
Annualized Probability:	1.68
Warning time:	Days to none at all
Potential impact:	May cause minimal to severe property damage. Will cause loss of ground support resulting in infrastructural damages.
Potential of injury or death:	Injury and slight chance of death
Potential duration of facility shutdown:	Days to months
Past Damages:	Statewide Estimate: $500,000 to $2,000,000 annually according to Kentucky Geological Survey Local Estimate: At least $15,000 annually
Extent (Date, Damages, Scale/Size):	Size: Largest reported sinkhole is 59.9 acres (KGS) Additionally, in what was described by multiple local news sites as an atypically massive sinkhole, a 30-foot deep sinkhole opened up on property in the Stonewall neighborhood.

*Kentucky Geologic Cover-Collapse Database

Historical Impact

In Kentucky, about 38% of the state has sinkholes that are recognizable on topographic maps, and 25% has obvious and well-developed Karst features. Much of the state's beautiful scenery is a direct result of the development of a Karst landscape. According to the KGS, karst hazards in Kentucky produce $500,000 to $2,000,000 of economic loss annually and may have devastating effect on individuals. Karst hazards in Lexington Fayette County include: sinkhole flooding, sudden cover collapse, and leakage around dams. The most noticeable Lexington Fayette County issues are sinkhole flooding and cover collapse Karst topography that can cause major drainage problems. Sinkholes receive all the runoff during rainfall events. The topography of their catchment can direct creeks and ditches into sinkholes. The conduits draining the sinkhole have a restricted hydraulic capacity in comparison to a surface flowing stream. When the runoff entering the sinkhole exceeds the conduit capacity water is stored in the sinkholes and can flood homes and other structures. It is difficult to provide conveyance systems for the release of excess water due to the topography. Therefore, the problems arising from sinkholes are complex, expensive and difficult to resolve.

An average of 1.68 cases cover collapse per year in Fayette county are reported to KGS. KGS has a cover collapse database of reported sinkholes dating from 1991-2015. Property damage is typically minor and found in roadways, sidewalks, yards, detention basins, and foundations. It is currently inefficiently tracked but typical damage costs for individual cases have been recorded as high as 10's of thousands of dollars.

More recent examples of areas that are susceptible to sinkhole activity in Lexington Fayette County can be seen south of Leestown Road near Masterson Station Park, Boiling Springs Drive, the Beaumont area, including the event described below.

July 10, 2010: A portion of Todds Station Road in Lexington closed temporarily to allow a crew to repair a sinkhole that formed in the road.

April 20, 2015: According to the Lexington Herald Leader, a thoroughbred colt was rescued after a sinkhole collapsed on a Fayette County Farm

June 10, 2019: According to multiple news sites, the Stonewall neighborhood in Lexington that aligns Harrodsburg Road from New Circle Road to Man O'War saw a property suddenly develop a "massive" sinkhole that sank 30 feet deep. Further, this sinkhole had to be investigated as a potential predictor of future sinkholes as there are caves running underneath the Stonewall community.

General Characteristics of the Soils

Lexington Fayette County is predominately underlain by Lexington Limestone Formation. Karst formation, or the rapid underground movement of water through eroded bedding planes and caves, also plays an important part in the thickness of the soil and has planning ramifications as well. Soils in the Inner Bluegrass Physiographic Region of Lexington Fayette County generally range from deep and well drained to thin soil cover. The soils are high in natural fertility, have clay subsoil, and are formed in place from the weathered limestone lying underneath

4.12.3 Assessing Vulnerability: Karst & Sinkhole

Karst/Sinkhole Vulnerability Score = Exposure Score + Risk Score

Risk Score = Geographic Extent + Occurrence Score

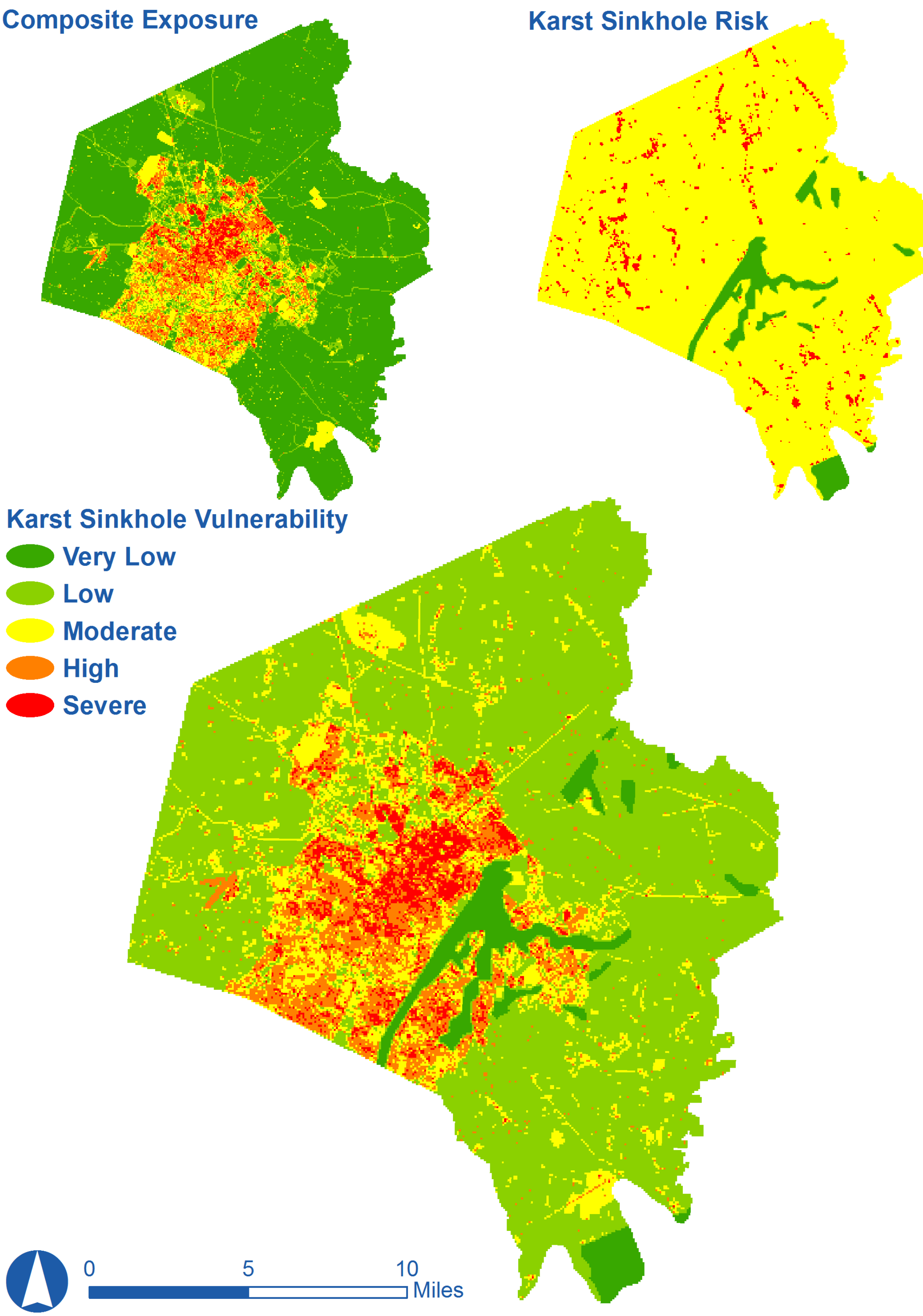
Geographic Extent Score = Karst risk of each grid cell based on KGS karst maps and KGS sinkhole data, which maps out the highly prone Karst areas and where sinkholes occur. Karst areas are mapped for Fayette County with karst risk levels ranging from none to moderate. Karst risk values were assigned to each grid cell and then 0-1 score was calculated.

Occurrence Score = number of sinkholes in each grid cell. The sinkholes were totaled in each grid cell and then a 0-1 score was calculated for each cell

The occurrence score was added to geographic extent score and total was then scored 0-1.

The Karst/Sinkhole Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Karst/Sinkhole Vulnerability Score (Figure 4.11).

Figure 4.11: Karst/Sinkhole Vulnerability



4.13 Severe Storm

4.13.1 Identify: Severe Storm

Storms are created when a center of low pressure develops with the system of high pressure surrounding it. This combination of opposing forces can create winds and result in the formation of storm clouds such as cumulonimbus. Small localized areas of low pressure can form from hot air rising off hot ground, resulting in smaller disturbances such as dust devils and whirlwinds. All thunderstorms contain lightning and may occur singly, in clusters or in lines. Thus, it is possible for several thunderstorms to affect one location in the course of a few hours. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended period time.

Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt." This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning reaches a temperature approaching 50,000 degrees Fahrenheit in a split second. The rapid heating and cooling of air near the lightning causes thunder.

While thunderstorms and lightning can be found throughout the United States, they are most likely to occur in the central and southern states.

Types of Thunderstorms

- *Single Cell (pulse storms).* Typically, last 20-30 minutes. Pulse storms can produce severe weather elements such as downbursts, hail, some heavy rainfall and occasionally weak tornadoes. This storm is light to moderately dangerous to the public and moderately to highly dangerous to aviation.
- *Multicell Cluster*. These storms consist of a cluster of storms in varying stages of development. Multicell storms can produce moderate size hail, flash floods and weak tornadoes. This storm is moderately dangerous to the public and moderately to highly dangerous to aviation.
- *Multicell Line*. Multicell line storms consist of a line of storms with a continuous, well developed gust front at the leading edge of the line. Also known as squall lines, these storms can produce small to moderate size hail, occasional flash floods and weak tornadoes. This storm is moderately dangerous to the public and moderately to highly dangerous to aviation.
- *Supercell*. Even though it is the rarest of storm types, the supercell is the most dangerous because of the extreme weather generated. Defined as a thunderstorm with a rotating updraft, these storms can produce strong downbursts, large hail, occasional flash floods and weak to violent tornadoes. This storm is extremely dangerous to the public and aviation.

Types of Lightning

Flashes that do not strike the surface are called cloud flashes. They may be inside a cloud, travel from one part of a cloud to another, or from cloud to air. Overall, there are four different types of lightning:

1) Cloud to sky (sprites)
2) Cloud to ground

3) Intra-cloud
4) Inter-cloud

Lightning flashes can have more than one ground point. Roughly, there are five to ten times as many cloud flashes than cloud to ground flashes.

Thunderstorm Facts

- The NWS estimates more than 14.6 million thunderstorms worldwide each year.
- Approximately 28 thunderstorms occur worldwide in a given minute.
- In the last 25 years, severe storms have been involved in over 2,480 federal disasters (all types).

Lightning Strike Victims, Denoted Effects			
Frequency 25% or greater			
Memory Deficits & Loss	52% **	Depression	32% *
Attention Deficits	41% **	Inability to Sit Long	32%
Sleep Disturbance	44% *	External Burns	32%
Numbness/ Parathesias	36% **	Severe Headaches	32% **
Dizziness	38% *	Fear of Crowds	29% *
Easily Fatigued	37% *	Storm Phobia	29% *
Stiffness in Joints	35%	Inability to Cope	29% *
Irritability/ Temper Loss	34% *	General Weakness	29% **
Photophobia	34%	Unable to Work	29% **
Loss of Strength/Weakness	34% **	Reduced Libido	26% *
Muscle Spasms	34%	Confusion	25% **
Chronic Fatigue	32% *	Coordination Problems	28% **
Hearing Loss	25%		
* Denotes Psychological ** Denotes Psychological or Organic No Asterisk Denotes Organic			

Dangers Associated with Thunderstorms

- Lightning
- Flash floods
- Hail
- Outflow
- Tornadoes
- Winds
- Downbursts or strong down drafts which can cause an outburst of potentially damaging winds at or near the ground
- Micro or macro-bursts

Lightning Facts

- Lightning deaths in the U.S. have declined drastically since the early 20th Century, with about 25 deaths per year since 2015 compared to 400 deaths per year from 1920 to 1940. Lightning still accounts for approximately 150 injuries per year in the U.S.
- Lightning is a component of all thunderstorms.
- In the continental U.S. there are more than 20 million cloud to ground lightning flashes each year.
- The longest bolt, seen to date, was 118 miles long in the Dallas-Ft. Worth, TX area.
- The peak temperature of lightning is around 60,000-degree Fahrenheit, or about 5 times hotter than the surface of the Sun.
- Lightning most commonly occurs in thunderstorms, but it can also occur in snowstorms, sandstorms, during “dry lightning” events, and in the ejected material over volcanoes.
- Cloud to ground lightning can injure or kill people and destroy objects by direct or indirect means. Objects can either absorb or transmit energy. The absorbed energy can cause the object to explode, burn, or totally destruct. The various forms of transfer are:

- o Tall object transferred to person
- o Tall object to ground to person.
- o Object (telephone line, plumbing pipes) to a person in contact with the appliance

Effects of Lightning

- ❖ Fires may occur in structures such as storage and processing units, aircraft and electrical infrastructure and components.
- ❖ Forest fires may be initiated by lightning. Half the wildfires in the western U.S. are caused by lightning. Dry lightning (lightning occurring without rainfall) is more likely to cause forest fires.
- ❖ Injury and death to people
- ❖ 85% of lightning victims are children and young men ages 10 to 35.
- ❖ 25% of victims die and 70% of survivors suffer long term effects.

4.13.2 Profile: Severe Storm

SUMMARY OF SEVERE STORM RISK FACTORS	
Period of occurrence:	Spring, Summer, and Fall
Number of events: (1955-2017)	268
Annualized Probability:	4.32
Warning time:	Minutes to hours
Potential impact:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Impacts human life, health, and public safety.
Potential of injury or death:	Injury and risk of multiple deaths. Historic: 2 deaths, 11 injuries
Potential duration of facility shutdown:	Days to weeks
Past Damages (2017 dollars):	Total: $65,332,000 Property: $65,322,000 Crop: $10,000
Extent (Date, Damages, Scale/Size):	5/18/1993: $50,000,000, Size: Six miles of straight-line wind damage

Historical Impact

Lexington Fayette County is susceptible to severe storms that can be a combination of intense rain, high winds, and lightening. Some of these severe storms have the potential to cause damage to property and crops and can even result in injury or death.

Kentucky is at risk to tropical depressions and tropical storms, as hurricanes usually are downgraded to these types of events by the time, they reach the region. The result of these storms comes in the form of damaging high winds and high-volume precipitation that usually causes flooding which is captured under the severe storm category.

Lexington Fayette County has been declared in several severe storm Presidential Declarations.

The following State and local data provide more detailed information on several recent severe storms that resulted in damage, injury, or death.

- **November 18, 2017**: Impressively strong atmospheric conditions led to very strong gradient winds ahead of the cold front. Later in the day a line of strong to severe storms pushed into central Kentucky There were several reports of damaging winds along with 3 brief tornadoes which led to a few minor injuries.
- **June 18, 2017**: An unstable humid air mass colliding with a cold front sparked a round of strong to severe thunderstorms which brought locally damaging winds to parts of the Bluegrass region. In addition, the very moist air mass resulted in heavy rain and localized flash flooding.
- **March 1, 2017**: Multiple rounds of severe weather impacted central Kentucky during the early morning hours. In the end, there were 4 tornadoes across central Kentucky. In addition to the tornadoes, there were several areas of intense straight-line winds estimated up to 100 mph in places. The impacts included numerous areas of structural damage and downed trees. The widespread rain also brought several rivers into minor flood. Estimated damages were over $5.2 million from this event.
- **December 18, 2016**: A horse barn at the Mercury Equine Center in Lexington caught fire due to a lightning strike shortly after midnight Sunday December 19. The fire resulted in the loss of 23 thoroughbred horses and a total loss for the barn. An initial estimate put the loss of the facility and racing horses at over $2 million dollars.
- **April 2, 2016**: Maximum gusts from this event ranged from 50 to 60 mph and resulted in downed trees and power lines along with some structural damage to property.
- **July 13, 2015**: Strong to severe thunderstorms developed and then organized into bowing segments across the area, spawning three weak tornadoes in addition to widespread areas of downburst wind damage. Thousands of trees were downed, causing scattered power outages and some structural damage. In addition, due to the very wet antecedent conditions, flash flooding occurred in several locations, resulting in closed and impassable roads, water rescues and significant property damage.
- **July 10, 2015**: Damaging winds brought down trees and power lines resulting in some structural damage across the area. A couple of short-lived tornadoes were also found to have occurred near Fort Knox and Belmont, Kentucky.
- **July 27, 2014**: A bow echo moved southeast of the Ohio River during the evening of the 26th, bringing widespread damaging winds and isolated large hail. During the early morning hours of the 27th, additional clusters of strong storms moved across central Kentucky. By late morning, a supercell developed northwest of Lexington, bringing very large hail and a damaging microburst in Lexington.
- **October 31, 2013**: Widespread minor wind damage developed as large branches fall across roads and power lines. In addition to strong gradient winds, several convective lines of showers developed by mid-evening across central Kentucky. Despite a lack of thunder, these lines of showers brought additional wind damage.
- **October 26, 2010**: A solid line of severe and briefly tornadic thunderstorms raced through southern Indiana and central Kentucky during the late morning and early afternoon hours with winds around 75 mph.
- **May 1, 2010**: Storms produced record or near-record 2-day rainfall totals from 8 to 10+ inches in many locations across central Kentucky. Major flooding occurred in at least 40 Kentucky counties, washing out roads and inundating municipal water treatment plants. Four lives were lost in Kentucky - three in vehicles and one in a home, where the resident was apparently electrocuted in high water. Over the following days, most area rivers were in flood

- **September 2008**: The worst power outage in Kentucky history, a result of high winds left over from Hurricane Ike, knocked out power to 600,000.
- **July 18, 2007**: An upper level disturbance set off some severe thunderstorms over the Bluegrass region of Kentucky. Most of the wind damage was in the form of downed trees and power lines. Large hail also fell over some areas. Heavy rains from the thunderstorms also caused some flash flooding.
- **May 31, 2006**: A cluster of thunderstorms produced widespread tree damage, minor structural damage, heavy rains, and some large hail in the Lexington area.
- **May 25, 2006**: A lightning-related death occurred.
- **May 27, 2004**: Numerous trees and power lines were downed. Two truck loading stations were damaged on Jaggie Fox Way near Georgetown Road. Several horse barns were damaged or destroyed north of Interstate 64 between Newtown Pike and Russell Cave Road, but no animals were injured.
- **August 9, 2000**: Trees were downed across the city of Lexington and power lines were downed in the Chevy Chase area. A man was killed when a tree was blown onto the vehicle he was driving.
- **June 29, 1998**: Bluegrass Airport and several other locations across Lexington Fayette County reported trees down. Numerous streets were water covered as well. Several major roads including Richmond Road and New Circle Road were inundated with up to 2 feet of water.
- **October 30, 1996**: High winds knocked down several trees and power lines in southeastern Lexington Fayette County.
- **May 27, 1996**: Several trees were downed in Lexington and one person was injured when struck by lightning.
- **July 25, 1994**: Numerous trees fell onto power lines. This caused for scattered power outages throughout the city. Property damage in the area was estimated at $50,000.
- **June 21, 1994**: High winds at Bluegrass Airport blew a C-47 vintage transport into a B-24 Liberator and four to five cars. Several trees and power lines were also blown down. Estimated damage was $500,000.
- **May 18, 1993**: Thunderstorm winds did extensive damage at Hughes Aircraft, estimated by the builder to be around 5 million dollars. Condo and tree damage were reported around Griffin Gate in Lexington. Around six miles of straight-line wind damage occurred over northern Fayette County where part of a roof was blown off a school.
- **February 21, 1993**: A severe thunderstorm and strong winds knocked over trees, blew roofs off buildings, and left thousands of people without electricity. One person was injured by flying glass in Lexington. At least 30 roads were blocked by falling trees. Property damage alone was estimated to be $5,000,000.

4.13.3 Assessing Vulnerability: Severe Storm

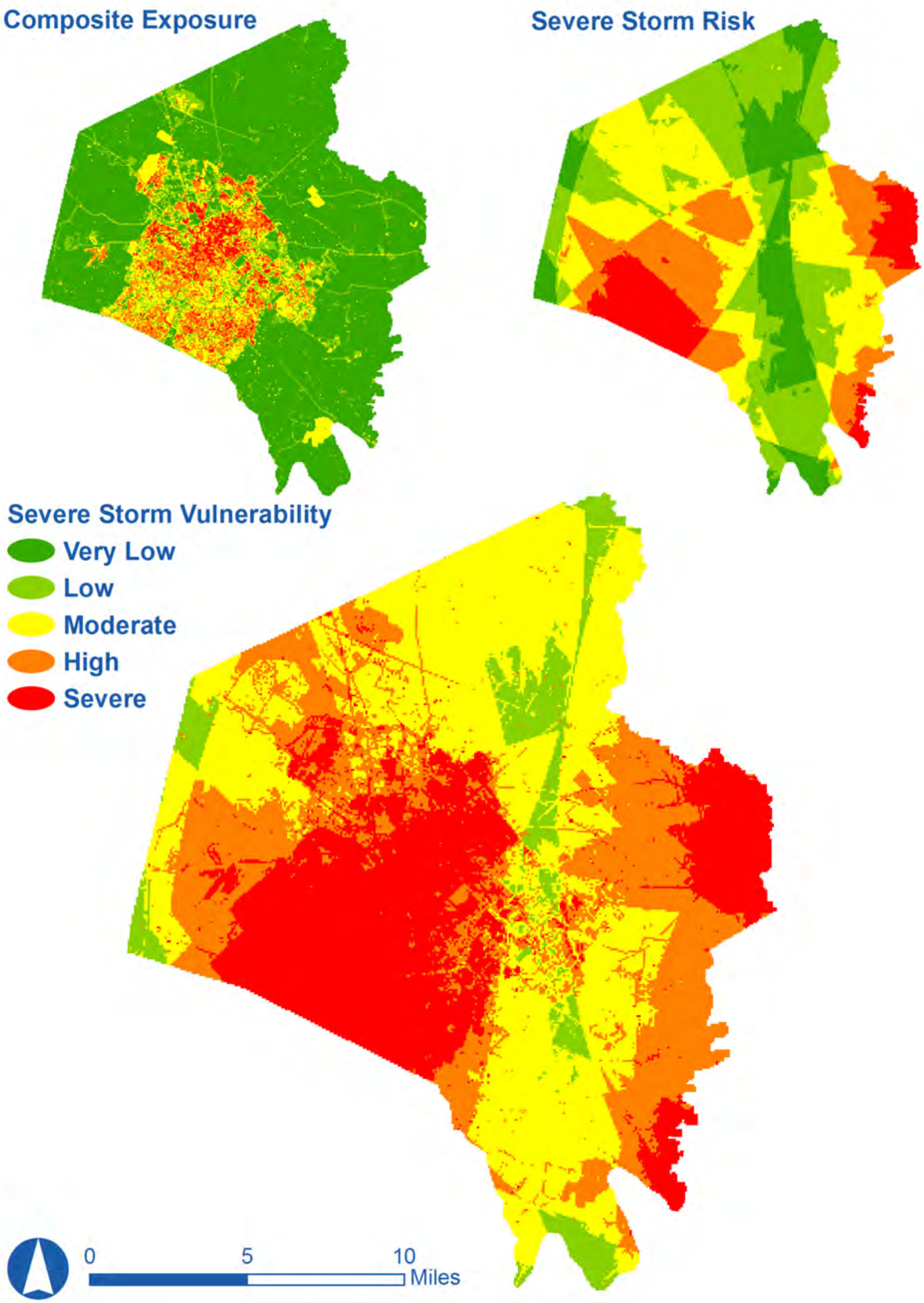
Severe Storm Vulnerability Score = Exposure Score + Risk Score

Risk Score = Occurrence Score

Occurrence Score = Occurrences were calculated for each grid cell by identifying and counting all Severe Storm events within 25 miles of each cell. Severe Storm events included were all recorded thunderstorm and wind events from 1950 – 2017 (National Centers for Environmental Information 'NCEI' Storm Events Database).

The Severe Storm Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Severe Storm Vulnerability Score (Figure 4.12).

Figure 4.12: LFUCG Severe Storm Vulnerability



4.14 Severe Winter Storm

4.14.1 Identify: Severe Winter Storm

A winter storm can range from moderate snow over a few hours to blizzard conditions with blinding wind-driven snow, sleet and/or ice that lasts several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by low temperatures and blowing snow, which can severely reduce visibility. A severe winter storm is defined as an event that drops four or more inches of snow during a 12-hour period or 6 or more inches during a 24-hour span. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can impact a community or region for days, weeks, or months.

Types

- *Blizzards* are by far the most dangerous of all winter storms. They are characterized by temperatures below twenty degrees Fahrenheit and winds of at least 35 miles per hour. In addition to the temperatures and winds, a blizzard must have a sufficient amount of falling or blowing snow. The snow must reduce visibility to one-quarter mile or less for at least three hours. With high winds and heavy snow, these storms can punish residents throughout much of the U.S. during the winter months each year. In Mid-March of 1993, a major blizzard struck the Eastern U.S., including parts of Kentucky.
- *Ice storms* occur when freezing rain falls from clouds and freezes immediately on impact. Ice storms occur when cold air at the surface is overridden by warm, moist air at higher altitudes. As the warm air advances and is lifted over the cold air, precipitation begins falling as rain at high altitudes then becomes super cooled as it passes through the cold air mass below, and, in turn, freezes upon contact with chilled surfaces at temperatures of 32º F or below. In extreme cases, ice may accumulate several inches thick, though just a thin coating is often enough to do severe damage.

Winter Storm Facts

- Winter storms have been known to occur in the time period between the end of October and the end of March.
- Every state in the continental U.S. and Alaska has been impacted by severe winter storms.
- The super-storm of March 1993 caused over $2 billion in property damage in twenty states and Washington D.C. At least 79 deaths and 600 injuries were attributed to the storm.

Possible Effects

Storm effects such as power outages, extreme cold, flooding, and snow accumulation can cause hazardous conditions and hidden problems, including the following:

- *Power outages* can result when snow and ice accumulation on trees cause branches and trunks to break and fall onto vulnerable power lines. Blackouts vary in size from one street to an entire city.
- *Extreme cold temperatures* may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold resulting in frostbite.

- *Flooding* may occur after precipitation has accumulated and then temperatures rise once again which melts snow and ice. In turn, as more snow and ice accumulate the threat of flooding increases.
- *Snow and ice accumulation on roadways* can cause severe transportation problems in the form of extremely hazardous roadway conditions with vehicles losing control, collisions, and road closures.

4.14.2 Profile: Severe Winter Storm

SUMMARY OF SEVERE WINTER STORM RISK FACTORS	
Period of occurrence:	Winter
Number of events: (1996-2017)	13
Annualized Probability:	0.54
Warning time:	Days for Snow, Minutes to hours for ice
Potential impact:	Power outages, which results in loss of electrical power and potentially loss of heat, and human life. Extreme cold temperatures may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold resulting in frostbite.
Cause of injury or death:	Injury and slight risk of death. Significant threat to the elderly. One injury reported.
Potential duration of facility shutdown:	Days
Past Damages (2017 dollars):	Total: $18,100,000 Property: $18,100,000 Crop: $0
Extent (Date, Damages, Scale/Size):	02/15/2003, $27,226,615, Size: 1.25 inches of ice and 30 inches of snow; also see “Great Ice Storm of 1951”

Historical Impact

Lexington Fayette County experiences regular winter weather, which often includes extreme cold and winter precipitation and heavy snowfall. The County’s regional proximity to the Gulf of Mexico provides a necessary moisture source, yet it is far enough north to be influenced by polar air masses. Low-pressure systems that bring heavy snow to Lexington Fayette County usually track eastward across the southern U.S. before turning toward the northeast. Frequently, these systems move up the east coast and have little effect on Lexington Fayette County. Sometimes, however, storms turn and move along the western margin of the Appalachian Mountains. With cold air in place over Kentucky and the region, these storms bring moisture from the Gulf of Mexico and can dump heavy snow as they move through Lexington Fayette County.

Lexington Fayette County has been declared in three severe winter storm Presidential Declarations as follows.

Lexington Fayette County Presidential and Declaration for Severe Winter Storms
February 5, 2009, DR1818, severe winter storms and flooding
March 14, 2003, DR1454, Ice, Snow, Flooding, and Tornadoes
March 16, 1994, DR1018, Freezing rain, Sleet, Snow

Several sources were consulted for winter storm event records and descriptions. Details regarding significant winter storm events (damaging or resulting in casualties) reported to the NCEI Storm Events Database include:

- **March 2, 2014**: The Lexington media reported 4 to 5 inches of snow and sleet. Light freezing rain preceded this with around one tenth of an inch of ice.
- **February 4, 2014**: The ASOS ice sensor at the Lexington Airport measured 0.37 of an inch of ice. Sporadic tree damage and power outages were reported in Lexington.
- **January 27, 2009**: A 36-hour barrage of ice, snow and freezing rain snapped power lines across Kentucky, leaving at least 525,000 electric customers out of power. In Lexington, patches of the city were without power all day, leaving at least 36,500 homes and businesses without light and heat. Icing - accumulating between one quarter and one-half inch - lead to widespread tree damage and power outages by the morning of the 28th. Colder air arrived after dawn on the 28th. Freezing rain changed back to snow with additional accumulations of 1 to 3 inches along and north of Interstate 64. This winter storm brought the most widespread damage due to icing in recent memory across Kentucky.
- **December 23, 2008**: Light freezing rain brought a rash of accidents on highways around the Lexington area. Broadcast media reported at least 50 accidents from early afternoon into the evening. In Lexington, at least 50 accidents had been reported to Lexington police since 1 p.m. "It is solid ice," said Lexington Police Assistant Chief Steve Stanley. "You cannot walk. Ice skates would be appropriate, but you cannot walk." Interstates 71, 75 and the Interstate 275 loop were reported as virtually impassable. An out-of-state driver was killed on Interstate 75 in Lexington when his vehicle was struck by another.
- **December 22, 2004**: A winter storm began with freezing rain, and then changed over to sleet and snow over parts of south central and east central Kentucky. Ice accumulations up to one half inch were reported, with up to an inch of snow or sleet on top. Some structural failures were reported, mainly in outbuildings and awnings covering service stations. A few flights were cancelled out of Bluegrass Field in Lexington. Many residents were without power for an extended time period, mainly in Franklin, Harrison, and Scott Counties. Trees and limbs brought down by the weight of the ice blocked many area streets and roads.
- **February 15, 2003**: Freezing rain and low temperatures fell upon Lexington/Fayette County. The hardest hit area was in and around Lexington, where up to 1.25 inches of ice accumulation was observed on trees and power lines. Many of these trees and power lines were downed triggering power outages, blocking roads (some of which were forced to be closed) and causing severe damage to homes and automobiles. In Fayette County I-75 and I-64 were briefly closed during this period as a result of the ice. There was also flooding reported specifically in the basements of many homes. After the storm, it is estimated that nearly 65,000 homes were without power for up to five days or more. Most of the property damage was reported in the Lexington area.
- Other examples of Lexington Fayette County winter storm events from State and local sources include:8
- **February 3-6, 1998**: A major snowstorm affected the Lexington Fayette County region. Most of the heavy snow was confined to an area around Lexington where anywhere from 12 to 30 inches of snow had accumulated over the entire period. In Fayette County, I-75 and I-64 were closed for during this period as a result of the snow. Because of the extremely wet nature of the snow, damage from this storm was extensive. Power outages were widespread as falling trees brought down power lines and poles. No presidential disaster was declared and the reported response and recovery costs of the storm for the Lexington Fayette County totaled approximately $300,000.

8 *These examples are not factored into the “Number of Events” and “Annual Probability” calculations provided in the Winter Storm Summary, as reporting prior to 1996 was sporadic, and using a reporting period of 1950-2017 would likely under-estimate the number and probability of flood events.

- **January 8, 1996**: The notorious "Blizzard of 96'" brought a significant amount of snowfall to the Lexington/Fayette County region. It was reported that 7 to 15 inches of snow (with drifts up to three feet) accumulated as a result of the storm. Road conditions remained hazardous in some locations for many days and a presidential disaster was declared. Snow removal costs totaled $306,342.
- **March 3, 1993**: One of the strongest winter storms ever (it is sometimes referred to as "the storm of the century") dumped 6 to 18 inches of snow over Lexington/Fayette County. For two days Interstate 75 was closed from Lexington to the Tennessee border and Interstate 64 was closed from Lexington to the West Virginia border. A presidential disaster was declared.
- **January 31, 1951**: The "Great Ice Storm of 1951," known as the worst winter storm on record for Lexington/Fayette County, disabled the region. When the storm was over it had deposited nearly two inches of ice covered by nine inches of snow over a path from Nashville, TN to Lexington. To make matters worse, record cold temperatures followed the storm (-20°F on February 2 and -18°F on Feb 3). Power and phone lines sustained great damage and many homes in both the city and county were without power. Travel was nearly impossible. Planes, buses, and trains were severely delayed as a result of adverse conditions. People were forced to walk to work in the brutal conditions, and some were injured in falls. It was considered the costliest winter storm ever at that time.

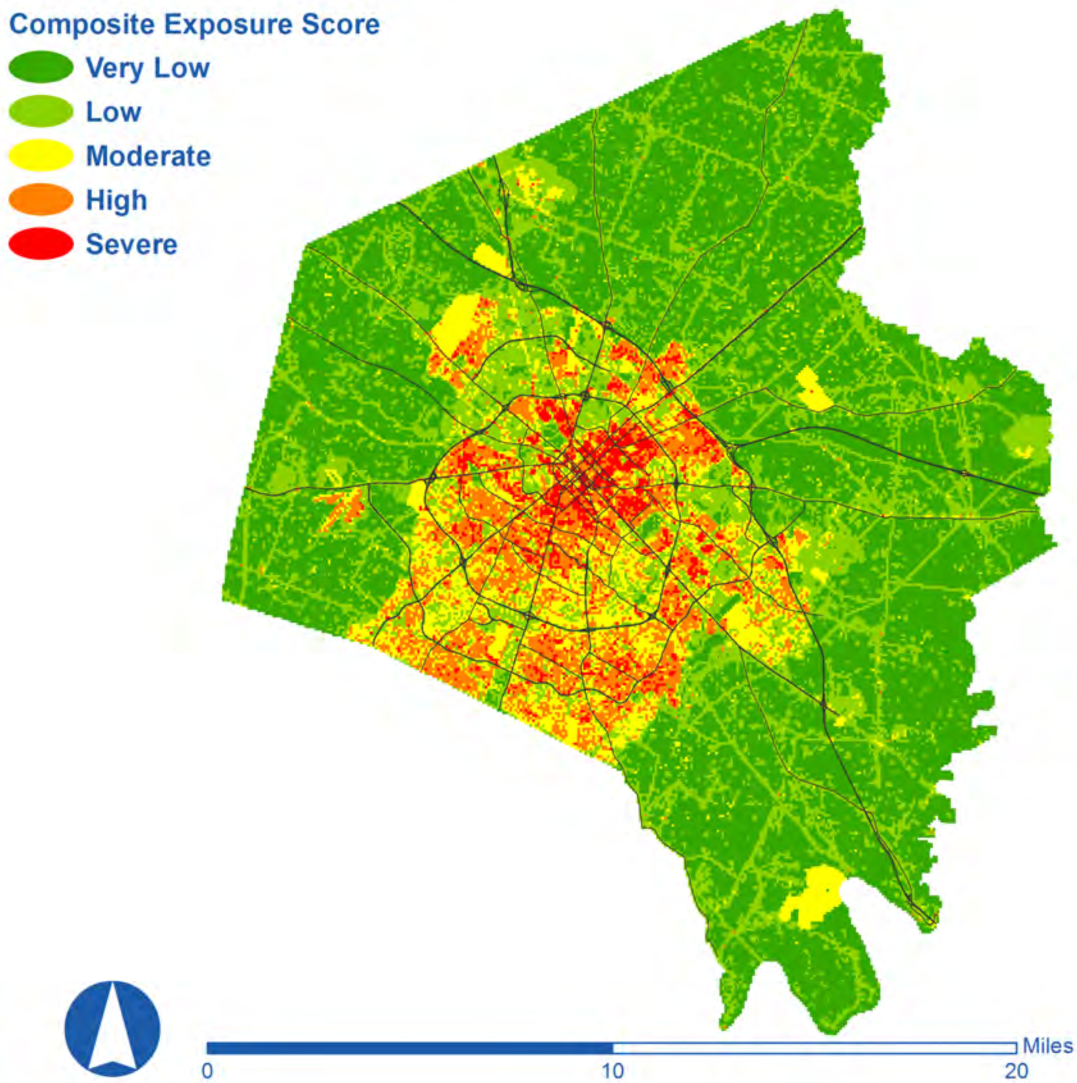
4.14.3 Assessing Vulnerability: Severe Winter Storm

Severe Winter Storm Vulnerability Score = Exposure Score + Risk Score

The Severe Winter Storm Vulnerability Score is currently difficult to calculate based on our current methodology of using Exposure + Risk to calculate Vulnerability. Currently LFUCG has no real spatial data that can be used to calculate the Risk Score variable in order to determine vulnerable areas to severe winter storms. Severe winter storms is the type of hazard that typically affects a county the size of Fayette County from a geographic standpoint equally. It was also determined that the severe winter storm hazard has the potential to affect all our Exposure variables (Population, Socially Vulnerable, Property, Critical Facilities, Infrastructure, Government Facilities). Therefore, at this point it was determined to use the following Exposure Score Map to display higher potentials of hazard vulnerability for the Drought hazard, until better data can be developed.

The Exposure Score provides a visual display of areas that could be harder hit by winter storms based on the exposure that is within each grid cell (Figure 4.13).

Figure 4.13: Sever Winter Storm Vulnerability



4.15 Tornado

4.15.1 Identify: Tornado

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity (up to 250 mph) and wind-blown debris with paths that can be in excess of one mile wide and fifty miles long. They have been known to blow off roofs of houses, move cars and tractor trailers, and demolish homes. Peak months of tornado activity for Kentucky and south-central Indiana are usually April, May and June. However, tornadoes have occurred in every month and at all times of the year. They tend to occur in the afternoons and evenings; over 80 percent of all tornadoes strike between noon and midnight.

Types

The magnitude of a tornado is categorized by its damage pattern (i.e. path) and its wind velocity, according to the Fujita-Pearson Tornado Measurement Scale. This scale is the only widely used rating method. Its aim is to validate classification by relating the degree of damage to the intensity of the wind.

The Fujita-Pearson Tornado Measurement Scale		
Fujita Scale	**Estimated Wind Speed (mph)**	**Typical Damage**
F0	< 73	Light Damage - Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
F1	73 - 112	Moderate Damage - Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113 - 157	Considerable Damage - Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
F3	158 - 206	Severe Damage - Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207 - 260	Devastating Damage - Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
F5	261 - 318	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.

Facts

- In the U.S., about 1,200 tornadoes are generated by severe thunderstorms each year.
- Earthquake-induced fires and wildfires may also produce tornadoes.
- A tornado can move as fast as 125 mph with internal winds speeds exceeding 300 mph.
- Powerful tornadoes have lifted and moved objects weighing more than 300 tons a distance of thirty feet and have tossed homes greater than 300 feet away from their foundations.
- During an outbreak from May 4-10 of 2003, 334 tornadoes were recorded.
- In the entire month of May 2003, 559 tornadoes were reported.
- On April 3, 1974, 148 tornadoes in 13 states killed 315 people.
- The path of a tornado can be many miles long, but tornadoes rarely last longer than 30 minutes.

Tornadoes may cause crop and property damage, power outages, environmental degradation, injury and death.

4.15.2 Profile: Tornado

SUMMARY OF TORNADO RISK FACTORS	
Period of occurrence:	Spring, Summer, and Fall
Number of events: (1955-2017)	8
Annualized Probability:	0.13
Warning time:	Minutes to hours
Potential impact:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Impacts human life, health, and public safety.
Cause of injury or death:	Injury and risk of multiple deaths
Potential duration of facility shutdown:	Days to weeks
Past Damages (2017 dollars):	Total: $33,075,000 Property: $33,075,000 Crop: $0
Extent (Date, Damages, Scale/Size):	Strongest: 5/27/2004, $7,500,000, F3 Greatest Damages: 03/10/1986, $25,000,000, F2

Historical Impact

Lexington Fayette County is located in the most severe wind zone (ZONE IV 250 mph) (See Map) in the Country. This signifies that the entire metropolitan area is highly vulnerable to tornadic weather. From 1955 to 2017, 11 tornadoes have touched down causing nearly $78.5 million in damages and 27 injuries in Lexington Fayette County. Of these 11 tornadoes two were categorized as F0, four as F1 class, four as F2 class, and one as F3 class.

The following State and local data provide more detailed information on several recent tornadoes through 2017 that resulted in damage, injury, or death.

- May 27, 2004: An F2/F3 tornado developed around McConnell Trace and hit McConnell Trace, Masterson Station, Buck Lane, Beaumont Farms and Citation Road. A great deal of damage was reported to area trees, horse farm fences, and rock walls as well as scattered livestock losses and crop washout. Six people were injured, 50 houses were destroyed while 64 homes sustained major damage and 94 received minor damage, while 15,000 people were without power.
- May 28, 1996: A 5 mile, F0 tornado with a width of 575yds blew through southwestern Fayette County. The tornado, of F0 intensity, swept through the Clays Mill area and near the Copper Field sub-division where some trees were blown down little structural damage was reported.
- May 18, 1995: An F1/F2 tornado struck Tates Creek Trailer Park on the Fayette County line. Several single and double-wide trailers were destroyed, and several trees were snapped near Coletown. The 30 injuries reported with this event likely occurred outside of Fayette County.
- March 10, 1986: An F2 tornado with a length of four miles and a width of 100 yards passed through Fayette County causing widespread damage and injuring 20 people.
- March 20, 1982: An F2 tornado hit northern Lexington. Houses were unroofed, and barns were flattened. The L&N Roundhouse was also flattened, and the roof was torn off the Tarr Distillery at 899 Manchester Street. One person was severely injured.
- April 3, 1974: An F2 tornado destroyed buildings in the southeastern part of Fayette County

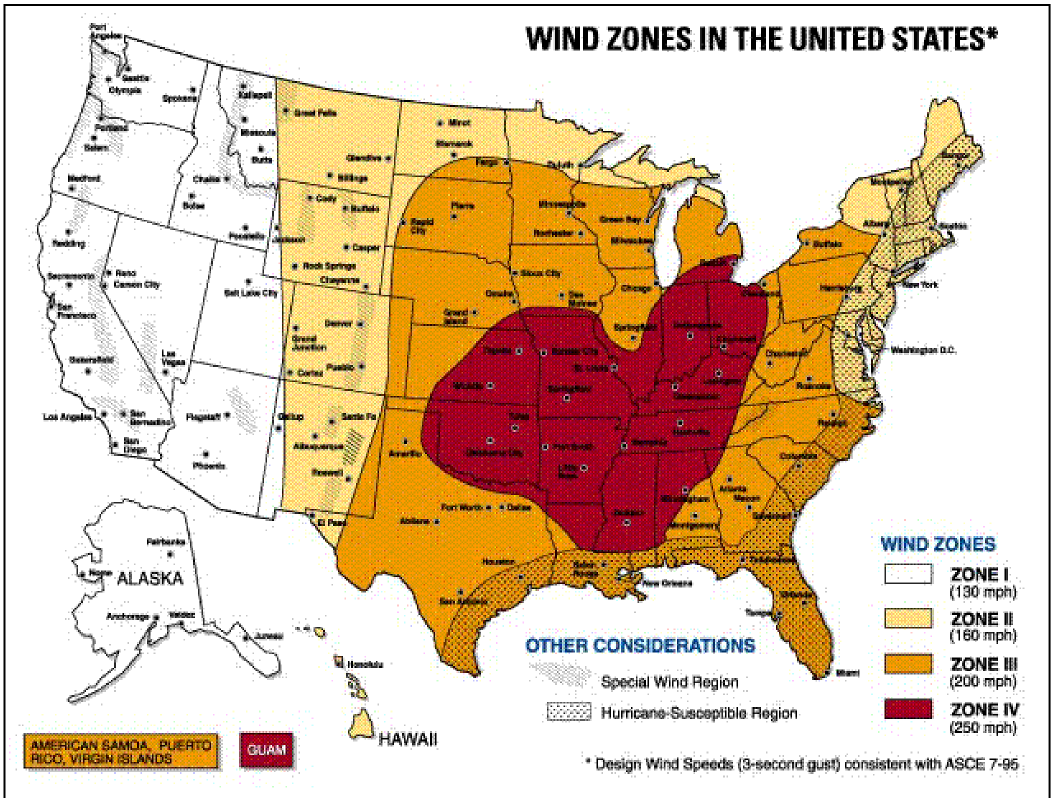


Figure I.2 Wind zones in the United States

Source: NCEI, NWS (http://www.crh.noaa.gov/lmk/?n=tornado_climatology_fayette

4.15.3 Assessing Vulnerability: Tornado

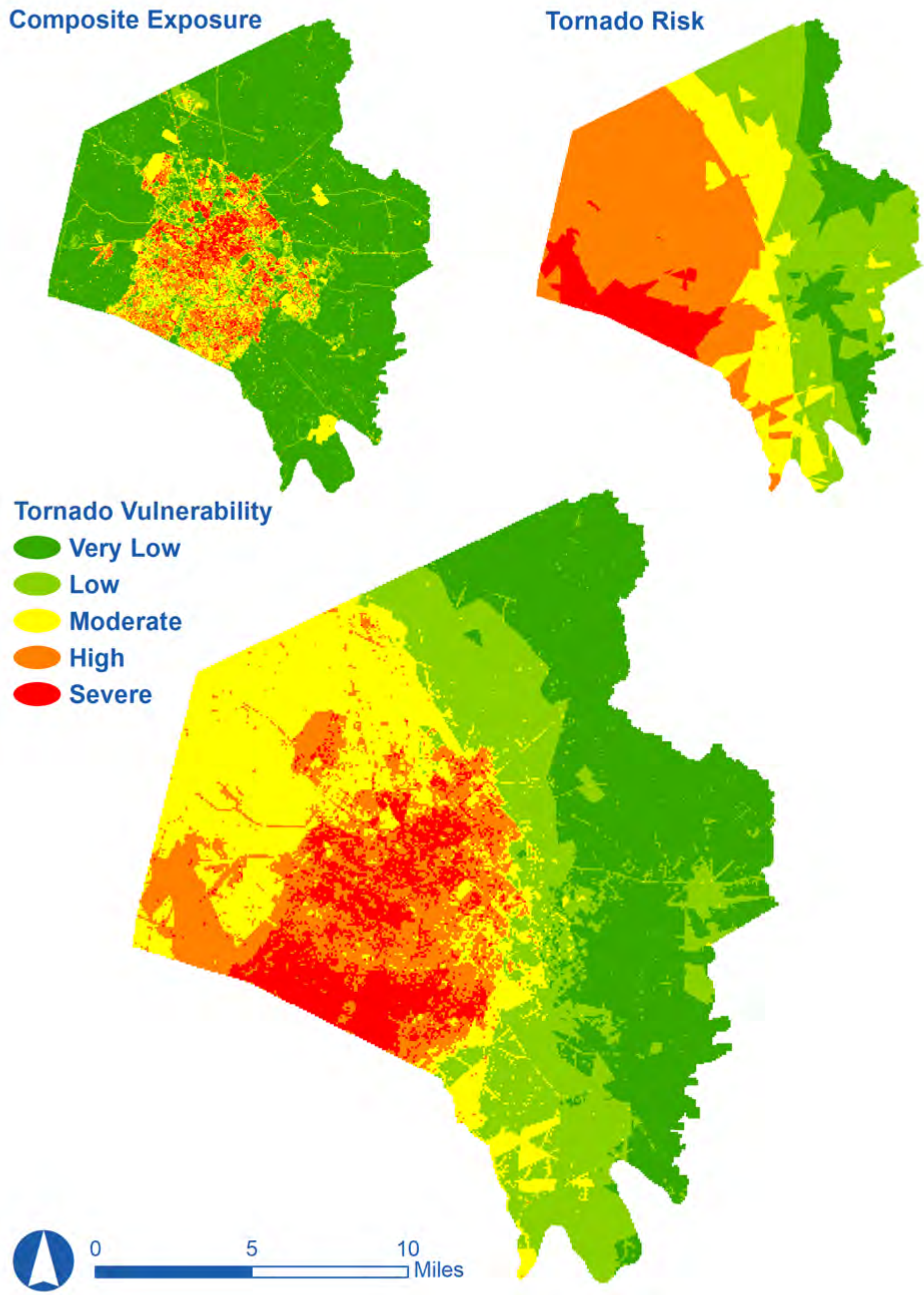
Tornado Vulnerability Score = Exposure Score + Risk Score

Risk Score = Occurrences

Occurrence Score = Occurrences were calculated for each grid cell by identifying and counting all tornado events/tracks within 25 miles of each cell. Tornado events included were all recorded tornadoes from 1950 – 2016 (NOAA Storm Prediction Center).

The Tornado Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Tornado Vulnerability Score (Figure 4.14).

Figure 4.14: LFUCG Tornado Vulnerability



4.16 Wildfire

4.16.1 Identify: Wildfire

A wildfire is an unplanned fire, a term which includes grass fires, forest fires, and scrub fires either man made or natural in origin. There are three different classes of wildland fires.

Types

- *Surface fires* are the most common type and burn along the floor of a forest, moving slowly and killing or damaging trees.
- *Ground fires* are usually started by lightning and burn on or below the forest floor.
- *Crown fires* spread rapidly by wind and move quickly by jumping along the tops of trees.
- *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.
- Wildland fires are usually signaled by dense smoke that fills the area for miles around.
- The average forest fire kills most trees up to 3-4 inches in diameter, in the area burned. These trees represent approximately 20 years of growth. In the case of up-slope burning, under severe conditions, almost every tree is killed regardless of size or type. When the trees are burned, and everything is killed, then the forest is slow to reestablish itself, because of the loss of these young seedlings, saplings, pole, and sawtimber trees.
- Included in the destruction by fires are the leaf and other litter on the forest floor. This exposes the soil to erosive forces, allowing rainstorms to wear away the naked soil and wash silt and debris downhill, which will clog the streams and damage fertile farmlands in the valleys. Once the litter and humus (spongy layer of decaying matter) is destroyed, water flows more swiftly to the valleys and increases flood danger.
- Other consequences of wildfires are the death of and loss of habitat for the forest's wildlife. Even when the adult animals escape, the young are left behind to perish. The heaviest wildlife lost is felt by game birds since they have ground nesting habits. Fish life also suffers as a result of the removal of stream shade and the loss of insect and plant food is destroyed by silt and lye from wood ashes washed down from burned hillsides.

Wildfire Fuel Categories

- *Light* fuels such as shrubs, grasses, leaves, and pine needles (any fuel having a diameter of one-half inch or less) burn rapidly and are quickly ignited because they are surrounded by plenty of oxygen. Fires in light fuels spread rapidly but burn out quickly, are easily extinguished, and fuel moisture changes more rapidly than in heavier fuels.
- *Heavy* fuels such as limbs, logs, and tree trunks (any fuel one-half inch or larger in diameter) warm more slowly than light fuels, and the interiors are exposed to oxygen only after the outer portion is burned.
- *Uniform* fuels include all of the fuels distributed continuously over an area. Areas containing a network of fuels that connect with each other to provide a continuous path for a fire to spread are included in this category.

- *Patchy* fuels include all fuels distributed unevenly over an area, or as areas of fuel with definite breaks or barriers present, such as patches of rock outcroppings, bare ground, swamps, or areas where the dominant type of fuel is much less combustible.
- *Ground* fuels are all of the combustible materials lying beneath the surface including deep duff, tree roots, rotten buried logs, and other organic material.
- *Surface* fuels are all of the combustible materials lying on or immediately above the ground, including needles or leaves, duff, grass, small deadwood, downed logs, stumps, large limbs, and low shrubs.
- *Aerial* fuels are all of the green and dead materials located in the upper canopy, including tree branches and crowns, snags, hanging moss, and tall shrubs.

Fuel Types

- *Grass*. Found in most areas, but grass is more dominant as a fuel in desert and range areas where other types of fuel are less prevalent. It can become prevalent in the years after a fire in formerly timbered areas.
- *Shrub (brush)*. Shrub is found throughout most areas of the U.S. Some examples of highly flammable shrub fuels are the palmetto/gallberry in the Southeast, sagebrush in the Great Basin, and chaparral in the Southwest.
- *Timber litter*. This type of fuel is most dominant in mountainous topography, especially in the Northwest.
- *Logging slash*. This fuel is found throughout the country. It is the debris left after logging, pruning, thinning, or shrub-cutting operations. It may include logs, chunks, bark, branches, stumps, and broken understory trees or shrubs.

Fuel Characteristics

Fuel moisture is the amount of water in a fuel. This measurement is expressed as a percentage. The higher the percentage, of moisture extant in the fuel, the greater the water within the fuel. How well a fuel will ignite, and burn is dependent, to a large extent, on its moisture content. Dry fuels will ignite and burn much more easily than the same fuels when they are wet (contain a high moisture content). As a fuel's moisture content increases, the amount of heat required to ignite and burn that fuel also increases. Light fuels take on and lose moisture faster than heavier fuels. Wet fuels have high moisture content because of exposure to precipitation or high relative humidity, while dry fuels have low moisture content because of prolonged exposure to sunshine, dry winds, Severe Storm, or low relative humidity.

Wildfire Facts

- Homeowners can do much to help save their homes from wildfires, such as constructing the roof and exterior structure of a dwelling with non-combustible or fire-resistant materials such as tile, slate, sheet iron, aluminum, brick or stone.
- While it was U.S. policy for most of the 20th century to suppress wildfires, fires benefit the ecosystem. The effects of fire can retard or accelerate the natural development of plant communities, alter species diversity and change nutrient flows.
- More than 100 years of suppressing fires, combined with past land-use practices, have resulted in a heavy buildup of dead vegetation, dense stands of trees, a shift to species that have not evolved and adapted to fire,

and occasionally an increase in non-native, fire-prone plants. Because of these conditions, today's fires tend to be larger, burn hotter, and spread farther and faster, making them more severe.

- Government scientists have also concluded that "fire severity has generally increased, and fire frequency has generally decreased over the last 200 years. The primary causative factors behind fire regime changes are effective fire prevention and suppression strategies, selection and regeneration cutting, domestic livestock grazing, and the introduction of exotic plants."
- Scientific analysis of the 2000 fire season revealed that the vast majority of burned acres were located in previously logged and roaded areas, not in road-less or wilderness areas.
- The Endangered Species Act permits federal officials to take actions that might impact endangered species or their habitat during times of emergency, including wildfire emergencies. Water can be taken from a river without permission from wildlife agencies during emergencies.
- There is consensus in the scientific literature dealing with fire and forest management that forests in un-roaded, un-logged areas have the most fire resiliency and present a lower fire risk compared to other areas.
- The Congressional Research Service, in an August 2000 report analyzing the impact of the fires in 2000, concluded, "Timber harvesting removes the relatively large diameter wood that can be converted into wood products, but leaves behind the small material, especially twigs and needles. The concentration of these 'fine fuels' on the forest floor increases the rate of spread of wildfires."
- Fire ecologists and most forest scientists agree that long-term ecological restoration with careful fire reintroduction (not increased resource extraction or aggressive fire suppression) holds the best hope of preventing future large-scale severe wildfires in fire-dependent ecosystems of the interior West.
- Many species depend on fires to improve habitat, recycle nutrients and maintain diverse habitats.
- Humans, either through negligence, accident, or intentional arson, have caused approximately 90% of all wildfires in the last decade. Accidental and negligent acts include unattended campfires, sparks, burning debris, and irresponsibly discarded cigarettes. The remaining 10% of fires are mostly caused by lightning but may also be caused by other acts of nature such as volcanic eruptions or earthquakes.

4.16.2 Profile: Wildfire

SUMMARY OF WILDFIRE RISK FACTORS	
Period of occurrence:	Year-Round, primarily Summer
Number of events: (2001-2017)	3
Annualized Probability:	0.19
Warning time:	None
Potential impact:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases.
Cause of injury or death:	Injury and risk of multiple deaths
Potential duration of facility shutdown:	30 Days or More
Past Damages:	Current best available data discovered is $500
Extent (Date, Damages, Scale/Size):	Size: 3,197 acres of contiguous tree canopy area located in the southern tip of the County; Largest wildfire on record: 2/21/2017, 28 acres

Wildland fires have been occurring in Kentucky for thousands of years. Native Americans used fire to clear land for use. Settlers moving into the state adopted the Native American land-clearing techniques, including the use of fire.

The Cumberland Plateau and the Appalachians in the eastern part of the state account for 50 percent of the state's forest cover, with 25 contiguous counties having a forest cover percentage of greater than 75 percent.

Kentucky Forest Fire Hazard Seasons

- Feb. 15 through April 30 and
- Oct. 1 through Dec. 15.

During this time, it is illegal to burn between the hours of 6 a.m. and 6 p.m. in or within 150 feet of any woodland or brushland

Private individuals own 78 percent of the forestland in Kentucky. Nine percent is public land administered by local, State, or federal agencies. Slightly more than one-half of the public timberland is managed by the U.S. Forest Service. Forest industry owns 2 percent of the timberland and other corporations account for the remaining 11 percent. The Division of Forestry owns and manages eight state forests - Tygarts, Green River, Pennyrile, Kentucky Ridge, Kentenia, Marrowbone, Knobs, and Rolleigh Peterson with a combined total of 39,401 acres.

The Division of Forestry is responsible for fighting wildland fires on private lands and enforcing forest fire hazard seasons and other outdoor burning regulations. The Division fights approximately 1,450 wildland fires annually. These fires burn more than 50,000 acres per year. The worst fire year in Kentucky was 2001, with a total of 178,900 acres burned. The leading cause of forest fires in Kentucky is arson, while the second is uncontrolled debris burning Arson is the act of intentionally and/or maliciously setting a fire. Wildland arson is a serious crime that hurts all Kentuckians. Over 99% of the wildfires in Kentucky are human-caused.

Kentucky's forest protection laws include penalties for intentionally setting a fire on land owned by another (KRS 149.380). The penalties for violating KRS 149.380 include a fine of not less than $1,000 or more than $10,000, imprisonment for not more than five years, or both fine and imprisonment.

Wildfire Potential Impact

Wildfire impacts human life, health, and public safety as well as a loss of wildlife habitat, increased soil erosion, and degraded water quality. Wildfire also can cause utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, damaged or destroyed critical facilities, and hazardous material releases.

Because smoke from wildfires is a mixture of gases and fine particles from burning trees and other plant materials, it can irritate eyes and cause damage to respiratory systems causing shortness of breath, chest pain, headaches, asthma exacerbations, coughing, and death. For those with heart disease, rapid heartbeat and fatigue may be experienced more readily under smoky conditions.

Included in the destruction by fires are the leaf and other litter on the forest floor. This exposes the soil to erosive forces, allowing rainstorms to wear away the naked soil and wash silt and debris downhill, which will clog the streams and damage fertile farmlands in the valleys. Once the litter and humus (spongy layer of decaying matter) is destroyed, water flows more swiftly to the valleys and increases flood danger.

Other consequences of wildfires are the death of and loss of habitat for the forest's wildlife. The heaviest wildlife lost is felt by game birds since they have ground nesting habits. Fish life also suffers because of the removal of stream shade and the loss of insect and plant food is destroyed by silt and lye from wood ashes washed down from burned hillsides. Wildland fires are usually signaled by dense smoke that fills the area for miles around. The average forest fire kills most trees up to 3-4 inches in diameter, in the area burned. These trees represent approximately 20 years of growth. In the case of up-slope burning, under severe conditions, almost every tree is killed regardless of size or type. When the trees are burned, and everything is killed, then the forest is slow to reestablish itself, because of the loss of these young seedlings, saplings, pole, and sawtimber trees.

Lexington Fayette Urban County Government Wildfire History

Lexington Fayette being a predominantly urban and agricultural county has very little history of wildfire. However, there is still a minor risk of wildfires affecting the community. According to wildfire data provided by the Kentucky Fire Commission there have been three identified wildland fires in Fayette County between 2001 and 2017. The most recent wildfire to effect Lexington-Fayette was on February 21, 2017, which burned 28 acres in the southern part of the county. These specific incidents can be seen on the Wildfire Risk Map in the Assessing Vulnerability Overview section.

4.16.3 Assessing Vulnerability: Wildfire

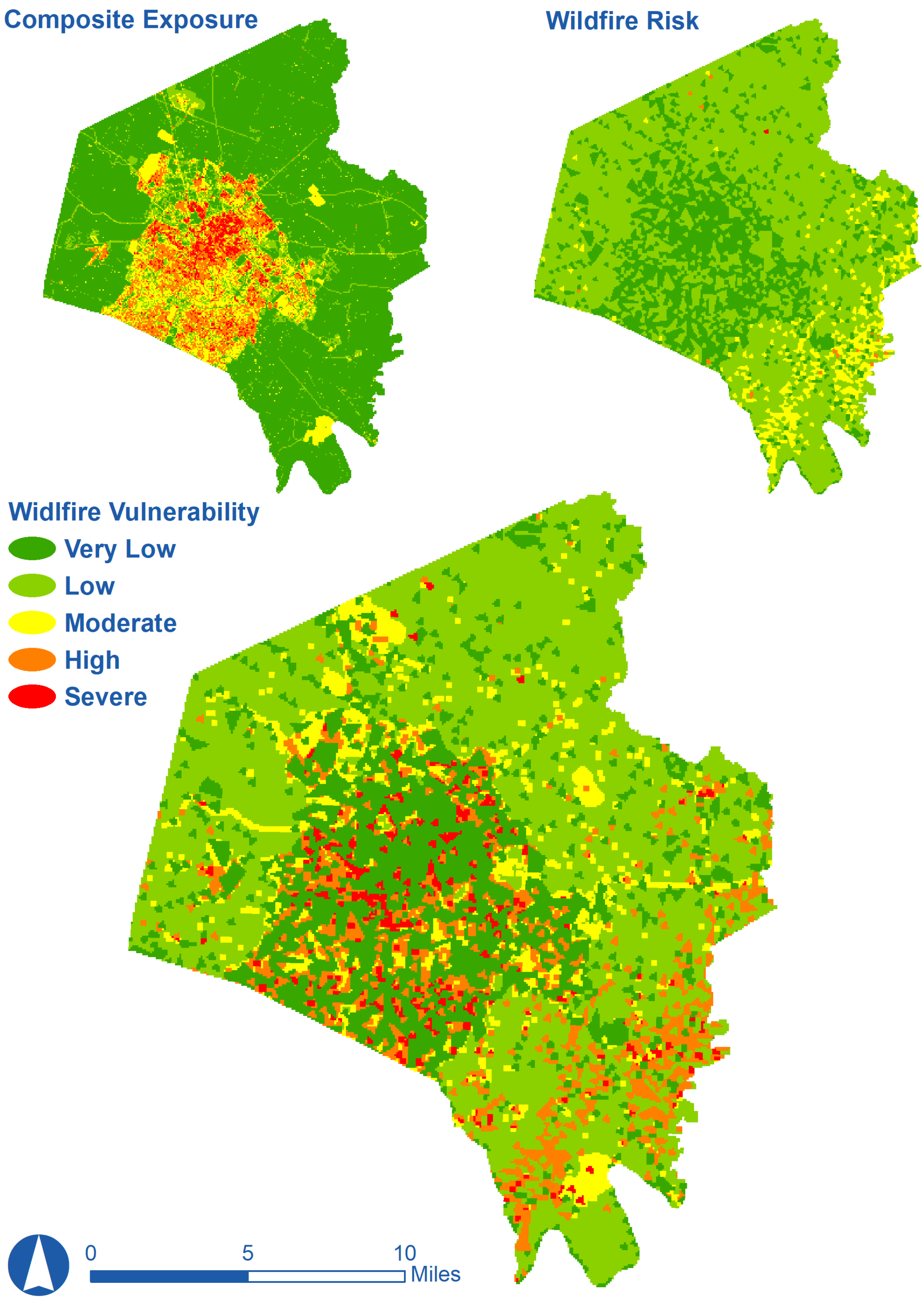
Wildfire Vulnerability Score = Exposure Score + Risk Score

Wildfire Risk Score = represents the mean score within each grid cell from the United States Forest Service's Wildfire Hazard Potential dataset[9].

The Wildfire Risk Score and the Exposure score were added together, and a new 0-1 score was calculated to give the final Wildfire Vulnerability Score (Figure 4.15).

[9] The Wildfire Hazard Potential (WHP) estimates wildfire likelihood and intensity generated in 2014 with the Large Fire Simulation system (FSim) for the national interagency Fire Program Analysis system (FPA), as well as spatial fuels and vegetation data from LANDFIRE 2010 and point locations of fire occurrence from FPA (ca. 1992 – 2012). https://www.fs.fed.us/rmrs/datasets/wildfire-hazard-potential-whp-conterminous-united-states-270-m-grid-version-2014-continuous

Figure 4.15: LFUCG Wildfire Vulnerability



4.17 Analyzing Developing Trends

An analysis of development trends provides Lexington Fayette County a basis for making decisions on the type of mitigation approaches to consider, and the locations where these approaches can be implemented. This information can also be used to influence decisions regarding future development in hazard areas.

There are several different methodologies in place that assess development trends. The following section describes the methodologies used for the LFUCG Hazard Mitigation Plan Update

Analyzing Development Trends

The Local Mitigation Plan should consider any or all of the following when analyzing development trends:

Describe trends in terms of the amount of change over time where the development is occurring;
Differentiate land uses of similar types that have distinctly different densities (for example, single-family homes, attached housing, and multifamily housing);
Where the future land uses are likely to occur based on comprehensive plans, zoning, redevelopment plans, or proposed annexation areas; or
The expected growth or redevelopment for some reasonable future timeframe (for example, 10 years). The timeframe could be coordinated with that of a local comprehensive or long-range plan review and update.

4.17.1 Population Trends

One of the more common methodologies in reviewing development trends is to review your population change data. This is predictive methodology based on the estimated population change during a certain timeframe.

The populations of Lexington Fayette County and the Census Bureau's Metropolitan Statistical Area (MSA) have increased steadily over the past four decades. The population of Lexington Fayette County grew by 124% from 131,906 in 1960 to 295,803 in 2010, with an increase of 13.5% for the last decade. From 2010 to 2016, Fayette County's population grew to 311,529, an increase of 5.3%

In the six-county (Fayette, Jessamine, Woodford, Scott, Bourbon, and Clark) MSA, the population has increased from 472,099 in 2010 to 495,193 in 2016, an increase of 4.9%. Fayette County, as a percentage of the MSA population, remained consistent, at 63% in 2010 and 2016. Fayette County, as a percentage of the regional population, is anticipated to decline slightly as Fayette County's Urban Service Area Boundary and Rural Land Management program guide future population growth and location.

At 5.3% and 4.9%, both Fayette County and the entire metro area have grown more rapidly than the percentage growth of the state as a whole (1.7%) over this time period. Projections used in Lexington Fayette County's 2013 Comprehensive Plan Update estimate the future population of the urban county to continue growing to 334,733 in 2020 and 375,986 in 2030[10].

Address data availability did not allow an analysis of population change at the 100-meter grid level for 2010 to 2016. Census block groups are the smallest geography at which population change data is available from 2010 to 2016. Figure 4.16, depicts population change from 2010 to 2016. Predictably, most of the population growth occurred inside or just outside of the urban growth boundary.

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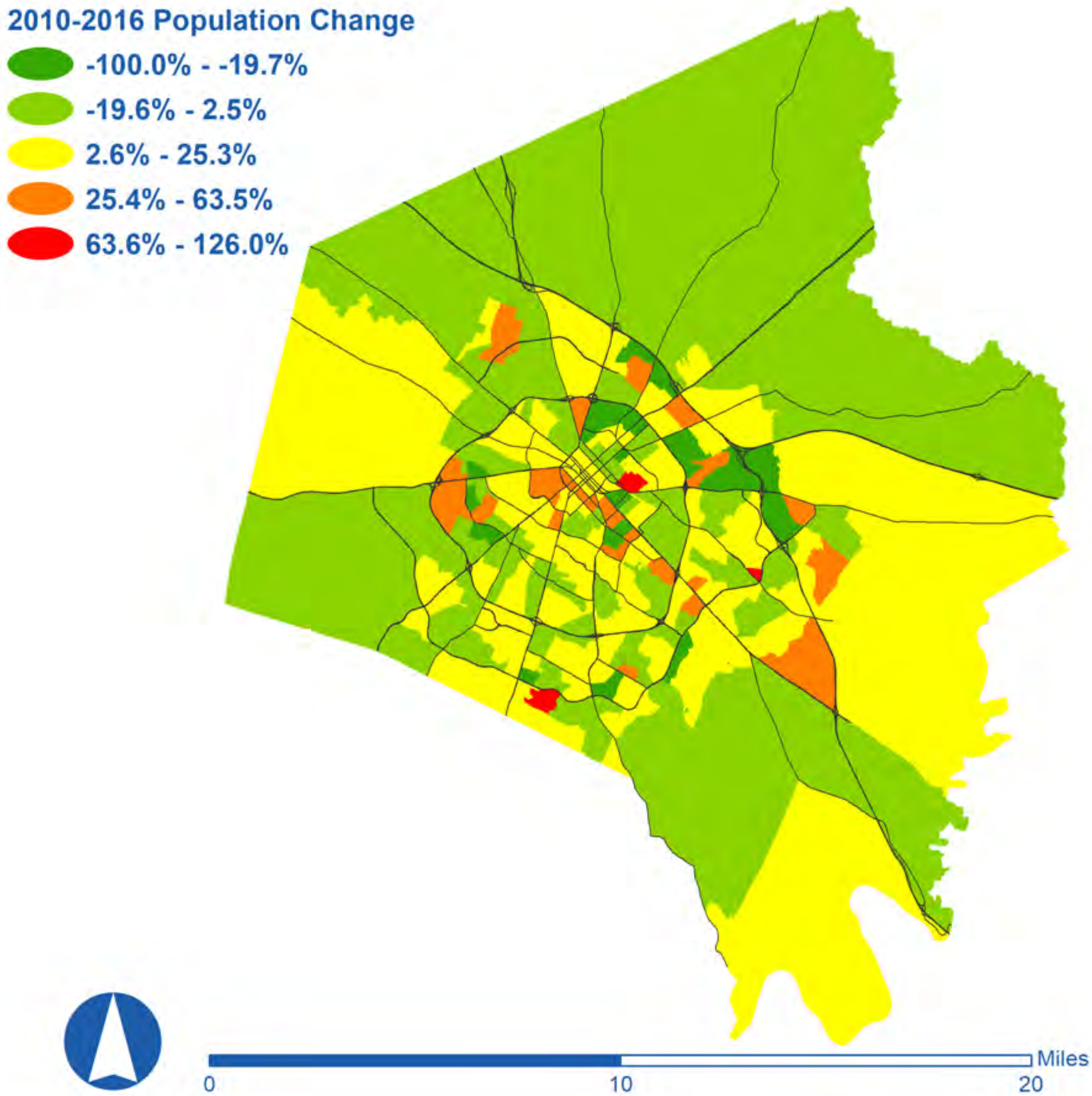
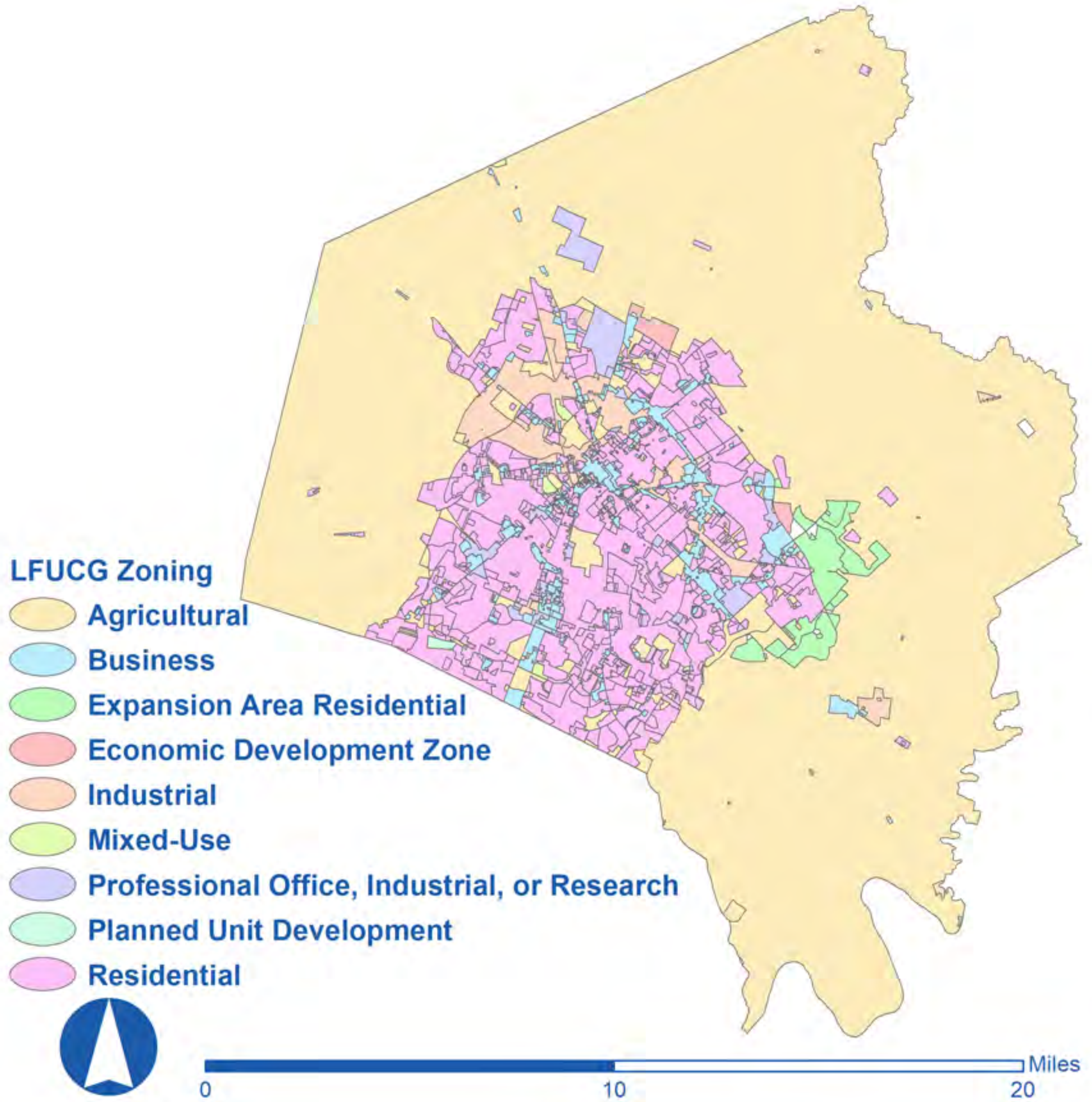
Figure 4.16: 2010-2016 LFUCG Population Change



4.17.2 Land Use

Another model used for the plan was to review the community's land use maps. Using the existing Land Use map from Lexington-Urban County Government's Department of Planning helps demonstrate areas of planned growth within the County. For the purpose of land conservation, the Rural Service Area will continue to be protected from development. This type of data is very useful when reviewing areas of planned growth versus areas of high risk according the Hazard Vulnerability Score maps.

Figure 4.17: LFUCG Zoning



Each of the models explained in this section depict different ways to capture development/population trends. These models are useful when analyzing development trends throughout Lexington Fayette County. Using each model along with each Hazard's, Hazard Vulnerability Score data provide the community with a better understanding of where growth is currently occurring and where growth should be monitored in the future. This data was also used to comprehend changes in development throughout Lexington Fayette County. As mentioned, these data sets along with the Hazard Vulnerability Score data sets provide a vision for proper landuse management in the future.

5. Capability Assessment

5.1 Introduction

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects. Careful examination of local capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing government activities. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level.

The Capability Assessment completed for the 2020 Lexington Fayette Urban County Government (LFUCG) Hazard Mitigation Plan update serves as a critical planning step and an integral part of an effective hazard mitigation strategy. Coupled with the Risk Assessment, the Capability Assessment helps identify and target meaningful mitigation actions for incorporation in the Mitigation Strategy portion of this plan. Any potential shortcomings in the ability of the city to implement hazard mitigation is tied to the mitigation strategy in the form of actions selected by the LFUCG Planning Team and Stakeholders Group. It not only helps establish the goals and objectives for the county to pursue under this plan, but it also ensures that those goals and actions are realistically achievable under given local conditions.

5.2 Conducting the Capability Assessment

The Capability Assessment began with completion of a Capability Assessment Review Form by the plan's stakeholder group. The assessment form compiled information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to and/or hinder the city's ability to implement hazard mitigation and climate adaptation. Other indicators in the form are related to the city's fiscal, administrative, and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes. Evaluating the current political climate is an important consideration with respect to hazard mitigation and climate adaptation. Capability information for the city was also updated based on information found in plans and local government websites.

At a minimum, results provide an extensive inventory of existing local plans, ordinances, programs, and resources that are in place or under development in addition to their overall effect on hazard loss reduction. However, the information can also serve to identify gaps, weaknesses, or conflicts that LFUCG can recast as opportunities for specific actions to be proposed as part of the hazard mitigation strategy. The results of this Capability Assessment provide critical information for developing an effective and meaningful mitigation strategy.

5.3 Capability Assessment Findings

The following are the findings of the Capability Assessment. It includes a variety of information including comprehensive plans, capital improvement plans, zoning and building codes, permitting, and other planning and regulatory tools. Essential to building the updated plan was to review existing plans, studies, reports, and technical information for incorporation. Other information that was incorporated into the plan includes:

Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii):[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.(In a box in 2013 HMP)

- Planned, in-process, and completed stand-alone mitigation activities
- GIS data
- Studies
- Plans
- Ordinances
- Land use regulations, and any available technical information

To better organize Lexington Fayette County's Capability Assessment, the LFUCG Stakeholder Group reviewed current capabilities according to four general categories:

A. Planning and Regulatory Capabilities
B. Administrative and Technical Capabilities
C. Fiscal Capabilities
D. Political Capabilities

A. Planning and Regulatory Capability

Planning / Regulatory Tools	LFUCG	Documentation
Hazard Mitigation Plan	✓	On file, but not available online
Comprehensive Land Use Plan	✓	Imagine Lexington underway now. 2013 plan is current: https://www.lexingtonky.gov/plans-studies-and-surveys
Floodplain Management Plan	✓	Hazard Mitigation Plan
Open Space Management Plan (or Parks & Rec/Greenway Plan)	✓	Lexington-Fayette County Greenspace Plan https://drive.google.com/file/d/0B0aBvWAKyfxaM1JIdFhJVjJMUHM/view Lexington-Fayette County Greenway Plan https://drive.google.com/file/d/0B0aBvWAKyfxaNVU1WTZuS21jdjQ/view
Stormwater Management Plan/Ordinance	✓	Stormwater Quality Management Program https://drive.google.com/file/d/0B_VhcJmdL_nhek54NTdFY3FCVWM/view Stormwater Discharges Ordinance https://library.municode.com/ky/lexington-fayette_county/codes/code_of_ordinances?nodeId=COOR_CH16SEGAREWE_ARTXSTDI
Natural Resource Protection Plan	✓	Lexington-Fayette County Greenspace Plan https://drive.google.com/file/d/0B0aBvWAKyfxaM1JIdFhJVjJMUHM/view Lexington-Fayette County Greenway Plan https://drive.google.com/file/d/0B0aBvWAKyfxaNVU1WTZuS21jdjQ/view
Flood Response Plan	✓	Included in EOP, not available online
Climate Adaptation Plan		
Sustainability Plan		
Greenhouse Gas Reduction Plan (or Climate Action Plan)		
Emergency Operations Plan	✓	On file, but not available online
Continuity of Operations Plan	✓	2010 COOP for pandemic flu, otherwise, some departments have plans
Evacuation Plan	✓	On file, but not available online, EOP
Disaster Recovery Plan	✓	On file, but not available online, EOP
Capital Improvements Plan	✓	LFUCG Budget Office maintains list of capital projects Stormwater Priority Projects

Planning / Regulatory Tools	LFUCG	Documentation
		https://www.lexingtonky.gov/sites/default/files/2018-01/Stormwater%20Priority%20Projects%20Master%20List%20Jan%202018%20Update.pdf
Economic Development Plan	✓	
Historic Preservation Plan	✓	Historic Preservation Ordinance https://drive.google.com/file/d/0B0aBvWAKyfxaWDV3eFVFcFFxZkE/view
Flood Damage Prevention Ordinance	✓	Floodplain Conservation and Protection Ordinance https://drive.google.com/file/d/0B0aBvWAKyfxacTlyWmhNcmk0aFU/view
Zoning Ordinance	✓	https://www.lexingtonky.gov/zoning-ordinance
Subdivision Ordinance	✓	Land Subdivision Regulations https://drive.google.com/file/d/1lOv-wmKX2pJYkv7qV3Zb6EpX3Hr__0lq/view
Tree Removal/Replacement Ordinance	✓	Tree Protection Standards https://drive.google.com/file/d/0B0aBvWAKyfxaYUZwQmtCUEhEUFk/view Tree protection ordinance in development process Street Tree Ordinance https://library.municode.com/ky/lexington-fayette_county/codes/code_of_ordinances?nodeId=COOR_CH17BSTTR
Building Energy Efficiency Ordinance	✓	KY statewide code - Residential 2009 IECC, commercial 2012 IECC amd
Unified Development Ordinance		
Post-Disaster Redevelopment Ordinance		
Building Code	✓	KY Statewide Code - KRC 2013 edition, KBC 2013 edition
Fire Code	✓	KY State Fire Code - NFPA 1/101
National Flood Insurance Program (NFIP)	✓	https://www.lexingtonky.gov/floodplains-and-flood-management
NFIP Community Rating System	✓	https://www.lexingtonky.gov/floodplains-and-flood-management

- Emergency Operation Plan (EOP)

An Emergency Operations Plan (EOP) serves as a framework of responsibilities and actions taken during a disaster or emergency. In March 2013, Lexington-Fayette County adopted an official EOP. This EOP is NIMS compliant. The plan follows the cyclical framework of emergency management including Mitigation, Preparedness, Response, and Recovery. The Mitigation Phase analyzes city's information about hazards (severe weather, flooding, sinkholes, and hazardous materials), compiles data about population and infrastructure vulnerability. identifies resources and partnerships and organizes action items such as changes in zoning and building codes, and floodplain buyouts. The preparedness Phase selects and trains staff and emergency response personnel, develops operations plans, and equips the Emergency Operations Center to achieve effective disaster response. The Response Phase addresses short-term, direct actions of an incident. And the Recovery Phase encompasses activities to return the area to normal as soon as possible. One of the main goals of EOC Plan is to outline the organization of functions of local, state, regional and federal agencies to best assist before during and after a disaster. These are known as Emergency Support Functions ESF. Agencies are organized in task-force teams under direction and control of a specific Primary Coordinating Agency. The following are the Emergency Support Functions: Public Information (LFUCG Division of Emergency Management PCA), Long-Term Recovery (LFUCG Division of Emergency Management PCA), Law Enforcement (Lexington Division of Police PCA), Utilities (Kentucky Utilities, Kentucky American Water, Columbia Gas, Windstream PCA), Agriculture (University of Kentucky Cooperative Extension Agency), Hazardous Materials (Lexington Division of Fire and Emergency Services PCA), Search and Rescue (Lexington Division of Fire and Emergency Services PCA), Health and Medical (Lexington Health Department PCA), Resource Management (LFUCG Division of Emergency Management PCA), Human Services, Mass Care, Housing, and Food Management (Lexington Department of Social Services PCA). Emergency Management (LFUCG Division of Emergency Management PCA), Fire (Lexington Division of Fire and Emergency Services PCA), Public Works (Department of Environmental Quality and Public Works PCA), Communications (LFUCG Division of Emergency Management PCA), and Transportation (LexTran PCA)

- Flood Response Plan (Part of the EOP)

  The Lexington-Fayette County EOP addresses flood as one of the main hazards for Lexington-Fayette County. It identifies flash floods, river basin floods and sinkhole flooding as the three main types of flooding. Lexington-Fayette County participates in the FEMA National Insurance Program and Community Rating System which provides qualifying owners with a reduction of their flood insurance premiums. The Lexington-Fayette County Emergency Operations Center (EOC) owns GIS layers for low-lying areas in and around creeks and waterways, and floodplain areas.

- Continuity of Operations (Part of the EOP)

  The Lexington-Fayette County EOP includes a Continuity of Operations Plan to preserve, maintain, and reconstitute the city's ability to carry out its responsibilities and provide essential services during emergencies. Under this plan, the Urban County Council is responsible to codify ordinances for legal transference of power from the Mayor to its respective alternates. The line of command is at follows. The Mayor is at the top of the line, followed by the Vice Mayor, followed by Public Safety Commissioner, followed by the DEM Director. In addition, the COPP identifies who is responsible and what are the procedures for backing up vital records, electronic data, police mainframes, fire mainframes, and the Web EOC system.

- Disaster Recovery Plan

  The EOP Recovery Phase identify the needs and resources, promotion of community restoration and housing, treatment of population affected, evaluation of the incident and lessons learned, and development of prevention initiatives.

- KY State Hazard Mitigation Plan

  There are six main goals in the KY State Hazard Mitigation Plan including reducing risk for natural hazard events, reducing property damage, sustainable growth, enhancing the state capability to implement comprehensive hazard mitigation strategies, increasing public and private sector involvement in hazard mitigation education, and scientific researching ways to optimize hazard mitigation.

- Imagine Lexington: 2018 Comprehensive Plan

In November 2017, Lexington-Fayette County finished the first phase of the city's updated comprehensive plan. As of December 2018 this plan is still in draft format. One of the themes of the Goals and Objectives is "Protective the Environment" Goals that support Hazard Mitigation Planning in this section include continued implementation of the Consent Decree, reduction of carbon footprint, and protection, conservation, and restoration of natural resources. Another theme of the Comprehensive Plan is "Maintaining a Balance between Planning for Urban Uses and Safeguarding Rural Land" This theme makes reference to maintaining the Urban Service Boundary which regulates development outside Lexington's Urban Service Area.

- 2013 Comprehensive Plan (Environmental and Green Infrastructure)

Some of the most recent green initiatives aiming to fulfill the Environmental and Green Infrastructure goal of the Comprehensive Plan are the Air Quality Attainment in 2005, the signing of U.S. Mayor's Climate Protection Agreement in 2005 and the addition of 264 acres to the Raven Run Nature Sanctuary. The following are the Green infrastructure components and the action items of each. Air Quality Component: LFUCG committed to conducting an inventory of local greenhouses emissions. Other supporting action items include the increase use of hybrid vehicles, and the use of energy efficient LED traffic signals. Emissions have not been calculated since 1990 and greenhouse gas emissions inventory has not been conducted. Water Quality Component: Includes stream restoration projects and stream protection regulations. Water quality regulation includes sanitary sewer projects, reduction of salt use. and a no-mow policy along stream banks. the Division of Engineering promote water quality awareness through programs such as Katy Catfish, Kentucky River Watershed Watch, and Town Branch Creek Watershed Awareness. Floodplain Component: Under the National Flood Insurance Program's Community Rating System Program, communities are rewarded with low insurance premium if prevention and mitigation activities are in place. Since 1991 LFUCG has started acquiring land and designated it as conservation areas. A large part of floodplain acreage has been dedicated to greenways. Drought Water Supply Component Bluegrass Water Supply Commission proposed three possible pipeline routes for a new water plant on the Kentucky River at Pool No. 3. Project had a tentative completion date by 2010. BWSC and Kentucky American Water were to become owners of the new facility.

- Urban Service Area Boundary:

Upon completing of the first phase of Imagine Lexington, 2018 Comprehensive Plan, the goals and objectives were adopted by council. One of the goals accepted by Council was to uphold the urban Service Area concept. The Urban Service Area is the portion of Lexington Fayette County where all urban activities are to occur. This planning tool has been effective in restricting growth to a confined area that is about 30% of the total County. Thus, the area of the County that contains most of the floodplain will not be subject to development. In fact, nearly 76% of all the special flood hazard areas in Lexington Fayette County are in the Agricultural Rural zone, which has a minimum lot size of 40 acres. This very low-density development pattern will minimize the development within a large portion of Lexington Fayette County's floodplains.

- Central Sector Small Area Plan (2007 Comprehensive Plan)

The Central Sector Small Area Plan proposed a fee-based on the number of impervious surfaces to raise funds for environmental cleaning and flooding problems. The goal was to raise approximately 16 million a year. LFUCG adopted the "Royal Springs Wellhead Protection Plan" into the 2007 Comprehensive Plan. The Royal Springs aquifer requires special attention because its susceptibility to pollution due to the karst geology of this area. The Central Sector is also localized in a region with 50% of the property located in a mapped groundwater basin. While flow routes have been studied, precise flow paths are unknown.

- **East End Small Area Plan (2007 Comprehensive Plan)**

  Any future development should take into consideration the Royal Springs Aquifer due to its susceptibility to pollution due to the karst geology of this area.

- **Expansion Area Master Plan**

  The Expansion Area Master Plan was adopted in 1996. It outlines the importance of conservation of environmentally sensitive areas. Sinkholes lands with steep slopes must not be developed. Stream corridors including floodways and floodplains should be protected Storm water should be managed and controlled to ensure that pollutants are not discharge directly or indirectly into the surface of water bodies.

- **2017 Rural Land Management Plan**

  The Rural Land Management Land Plan was approved in November 2017. This plan is dedicated to the planning and management of the land uses in the Rural Service Area. One of the plan goals is the protection of environmentally sensitive areas and wildlife habitat. According to the plan, the Rural Service Area has around 7.783 acres of FEMA floodplain. The Kentucky Agriculture Water Quality Act requires a Water Quality Plan that aims to improve quality of drinking water and control flooding.

- **Red Mile Development Plan**

  The Red Mile Development Plan encourages additional development and connectivity with the rest of the Lexington-Fayette County community. In the public meetings, some members of the public expressed concerns about flooding in property backyards.

- **Oxford Circle Redevelopment Feasibility Study**

  The Oxford Circle Redevelopment Feasibility Study is part of the Cardinal Valley Small Area Plan. It aims to redevelop this area as community space that includes a library and a community center. The plan assesses the physical space by analyzing pervious surfaces, urban heat island effect, and the 100-year floodplain. Vaughn's Branch Creek runs across the project area; therefore, the area has a history of flooding. The plan calls for floodplain modeling for future redevelopment and infill. The plan development includes an initiate for Vaughn's Branch Creek restoration that promote recreational spaces. A budget of $450.000 was allocated for this project.

- **Armstrong Mill West Small Area Plan**

  The Armstrong Mill West Small Area Plan recommends the reduction of impervious surfaces such as buildings. Driveways and parking lots. It also recommends working with schools to incorporate rain gardens, implementing additional street landscaping, incorporation heat islands reduction measures such as green wall and green roofs. The plan also recommends the improvement of existing stormier run-off areas and the incorporation of bioswales.

- **Cardinal Valley Small Area Plan**

  The Cardinal Valley Small Area Plan includes efforts to conserve, restore and enhance Wolf Run and Vaughn' Branch using green infrastructure such as permeable pavements, bioswales and rain gardens. The plan includes infrastructure for recreational uses such as multi-use trail that runs and crosses both branches. Future expansions to protect the floodplain have included the city's purchase of large amounts of greenway property. The potential uses for this area include low impact recreational activities that don't affect the primary function of rainwater management. Vulnerable population is known to live in this area.

- Winburn Russell Cave Small Area Plan

  There are special concerns for future development within the Winburn Russell Cave Small Area Plan, because of its association with the recharge areas of the Royals Springs Aquifer, which provides drinking water to the City of Georgetown. Drainage work was completed upon a 2009 study recommending specific measures to reduce flooding. Despite efforts, flooding remains a concern for the neighborhood. The area that represent major risk is the area within the Cane Run Creek 100-year flood plain. Vulnerable population is known to live in this area.

- Newtown Pike Extension Corridor Plan

  Plan implementation measures included the construction of a new run-off collection system transporting water to Town Branch and the improvement of the existing infrastructure. This plan mentions assessment of water lines to ensure that they meet required flows, and the installation of new water lines where new roads were built.

- Greenbrier Small Area Plan

  Within this plan, a storm water management plan was created addressing the Greenbrier Lake and surrounding area. The plan included basin infrastructure to assist the lake with overall storm water management system. The golf course surrounding the area is as natural retention feature that also provides recreation and wildlife habitat. Additionally, there are many sinkholes in the neighborhood.

- Lexington-Fayette County Greenspace Plan

  The Greenspace Plan was approved by LFUCG Planning Commission in 1994. This plan aims to protect the natural and historic heritage within an urban/rural form of Fayette County. The plan recommends measures to reduce flooding by expanding and improving the retention/detention systems along the lower part of the Wolf Run Creek and Vaughns Branch corridor. Additionally, the plan highlights and emphasizes the benefits of greenways as a natural way for flood control. The plan also outlines the importance of finer linkage between greenspace routes. As part of the tools and techniques for greenspace preservation, the plan suggests a new zoning category such as Greenspace Zone district or Greenspace Overlay Zone. The plan outlines specific items for the Division of Engineering including the coordination of greenspace planning with the storm water management planning, improvements for detention/storage infrastructure and the adoption of design standards for flood control.

- Greenways Master Plan

  The Greenways Master Plan was adopted as an element of the 2001 Comprehensive Plan in 2002. The Greenway Master Plan communicates the importance and need for greenways and recommends a county-wide interconnected system. One of the key plan recommendations includes conservation corridors based on the watershed boundary where development is prohibited within the 100-year floodplain.

  Nine Conservation Greenways are identified for protection to provide an opportunity to establish open space and riparian buffers, which will alleviate flooding, channelization, fragmentation of habitat and water quality impairment. Streams were selected with an emphasis on documented repetitive structural flooding, existence of water pollution, presence of open space and urban encroachment into floodplain areas.

- Tree Protection Ordinance

  Along with the reforestation program, the Tree Protection Ordinance (Article 26 of the Zoning Ordinance) has been in effect since 2001, requiring tree protection and planting in new developments. Under this regulation, all new development in Fayette County must meet minimum tree canopy coverage, as well as a tree preservation standard. Residential and non-residential uses in agriculture zones - Minimum of 30% of developable area. Most business and Commercial a minimum of 20%. Floodplain reforestation done in accordance with the Storm Water Manual, may be fully counted as the actual square footage of the land area to be reforested. There are also requirements for trees in special locations such as riparian trees. - Conservation of riparian. Construction and/or disturbance will not be permitted in the designated riparian buffer unless those are activities related to road, sewer, storm water, or flood control infrastructure. Additionally, trees in steep slope areas or sinkholes have the highest priority for preservation. Sinkholes are to be left as open slope. No tree shall be removed from any area with a slope exceeding 15% or a sinkhole.

❖ Sinkhole Ordinance

Lexington Fayette County is in an area of karst topography where sinkholes are frequently found. Development in and around sinkholes can lead to severe structural, foundation and erosion problems. Since the early 1980s, the LFUCG has included special standards for sinkholes in the Subdivision Regulations. The Sinkhole Ordinance prohibits the fillings of sinkholes and limits development within their boundary as well as the discharge of storm water into sinkholes. Sinkhole boundaries are defined on topographic maps with 5-foot contours. Non-developable areas maybe set aside for open space. The ordinance also enforces sinkholes and surrounding areas to be shown on any development or preliminary subdivision plan. Non-buildable sinkhole areas and regulations of development in sinkhole drainage areas ought to be determined by the Planning Commission. Sinkholes may not be used as a part of the storm drainage system without a complete geotechnical evaluation.

❖ Mining Ordinance

The ordinance enforces reasonable drainage control for mining and quarrying of non-metallic minerals. Mining of non-metallic minerals must ensure proper drainage control. Concert mixing facilities and asphalt plants shall be operated under local, state and federal laws of Storm Water Disposal Standards, and Soil Erosion Control. Facilities ought to have adequate drainage, erosion and sediment control measures.

❖ Purchase of Development Rights Program (PDR):

As of July 1, 2011, this program has received $38.6 million dollars in local funds and $36.4 million dollars in federal and state matching grants. To date, 191 conservation easements have been purchased and 37 conservation easements have been donated to the program, conserving over 26,424 acres of productive rural farm land. Over the last 10 years, the PDR program has achieved nearly 51% of the 50,000-acre goal adopted in the PDR Ordinance (NO. 4-2000). The PDR Program is designed to purchase conservation easements on farm land in the Rural Service Area, restricting the use to agriculture and limiting impervious surface areas to protect the general agriculture, equine, and tourism industries. The presence of prime farmland soils, soils of statewide importance, focus areas, rural greenways, natural areas and environmentally sensitive areas, including floodplain land, are some of the criteria used to determine the priority of conservation easement acquisition. This program is significant because about 70% of Lexington Fayette County's floodplains are within the rural area, which is being further protected through this PDR program. This program is considered a model program by many other jurisdictions in Kentucky, as well as across the country.

❖ Zoning Ordinance - General Zone Requirements

Exemptions to zoning regulations apply to agricultural land, however buildings or structures in the designated floodplain must fully comply with flooding regulations.

- Detention Basin Inspection Team

The Division of Water Quality (DWQ) has established a protocol for the maintenance and structural repairs of detention basins, retention ponds, and other storm water control devices in the community. In many cases, the LFUCG now owns several detention basins throughout the County and mandates ownership in new residential subdivisions. This enables the government to fully control these storm water devices to ensure their proper maintenance and functionality. In cases where the government does not own the detention basin, the DWQ staff has been given the authority to enforce detention basin maintenance requirements. Each detention basin is inspected twice a year.

- LFUCG Floodplain Ordinance

In March 2017 the Floodplain Conservation and Protection Ordinance was updated. The purpose of this ordinance is the designation of flood hazard areas for public awareness, minimization of property damage, minimization of ground water pollution and erosion. Under the ordinance, no construction is allowed in the floodplain (unless granted a Local Special Use Permit). The ordinance also regulates permitted activities such as agriculture. private and public recreation, and approved detention and retention basins. In addition, all buildings must be set back 25 feet from the floodplain and two feet above the base flood elevation. The requirements also incorporate best management practices for floodplains.

- Floodplain Studies

As Lexington has developed in the past decades, the LFUCG has completed several major studies to assess flood hazards and risks and to update the DFIRMs. These studies have helped in planning, zoning, and in identifying capital projects and community needs. As a result, these studies have been included in the updated plan.

- Infrastructure Hearing Board

In 2005, the LFUCG established an Infrastructure Hearing Board to investigate, cite, and issue fines for violations of Zoning and Subdivision Regulations. In 2011 the regulations governing erosion control were amended from Article 20 of the Zoning Ordinance and placed in Chapter 16 of the Code of Ordinances to strengthen enforcement and increase penalties. The Board hears appeals of citations issued by the Divisions of Engineering and Water Quality and collects civil penalties. Typical violations that invoke enforcement actions include but are not limited to: inadequate erosion and silt control, mud/direct in streets, and covered manholes.

- Storm water Quality Projects Incentive Grant Program

The Storm Water Quality Projects Incentive Grant was established to finance projects to improve water quality, address storm water concerns, prevent storm water runoff and flooding and provide community education. Application for these grants is open to Fayette County neighborhood, community and homeowner associations incorporated with the Commonwealth of Kentucky that represent single family homeowners or farms who pay the Water Quality Management Fee. Grants are reviewed by the DWQ. There are generally three grant types: 1) Neighborhood Grants, 2) Education Grants, and 3) Infrastructure Grants. Examples of Neighborhood Grant_Projects include rain gardens, rain barrels, aeration for retention ponds, stream bank restoration, neighborhood workshops and other education initiatives.

- Storm water Quality Management Program

The SWQMP is a comprehensive program to manage the quality of storm water discharged from the MS4 Municipal Separate Storm Sewer System (MS4) and it is integrated with the city's watershed management plan. This plan addresses the identification of impaired and unimpaired waterbodies, design and construction considerations for watershed management infrastructure related projects, and public involvement, education and outreach. This plan is committed to the Consent Decree which requires LFUCG to complete a Commonwealth Environmental Project to prioritize flooding projects and implement $30M in capital projects to address flooding by January 2021. Also, although there are few wetlands remaining in the area, there are current efforts to restore wetlands through LFUCG Storm Water Incentive Grant Program. Additionally, Lexington has completed a quarter of a major program to improve the city's storm water and sanitary sewer collection. This program, estimated to cost $600 M over a span of 15-20 years, includes water infrastructure upgrades, erosion control programs, and risk areas control improvements.

- Storm water Discharges Ordinances

  This ordinance ensures compliance with the urban county government's MS4 permit regulations implementing the Clean Water Act and reduce impacts to public health, welfare, and the environment due to storm water runoff from public and private properties, including flooding and property damage.

- Flood Insurance

  The LFUCG has participated in the NFIP since 1973 and in the Community Rating System (CRS) since 1991. Because Lexington participates in the NFIP, flood insurance is available throughout the community. The FIRMs were last updated in December 2017. Additionally, LFUCG participates in the Cooperating Technical Partners (CTP) Program to collaborate in maintaining up-to-date flood hazard maps and other flood hazard information. The divisions of Planning and Water Quality aid homeowners, real estate professionals and insurance agents in map determinations. The Division of Planning has, since 2009, been cooperating with professional membership organizations to electronically disseminate information to mortgage, real estate and insurance professionals on all floodplain services the LFUCG provides. Information about flood insurance, FEMA and links to their web sites are also provided.

- Property Acquisition

  As is the case with other communities, Lexington Fayette County has several structures that had repeated flood damage or have made multiple flood insurance claims through the NFIP. The LFUCG is working to purchase and demolish many of these homes. Although expensive in the short term, property acquisition is far more cost efficient than repeatedly providing for their repair and reconstruction.

- Sump Pump Redirection Program

  Occasionally, clear water enters the sanitary sewer system through the basement sump pumps and the connection of downspouts to sewer laterals. This additional storm water can overload the sanitary sewer system, causing sewage overflows and sewage backups in homes. To mitigate this problem, the Divisions of Engineering and Sanitary Sewers have a program to redirect sump pumps at no cost to the home owner. This program is being actively implemented to assist in addressing water quality issues in compliance with the LFUCG’s Consent Decree with the EPA.

- Building Elevation Requirements

  Prior to January of 2001, LFUCG followed the State requirement for all new structures in or adjoining a floodplain to meet a minimum floor elevation of one foot above the base flood elevation. In January of 2001, LFUCG instituted a higher regulatory standard that the minimum floor elevation be increased to two feet above the base flood elevation.

B. Administrative and Technical Capabilities

Staff / Personnel Resources	LFUCG	Documentation
Planners with knowledge of land development / land management practices	✓	Division of Planning, Division of Water Quality
Engineers or professionals trained in construction practices related to buildings and/or infrastructure	✓	Building Inspection
Planners or engineers with an understanding of natural and/or human-caused hazards	✓	Division of Planning, Division of Water Quality, Division of Environmental Quality & Public Works
Planners or engineers with an understanding of climate change impacts	✓	Division of Water Quality, Division of Environmental Quality & Public Works
Emergency Manager	✓	Division of Emergency Management
Floodplain Manager	✓	Division of Planning
Sustainability or Climate Change Coordinator		
Land Surveyors	✓	
Scientists familiar with the hazards of the community	✓	University of Kentucky
Scientists familiar with the community's climate change impacts	✓	University of Kentucky
Staff with education or expertise to assess the community's vulnerability to hazards	✓	Division of Emergency Management, Division of Planning, Division of Water Quality, Building Inspection
Personnel skilled in GIS and/or HAZUS	✓	Computer Services, Division of Planning, Division of Water Quality, Division of Environmental Quality & Public Works, Division of EM
Resource development staff or grant writers	✓	Office of Grants and Special Programs

D. Fiscal Capabilities

Fiscal Tool / Resources	LFUCG	Documentation
Capital Improvement Programming	✓	LFUCG Budget Office maintains list of capital projects, RMP (consent decree) completes stormwater projects
Community Development Block Grants (CDBG)	✓	Office of G&SP
Special Purpose Taxes (or taxing districts)	✓	TIF's, Urban Services Tax,
Gas / Electric Utility Fees	✓	
Water / Sewer Fees	✓	Water Quality Management Fee - Division of Water Quality (Sewer)
Stormwater Utility Fees	✓	Stormwater Fee, Impermeable Fee - Division of Water Quality

Fiscal Tool / Resources	LFUCG	Documentation
Development Impact Fees	✓	Exaction Fees & PDR program – Division of Planning
Tree Removal Fees		
General Obligation, Revenue, and/or Special Tax Bonds	✓	Can use general funds for capital projects that may include mitigation
Partnering Arrangements or Intergovernmental Agreements	✓	Mutual Aid with surrounding counties, Intergovernmental Stormwater Agreement with Jessamine County, Royal Springs Aquifer Committee to preserve water quality

E. Political Capabilities

Lexington government is proactive toward creating and maintaining policies and projects which reduce the impact of current and future hazards.

6. Mitigation Strategy

> **44 CFR Part 201**
> **Mitigation Planning**
>
> **§201.6(c)3 The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.**

The Local Mitigation Plan requirements encourage agencies at all levels, residents, businesses, and the nonprofit sector to participate in the development of the Mitigation Strategy. Local agency and public participation enable the development of mitigation actions that are supported by various stakeholders and reflect the needs of the community.

Furthermore, the intent of the Mitigation Strategy is to provide the Lexington Fayette County Urban Government (LFUCG) with the goals that will serve as guiding principles for future mitigation policy and project administration along with an analysis of mitigation actions deemed obtainable to meet those goals and reduce the impact of identified hazards. It is designed to be comprehensive, strategic, and functional in nature:

- In being *comprehensive*, the development of the Mitigation Strategy includes a thorough review of all hazards and identifies extensive mitigation measures intended to not only reduce the future impacts of hazards, but also to help the city achieve compatible economic, environmental, and social goals.
- In being *strategic*, the development of the Mitigation Strategy ensures that all policies and projects proposed for implementation are consistent with pre-identified, long-term planning goals.
- In being *functional,* each proposed mitigation action is linked to established priorities and assigned to specific departments or individuals responsible for their implementation with target completion deadlines. When available, funding sources are identified that can be used to assist in project implementation.

The first step in designing the Mitigation Strategy includes the identification of mitigation goals. Mitigation goals represent broad statements that are consistent with the hazards identified within the plan. These goals set the blueprint for the Mitigation Strategy and allowed the LFUCG Stakeholders Group to vision what they wanted to achieve over the next five-year period.

The second step involves the identification, consideration, and analysis of available mitigation measures (i.e., activities, policies, etc.) that lead to identifying mitigation actions that will help achieve the identified mitigation goals. These actions include both hazard mitigation policies (such as the regulation of land in known hazard areas through a local ordinance) and hazard mitigation projects that seek to address specifically targeted hazard risks (such as the acquisition and relocation of a repetitive loss structures). Alternative mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this Plan is maintained over time.

The third and last step in designing the Mitigation Strategy section is the development of the Mitigation Action Plan. The Mitigation Action Plan represents an explicit and functional plan for each action and is the most essential outcome of the mitigation planning process. The Mitigation Action Plan includes a prioritized listing of proposed hazard mitigation actions (policies and projects) for LFUCG to complete to enhance the community's resilience. Each action has accompanying information, such as those departments or individuals assigned responsibility for implementation, potential funding sources, and an estimated target date for completion. The Mitigation Action Plan provides those departments or individuals responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring success or progress over time. The cohesive collection of actions listed in the Mitigation Action Plan can also serve as an easily understood menu of mitigation policies and projects for those local decision makers who want to quickly review the recommendations and proposed actions of the Plan and potentially integrate with other planning documents.

In preparing the 2020 Mitigation Strategy, members of the LFUCG Planning Team and local Stakeholders Group considered the overall hazard risk and capability to mitigate the effects of hazards as recorded through the risk and capability assessment process. The adopted mitigation goals were also considered when developing each action item. Lastly, a thorough review of the Mitigation Strategy from the 2013 LFUCG Hazard Mitigation Plan was completed to see progress and align it to the current Mitigation Strategy section.

The Mitigation Action Plan responds to the Risk Assessment with projects and activities to mitigate Lexington's identified hazards. The action plan outlines projects in a five-year plan that allows LFUCG to make informed hazard mitigation policy and project determinations such as better land use and zoning decisions, resilient infrastructure, and most importantly keeping the public safe and educated about the vulnerabilities they face from hazards.

6.1 Mitigation Goals

The primary goal of all local governments is to promote the health, safety, and welfare of its citizens. In keeping with this standard and promoting a proactive approach to disaster management and risk reduction, LFUCG reviewed, amended, and ultimately defined five goal statements for the 2020 plan update.

During the June 21st Mitigation Strategy Meeting the Stakeholder Group discussed the Mitigation Goals from the 2013 Plan. During this meeting the Stakeholder Group revised Goal 4 and voted to keep the other Goals in the same format. These five goals set the blueprint for the Mitigation Strategy and provide overarching statements for the LFUCG community to implement mitigation action.

Goal 1 - Attempt to minimize the loss of life and injuries that could be caused by natural and man-made hazards.

Goal 2 - Facilitate a resilient economy by protecting agriculture, business and other economic activities from natural and man-made hazards.

Goal 3 - Develop a community-wide mitigation effort by building stronger partnerships between government, businesses, and the general public.

Goal 4 - Increase public and private understanding of hazard mitigation through the promotion of mitigation education and awareness of natural and man-made hazards.

Goal 5 - Enhance existing or design new county policies and technical capabilities that will reduce the effects of natural and man-made hazards.

6.2 Updating Mitigation Strategy

It is important to document the mitigation successes that have occurred over the last five years. LFUCG has been very successful to-date with mitigation activities. The Mitigation Actions described below highlight successful mitigation. A status report for all the mitigation actions and strategies from the 2013 Plan can be found in Appendix G.

- Action 1.1.6: In 2016, Lexington Division of Emergency Management (DEM) upgraded to a stand-alone Emergency Operations Center
- Action 1.1.7: DEM received funding to support the development of two new Tornado shelters, located on Versailles and Thompson Roads
- Action 1.1.8: DEM has added three new sirens at Raven Run, Hisle Park and Picadome. Currently a new siren is being put in at the downtown Courthouse Building
- Action 1.2.1: In 2017, DEM purchased new alert and notification tools called Deaflinks and LexAlerts, and a new APP called BeReady lex
- Action 2.1.1: The LFUCG GIS department and DEM have leveraged the county's ArcGIS online presence to interface with WebEOC to consume LFUCG's enterprise GIS and WebEOC board data
- Action 2.1.2: In 2018, the Multicultural Affairs Office worked with the Fayette county schools and LFUCG GIS department to map where the LEP population resides throughout the county
- Action 2.3.1: DEM developed a brochure called Disaster Resistant Home
- Action 2.3.3:
  - In 2013-2014, DWQ acquired two properties on Wallhampton Drive to construct a detention basin,
  - In 2015, DWQ acquired four properties on Clarksdale Court, two properties on Fort Sumter Drive, one property on Gayle Drive, one property on Clays Mill Road, and two properties on Lafayette Parkway
  - In 2016, DWQ acquired three properties on Elam Park Road, one property on Clarksdale Road, and one property on Gayle Drive
  - In 2017, acquired one property on Gayle Drive
- Action 2.3.4: The Water Quality Management Fee (WQMF) was established to provide a consistent funding source for stormwater projects
- Action 3.1.1: In 2017, DEM acquired the funding and hired an Emergency Planner for the division
- Action 3.1.2: With the hire mentioned above DEM has improved the integration of ESF-5 and 14 into the planning of the Emergency Operations Plan (EOP). In addition, DEM added recovery and mitigation duties to the Operations and Recovery Manager
- Action 3.1.4: Through enhanced mutual aid agreements DEM and LFUCG are better integrated with regional and State assets/resources
- Action 3.1.5: DEM has continued to use the State's CHAMPS system when participating in Hazard Mitigation Assistance Grants
- Action 3.2.2: DEM has conducted two courses per year and have trained nearly 300 people in CERT training
- Action 3.2.4: Over the last five years DEM has created a business community position (Business Liaison) at the EOC
- Action 5.3.2 – In 2018, DEM mapped the current siren radius at ¼ and ½ mile to display current siren coverage

6.3 Mitigation Actions

In formulating the 2020 Mitigation Strategy for LFUCG, a wide range of activities were considered to help advance the established five mitigation goals, in addition to addressing any specific hazard concerns. In order to help the community and the stakeholders understand what mitigation activities to consider, the team presented the following six broad categories of mitigation techniques: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Awareness and Education. Presenting mitigation activities examples under these category types helped the decision makers understand the kinds of activities addressed under a Hazard Mitigation Plan. The following provides example activities presented under each category:

Prevention
Preventative activities are intended to keep hazard problems from getting worse and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred, or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Open space preservation
- Floodplain regulations

Property Protection
Property protection activities involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection

Natural Resource Protection
Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, and steep slopes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Riparian buffers
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)

Structural Projects
Structural mitigation activities are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls
- Diversions / detention / retention
- Channel modification
- Storm sewers
- Storm Shelters
- Shatter proof windows

Emergency Services
Although not typically considered a "mitigation" technique, emergency service activities do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

Public Education and Awareness
Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure

6.3.1 Updating the 2013 Mitigation Strategy

To complete the review of LFUCG's Mitigation Action's, the 2013 Mitigation Action Workbook was provided to members of the LFUCG Planning Team and Stakeholders Group. Specific instructions were provided to help refine the list as well as provide information for new actions.

The LFUCG Stakeholders Group were provided two documents to help update and revise the 2013 Mitigation Strategy. On June 8, 2018 the Stantec team sent the following two attachments:

- Mitigation_Action_Workbook_Instructions
- LFUCG_Mitigation_Action_Workbook_2013_Update

The Mitigation Action Workbook Instructions document found in Appendix C provided the stakeholders with the instructions and descriptions of the needed information to develop the Mitigation Action Workbook. The LFUCG Mitigation Action Workbook 2013 Update was an excel file that was LFUCG's Mitigation Action Workbook from the 2013.

At the June 21, 2018 Mitigation Strategy meeting the Mitigation Strategy feedback was reviewed and additional comments were captured. After this meeting the LFUCG Planning Team put together the final 2020 Mitigation Action Workbook and prioritized the actions.

Mitigation Action Prioritization

Mitigation action prioritization emphasizes the extent to which benefits are maximized, according to a review of the proposed projects potential benefits and their associated costs. Through the Benefit-Cost Prioritization Matrix (Table 6.1), the higher the action's benefit, and the lower the cost, the more cost beneficial and higher priority the action was determined to be for the LFUCG community.

The benefit scale is based on using a simplified version of FEMA's Mitigation Action Evaluation Worksheet (see Appendix H). For each Action, the Planning Team identified the potential benefits using the following criteria as laid out in the Mitigation Action Evaluation Worksheet.

- Enhance Life Safety
- Protect Property
- The Action is Technically Feasible
- The Action is Political Feasible
- The Action is Legal
- Positive Environmental Impacts
- Positive Social Impact
- Administrative Capability
- Local Champion
- The Action Advances Other Community Objectives

The Planning Team using the criteria described above ranked each action's potential benefit as "very high," "high," "moderate," or "low". This information provided the benefit variable for the Benefit Cost Prioritization Matrix and methodology.

Next, the Planning Team using information captured at the Mitigation Strategy meeting and the Mitigation Action Workbook update exercise determined a rough cost estimates that were scored based on which category they fell within.

- Low Estimated Cost ($0 - $4,999)
- Moderate Estimated Cost ($5000 - $49,999)
- High Estimated Cost ($50,000 - $249,999)
- Very High Estimated Cost ($250,000 - Above)

Once the general benefit and cost of the project was determined, the Planning Team determined the priority of each action item based on the following Benefit Cost Prioritization Matrix (Table 6.1). This simplified decision-making chart, uses rough cost estimations and the mitigation benefit evaluation variables to assign a prioritization ranking for each action item. Those action items that receive a higher-ranking signal projects that could need special attention. Inversely, projects that are estimated to be higher in cost with a lower benefit receive a lower ranking. It is important to note that this Benefit Cost methodology is to be used as a first pass screening tool. This methodology provides a simplistic Benefit-Cost model and depending on the action item a more detailed Benefit-Cost model maybe needed in the future.

Table 6.1: Benefit-Cost Prioritization Matrix

Prioritization Matrix					
		Benefit			
		D (Low)	C (Moderate)	B (High)	A (Very High)
Estimated Cost	Very High	Low	Low	Moderate	High
	High	Low	Moderate	Moderate	Very High
	Moderate	Low	High	High	Very High
	Low	Moderate	High	Very High	Very High

The following key elements are captured within the 2020 Mitigation Action Workbook to help LFUCG comprehend and track each action over the next five years.

- Action Number: Each identified hazard is represented, and the Actions are broken down by which Goal they fit within. For example, 1.1, represents Goal 1, Action 1.
- Description: Briefly describes the action or mitigation project
- Timeframe: Timeframe goals for each action
- Hazard(s) Addressed: Describes the hazard type
- Office Responsible: Identifies which LFUCG departments and other outside organizations will be responsible for leading, participating, and working to complete this action item (see acronym Appendix I)
- Funding/Budget Considerations:
  - ***Grant*** = Action item potentially funded through various grant sources (FEMA HMA and others)
  - ***Internal*** = General normal operating budget funding from DEM and other departments
  - ***Departmental*** = Departmental annual budget funding through other LFUCG departments
- Estimated Cost: General estimated cost numbers broken down into categories to be used within the BC prioritization process
- Benefits: The benefit scale is based on using a simplified version of FEMA's Mitigation Action Evaluation Worksheet (see Appendix H
- BC Prioritization: Uses the estimated costs and the mitigation benefit evaluation variables to assign a prioritization ranking for each action item.

For the 2020 Plan, LFUCG currently has 46 Hazard Mitigation actions, new Mitigation Actions are highlighted in light blue. It is important to note the following Mitigation Actions are also located in an excel based Mitigation Action Workbook that members of DEM will use to manage and maintain during Plan Maintenance.

2020 Mitigation Action Workbook

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
1.1	Research and determine best practices, standard equipment, and human capital needed by the fire departments, law enforcement and other public agencies to respond to, and recover from, hazard events.	Annually	All Identified Hazards	Public Safety Agencies	Grant, Internal	$5,000 – $49,999 (Moderate)	Very High	Very High
1.2	Inventory existing local and regional fire department, law enforcement, and equipment from other public agencies to determine which additional natural and man-made hazards related equipment and personnel is needed.	Annually (2019 New Commodity Study)	All Identified Hazards	Public Safety Agencies	Grant, Internal	$50,000 - $249,999 (High)	Very High	Very High
1.3	Utilizing available funding sources (grant, internal etc.), purchase required fire department and law enforcement equipment, and training needed for public agencies to respond to, and recover from, hazard events.	Annually	All Identified Hazards	Public Safety Agencies	Grant, Internal	$0 - $4,999 (Low)	Very High	Very High
1.4	Ensure First Responders and Fayette County School District Staff have access to and are trained on how to use I-Speak cards, telephone, and in-person interpreters for emergency purposes.	1-2 Years (Annually)	All Identified Hazards	Fayette County Public Schools, First Responders, Communications, Multicultural Affairs	Grant, Internal	$5,000 – $49,999 (Moderate)	High	High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
1.5	Provide cross-cultural communication training to first responders to educate and assist with cross-cultural education with the LEP population.	1-2 Years (Annually)	All Identified Hazards	First Responders, LEP Experts and Support Groups, Multicultural Affairs	Internal	$5,000 – $49,999 (Moderate)	High	High
1.6	Continue to review opportunities to upgrade and enhance existing DEM facilities.	1-5 Years	All Identified Hazards	DEM, 911	Grant (FEMA HMA), Internal	$50,000 - $249,999 (High)	Very High	Very High
1.7	Explore funding opportunities for community saferoom construction in accordance with FEMA guidelines.	Annually	Severe Storm, Tornado, Hail	DEM	Grant (FEMA HMA), Internal	$50,000 - $249,999 (High)	High	Moderate
1.8	Obtain funding to enhance and upgrade existing outdoor warning systems.	Annually	Severe Storm, Tornado, Hail, HAZMAT, Dam Failure	DEM	Grant (FEMA HMA), Internal	$250,000 – Above (Very High)	High	Moderate
1.9	Continue to seek and obtain funding through the Chemical Stockpile Emergency Preparedness Program (CSEPP) for planning, training, and exercising with the depot, surrounding counties, and the state of Kentucky.	Annually	HAZMAT	DEM, DWQ, First Responders	Grant	$250,000 – Above (Very High)	Very High	Moderate
1.10	Conduct outreach to educate citizens on how to receive up-to-date evacuation instructions, shelter-in-place procedures, and information pertaining to all hazards.	Annually	All Identified Hazards	DEM, LEPC	Internal, Grant	$5,000 – $49,999 (Moderate)	Moderate	High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
1.11	Install flood marker signs that include both a "Road May Flood" sign, as well as signage indicating water depth.	1-3 Years	Flooding	DEM, Kentucky Department of Highways, DWQ	Internal, Grant (FEMA HMA)	$50,000 - $249,999 (High)	Very High	Very High
1.12	Work with local utility providers to better understand the potential risks and vulnerabilities posed to the community's utility infrastructure to all identified hazards.	Annually	All Identified Hazards	DEM, LFUCG Utility Providers	Internal	$0 - $4,999 (Low)	Very High	Very High
1.13	As resources permit, conduct resilience assessments on LFUCG owned and operated buildings to ensure that they are resistant to natural and man-made hazard events.	Annual (1-3 Years)	Earthquake, Flood, Hail, Karst/Sinkhole, Severe Storm, Severe Winter Storm, Tornado	Code Enforcement/Building Inspection, DEM , DWQ, First Responders, Risk Management	Grant (FEMA HMA), Internal	$50,000 - $249,999 (High)	Moderate	Moderate
1.14	Protect critical facilities and infrastructure from potential lighting damage by installing lighting protection measures.	Annually	Severe Storm	DEM, LFUCG Utility Providers	Internal, Grant (FEMA HMA)	$0 - $4,999 (Low)	High	Very High
1.15	Promote tornado/wind construction building materials and engineering measures.	Annually	Severe Storm, Tornado	DEM, Code Enforcement/Building Inspection, First Responders	Internal, Grant (FEMA HMA)	$5,000 – $49,999 (Moderate)	High	High
1.16	As resources permit, conduct updates, maintenance and training on Emergency Plans of LFUCG owned and operated buildings.	Annually	All Identified Hazards	Code Enforcement/Building Inspection, DEM, DWQ, First Responders, Risk Management	Internal	$5,000 – $49,999 (Moderate)	High	

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
2.1	Enhance and leverage local data infrastructures (ArcGIS Online, WebEOC, Enterprise GIS) to help the public and private stakeholders better understand their Risks and Vulnerabilities.	Annually	All Identified Hazards	LFUCG I.T., LFUCG G.I.S., Hospitals, DWQ	Internal, Grant (FEMA HMA)	$5,000 – $49,999 (Moderate)	High	High
2.2	Identify consistent data sources for the creation of a systemic LEP population data collection and dissemination protocol for hazard vulnerability information.	Annually	All Identified Hazards	DEM, LEP Experts and Support Groups, Multicultural Affairs	Internal	$0 - $4,999 (Low)	Very High	Very High
2.3	Provide information to the development community through publications and electronic resources about residential floodproofing, tornado safe rooms and community shelters, as well as guidelines and criteria for construction.	Every 2 Years	Flood, Tornado, Severe Storm	Code Enforcement/Building Inspection, DEM , Engineering, DWQ	Departmental	$5,000 – $49,999 (Moderate)	Moderate	High
2.4	Implement an acquisition program that targets environmentally sensitive land and land located within a floodplain. Projects would include a cost-benefit analysis and purchases of development rights that offer financial incentives in exchange for removal of future development rights.	Annually (1-2 Years)	Flooding	CAO Office, DWQ, Parks & Recreation, PDR, Planning	Internal, Grant (FEMA HMA)	$250,000 – Above (Very High)	Very High	High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
2.5	When resources permit, purchase and demolish floodprone structures that meet NFIP/CRS guidelines for repetitive loss or for having repeated or extensive flood damage.	Annually	Flooding	DWQ, Engineering	Grant (FEMA HMA), Internal	$250,000 – Above (Very High)	Very High	High
2.6	Evaluate the need and acquire generators for critical facilities within the County.	Annually	Severe Storm, Extreme Heat, Extreme Cold, Hail, Severe Winter Storm, Tornado, Wildfire, Flood, Dam Failure	DEM, Public Safety, First Responders	Grant (FEMA HMA), Internal	$50,000 - $249,999 (High)	High	Moderate
2.7	Continue to seek and request consistent funding sources for the completion of prioritized stormwater projects in accordance with identified priority storm water projects.	Annually	Flooding	DWQ	Grant (FEMA HMA), Departmental, WQMF	$250,000 – Above (Very High)	Very High	High
3.1	Conduct an exercise with a priority of focusing on mitigation and recovery.	2-3 Years	All Identified Hazards	DEM	Grant (FEMA HMA), Internal	$5,000 – $49,999 (Moderate)	Moderate	High
3.2	Continue to enhance relationships with regional and state assets/resources into pre-disaster planning programs.	Annually	All Identified Hazards	DEM	Departmental	$0 - $4,999 (Low)	Very High	Very High
3.3	Continue to use the state's CHAMPS system in order to participate in HMA grants.	Annually	All Identified Hazards	DEM	Internal	$0 - $4,999 (Low)	Very High	Very High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
3.4	Continue efforts to bring more neighborhoods, including LEPs, into the Neighborhood Emergency Network (NEN) and the Community Emergency Response Team (CERT).	Annually	All Identified Hazards	DEM, Multicultural Affairs	Internal	$0 - $4,999 (Low)	Moderate	High
3.5	Continue to obtain funding and support for CERT supplies and equipment, volunteer coordination, and recognition/appreciation events for volunteers.	Annually	All Identified Hazards	DEM	Grant, Internal	$5,000 – $49,999 (Moderate)	High	High
3.6	Enhance LEP partnerships; invite LEP reps to participate in public safety planning and exercises.	1-2 Years	All Identified Hazards	DEM, LEP Experts and Support Groups Multicultural Affairs	Departmental	$0 - $4,999 (Low)	Moderate	High
3.7	Increase business and private sector (i.e. the Lexington Chamber of Commerce) involvement in the emergency management system.	1-3 Years	All Identified Hazards	Commerce Lexington, DEM	Internal	$0 - $4,999 (Low)	Moderate	High
3.8	Review, assess, and make recommendations on hazard related laws, regulations, codes, policies, and other guidelines.	Every 2 Years	All Identified Hazards	DEM, Code Enforcement/ Building Inspection, Multicultural Affairs	Internal	$0 - $4,999 (Low)	Moderate	High
3.9	Monitor water supply and drought conditions to help mitigate future droughts.	Annually	Drought	DEM, DWQ, Kentucky American Water	Internal	$0 - $4,999 (Low)	Moderate	High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
4.1	Provide multi-lingual disaster related information to LFUCG agencies, media, and other LEP organizations, CERT, and the public at-large through publications and electronic resources about emergency procedures. Continue processes to evaluate prevalent languages for Fayette county.	Annually	All Identified Hazards	Code Enforcement/Building Inspections, DEM, LEPC, LEP Experts and Support Groups (International Red Cross) Multicultural Affairs, Fayette County Public Schools	Internal	$5,000 – $49,999 (Moderate)	High	High
4.2	Develop an internal outreach program, targeting new members of the Planning Commission and Division of Planning staff for the purpose of educating and providing informational materials about all hazards planning, it's importance when considering land use planning, and existing and planned mitigation efforts by DEM.	1-5 Years	All Identified Hazards	DEM, Planning	Internal	$0 - $4,999 (Low)	Moderate	High
4.3	When funding permits, conduct hazard mitigation related training seminars and workshops for local building code enforcement officials.	3-5 Years	All Identified Hazards	Code Enforcement/ Building Inspection, DEM	Grant (FEMA HMA)	$0 - $4,999 (Low)	Moderate	High
4.4	Work with local media providers to disseminate public safety messages.	1-5 Years	All Identified Hazards	DEM, Local Media Providers	Internal	$5,000 – $49,999 (Moderate)	High	High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
4.5	Encourage the incorporation of available hazard mitigation education and outreach programs/products into school programs including LEP students and their families who are not culturally or linguistically prepared.	2-4 Years	All Identified Hazards	DEM, Fayette County Public Schools, Multicultural Affairs, Private Schools	Internal Grant	$0 - $4,999 (Low)	Very High	Very High
4.6	Develop an Online Risk Assessment Open Data Portal for better Risk Assessment dissemination and education.	1-3 Years	All Identified Hazards	DEM, GIS	Grant (FEMA HMA)	$50,000 - $249,999 (High)	Very High	Very High
4.7	Promote the development of Emergency Action Plans (EAPs) by local dam owners.	1-5 Years	Dam Failure	DEM, DWQ	Internal, Grant (FEMA HMA)	$0 - $4,999 (Low)	Moderate	High
4.8	Increase education and awareness of extreme temperature risk and safety measures.	1-5 Years	Extreme Cold, Extreme Heat, Drought, Severe Winter Storm	DEM, LEP Experts and Support Groups, Multicultural Affairs	Internal, Grant (FEMA HMA)	$0 - $4,999 (Low)	Moderate	High
5.1	Develop a methodology and system to gather and archive information on local infrastructure, critical facilities, population, and hazardous material sites, as well as natural and/or man-made hazard event data. Use this information to support recovery and mitigation activities.	1-5 Years	All Identified Hazards	Code Enforcement/ Building Inspection, DEM, DWQ, Engineering, Multicultural Affairs, Public Works, Risk Management, GIS, IT	Internal, Departmental	$5,000 – $49,999 (Moderate)	Moderate	High

Action Number	Action Description	Timeframe (Years)	Hazards Addressed	Offices Responsible	Funding/Budget Considerations	Estimated Cost	Benefits	BC Prioritization
5.2	Share and distribute CRS and Lexington-Fayette County Floodplain Management Plan annual reports to LFUCG agencies and other steering committee members for review.	Annually	Flooding	DWQ, Engineering, Planning	Internal	$0 - $4,999 (Low)	Very High	Very High
5.3	Conduct outreach with the land use planning and development community for the purpose of incorporating mitigative building and development best practices into existing plans, policies, and procedures.	Annually	All Identified Hazards	DEM, Code Enforcement/ Building Inspection, Planning, Home Builders Association	Internal	$5,000 – $49,999 (Moderate)	Moderate	High
5.4	Develop enhanced geospatial data for geologic hazards (karst, earthquake) for Fayette County.	1-3 Years	Earthquake, Karst/Sinkhole	DEM, KGS, GIS	Grant (FEMA HMA)	$50,000 - $249,999 (High)	Moderate	Moderate
5.5	Promote and acquire NOAA weather radios throughout the County.	1-3 Years	Severe Storm, Tornado, Hail, Severe Winter Storm, Drought, Wildfire, Flood	DEM	Grant (FEMA HMA), Internal	$5,000 – $49,999 (Moderate)	High	High
5.6	Consider geologic hazards (sinkholes, earthquake, others) engineering in building construction and design.	1-5 Years	Earthquake, Karst/Sinkhole	DEM, Engineering, Planning	Internal	$5,000 – $49,999 (Moderate)	Moderate	High

7. Plan Maintenance

Per DMA 2000 guidance, when the Local Mitigation Plan is updated, local jurisdictions assess how the plan maintenance process worked and identify whether changes to the process are needed. Furthermore, a routine method and schedule for maintaining the plan is necessary to ensure continued risk reduction and loss avoidance.

Completing the plan maintenance process will keep LFUCG on track and serve as the basis for the 2023 plan update. The process of monitoring the plan will provide LFUCG the opportunity to document progress in achieving mitigation goals and actions. Each agency, department, or other partner participating under the Plan is responsible for implementing specific mitigation actions as prescribed in the Mitigation Strategy section. Every proposed action listed in the Mitigation Action Plan/Workbook is assigned to a specific "lead" agency or department in order to assign responsibility and accountability and increase the likelihood of subsequent implementation.

In addition to the assignment of a local lead department or agency, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. Using the Mitigation Action Workbook, members of LFUCG will seek funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, specific potential funding sources have been identified for proposed actions listed in the Mitigation Action Workbook.

Plan Maintenance Procedures

Requirement §201.6(c)(4) requires a formal plan maintenance process to ensure that the Mitigation Plan remains an active and relevant document. The plan maintenance process must include a method and schedule for monitoring, evaluating, and updating the plan at least every five years.

This section must also include an explanation of how local governments intend to incorporate their mitigation strategies into any existing planning mechanisms they have, such as comprehensive or capital improvement plans, or zoning and building codes. Lastly, this section requires that there be continued public participation throughout the plan maintenance process.

Monitoring Evaluating, and Updates

During the October 10, 2018 meeting, the Planning Team decided to renew regular meetings of the Hazard Mitigation Advisory Committee in order to facilitate and document plan maintenance progress. This committee's focus will be maintaining the plan and ensuring the mitigation strategy is implemented and incorporated into the City's planning efforts, programs, and policy. The Hazard Mitigation Advisory Committee will meet annually. Meetings will be open to the public and stakeholders who participated in the update planning process will be encouraged to continue their participation. These meetings will be led by the newly appointed Emergency Operations Manager. This position's responsibilities include the monitoring and implementation of Mitigation and Recovery throughout Fayette county.

Following the Plan Maintenance section from the 2013 Plan DEM will monitor the 2020 Five-Year Mitigation Action Workbook and associated projects on an ongoing basis. The LFUCG Planning Team and Hazard Mitigation Advisory Committee will use the "2020 Five-Year Mitigation Action Workbook" for the purpose of offering a user-friendly and interactive plan implementation tool, this excel workbook brings the Five-Year Mitigation Action Workbook and Plan Maintenance tasks to life by allowing DEM and the Hazard Mitigation Advisory Committee to continually monitor and update action item statuses within one workbook. This workbook includes tabs that include reference materials such as the plan Goals and Mitigation Actions.

To track annual progress the Planning Team has developed two plan maintenance forms/reports (Appendix J). The first one is an individual project progress report form that will be completed by the LFUCG Hazard Mitigation Advisory Committee and appropriate agencies and submitted to DEM on an annual basis. These reports are designed to allow responsible agencies and organizations the ability to list successes and/or potential issues with implementing responsible action items within the mitigation Five-Year Action Plan. In addition, a plan amendment form was developed to track potential changes to the plan itself, prior to the next 5-year update. These forms will be used by the Emergency Operations Manager to help maintain the progress of the plan over the next 5-years and be used when updating the 2024 Hazard Mitigation Plan. The continuous monitoring and formalized annual review will serve as the basis for the annual report, which will be completed one-year plan adoption.

Evaluating means assessing the effectiveness of the plan at achieving its stated purpose and goals. In combination with the strategy for monitoring, the LFUCG, DEM, and members of the Hazard Mitigation Advisory Committee will evaluate the status and progress of the plan elements on an annual basis by meeting and reporting. DEM will partner in facilitating the annual update process for the HMP. By incorporating the CRS requirements for reporting updates from the Floodplain Management Plan (FMP), the annual report for the Hazard Mitigation Plan will provide the status of mitigation actions and goals, beginning in 2020.

As appropriate, the Plan will be evaluated after a disaster, or after unexpected changes in land use or demographics in or near hazard areas. The Hazard Mitigation Advisory Committee also will be kept apprised of a change in federal regulations, programs and policies, such as a change in the allocation of HMGP or PDM grant dollars. These evaluations will be addressed in the annual Progress Report for the Plan and may affect the Action Plan.

Continued stakeholder evaluation of the plan and achievement of goals and actions will be provided annually through a survey of stakeholders that will seek information about the agency or organization's activities with respect to hazard mitigation. To accomplish this, DEM will explore adding mitigation questions into already existing survey mechanisms that are distributed on an annual basis.

The annual progress report will be approved by the Hazard Mitigation Advisory Committee. This Plan Maintenance process includes, but is not limited to, the proposal and passage (by majority vote) of updates to the Five-Year Mitigation Action Workbook by the Hazard Mitigation Advisory Committee during a regular annual or post-disaster meeting. DEM will document changes to the Five-Year Mitigation Action Workbook, including the responsible agency and timeframe for action item completion. Any needed changes to the Hazard Mitigation Plan will be documented in the annual update report. For public notification, a press release will provide the web-link to the annual progress report, which will be located on DEM's website.

LFUCG will also utilize Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) to track mitigation strategies and apply for HMGP funding when it becomes available.

Incorporation into Existing Planning Mechanisms

LFUCG will integrate the 2020 LFUCG Hazard Mitigation Plan into relevant city government decision-making processes, plans, or mechanisms, where feasible. This includes integrating the requirements of the Hazard Mitigation Plan into other local planning documents, processes, or mechanisms, such as comprehensive or capital improvement plans, when appropriate.

LFUCG has a successful track record of integrating hazard mitigation planning elements into other planning mechanisms where applicable/feasible. Examples of how this integration has occurred have been documented in Section 7: Capability Assessment. Specific examples of how integration has occurred include the following:

- **Imagine Lexington: 2019 Comprehensive Plan:** One of the themes of the Goals and Objectives is "Protect the Environment" Goals that support Hazard Mitigation Planning in this section include continued implementation of the Consent Decree, reduction of carbon footprint, and protection, conservation, and restoration of natural resources.
- **2017 Rural Management Plan:** This plan is dedicated to the planning and management of the land uses in the Rural Service Area. One of the plan goals is the protection of environmentally sensitive areas and wildlife habitat. According to the plan, the Rural Service Area has around 7.783 acres of FEMA floodplain. The Kentucky Agriculture Water Quality Act requires a Water Quality Plan that aims to improve quality of drinking water and control flooding.
- **LFUCG Floodplain Ordinance:** In March 2017 the Floodplain Conservation and Protection Ordinance was updated. The purpose of this ordinance is the designation of flood hazard areas for public awareness, minimization of property damage, minimization of ground water pollution and erosion.
- **Zoning Ordinance – General Zone Requirements:** Exemptions to zoning regulations apply to agricultural land, however buildings or structures in the designated floodplain must fully comply with flooding regulations.
- **Sinkhole Ordinance**: The Sinkhole Ordinance prohibits the fillings of sinkholes and limits development within their boundary as well as the discharge of storm water into sinkholes. Sinkhole boundaries are defined on topographic maps with 5-foot contours. Non-developable areas maybe set aside for open space. The ordinance also enforces sinkholes and surrounding areas to be shown on any development or preliminary subdivision plan.
- **Expansion Area Master Plan:** It outlines the importance of conservation of environmentally sensitive areas. Sinkholes lands with steep slopes must not be developed. Stream corridors including floodways and floodplains should be protected Storm water should be managed and controlled to ensure that pollutants are not discharge directly or indirectly into the surface of water bodies.

The members of the LFUCG Stakeholders Group and the Hazard Mitigation Advisory Committee will remain charged with ensuring that the goals and mitigation actions of new and updated local planning documents for their agencies or city service areas are consistent, or do not conflict with, the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability within LFUCG.

Continued Public Involvement

Public participation is an integral component to the hazard mitigation planning process and will continue to be essential as this Plan evolves over time. Public involvement procedures were reviewed as part of the 2020 plan update. As described above, significant changes or amendments to the Plan shall require a public hearing prior to any adoption procedures. Annual Hazard Mitigation Advisory Committee meetings will also be open to the public. In addition, LFUCG regularly posts information about hazard and risk assessment on city communication channels and DEM's website. LFUCG's hazard mitigation planning website will be used to provide updates and post the most current version of the plan: http://bereadylexington.com/lexington-updates-hazard-mitigation-plan/

By keeping the plan available on the city's website with an invitation and instructions on providing feedback, public awareness and comment opportunities will be maintained on a round-the-clock basis, 365 days per year.

Other efforts to involve the public in the maintenance, monitoring, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising the Annual Hazard Mitigation Plan meeting on the city website, social media channels, local newspapers, public bulletin boards and/or city office buildings;
- Designating willing and voluntary citizens and private sector representatives as official members of the Hazard Mitigation Advisory Committee;
- Keeping a current version on the hazard mitigation plan in public libraries and the division of planning and the emergency management office.

8. Plan Adoption

> **Local Mitigation Plan Prerequisites**
>
> **§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).**

Adoption by the local governing body demonstrates a commitment to fulfilling the hazard mitigation goals and actions outlined in the plan. Updated plans also are adopted to demonstrate community recognition of the current planning process, changes that have occurred within the previous five years, and validate the community priorities for hazard mitigation actions. The local jurisdiction submitting the plan must satisfy the plan adoption prerequisite before the plan can be approved by FEMA.

The plan was formally adopted by the Urban County Council on xxx (Appendix K). The endorsement of this plan demonstrates Lexington Fayette County's commitment to fulfilling the mitigation objectives outlined in the plan. It also legitimizes the plan and authorizes the responsible agencies identified in the plan to execute their responsibilities.

The plan submittal process began with DEM submitting the plan to the KyEM for review and comment and then incorporating any revisions. KyEM then submitted the plan to FEMA Region IV for approval, pending local adoption status. Please see Appendix L for approved Local Mitigation Plan Review Tool.

9. Appendices

Appendix A: Plan Meeting Information

The following information is broken down for each of the four Planning Meetings and the Public Review Documentation:

- Invites
- Agendas
- Sign-In Sheets
- Notes
- Public Review Documentation

2-15-18 Invite:

LFUCG Hazard Mitigation Plan 2018 Update
Draft Steering Committee invitation

To: Steering Committee
From: Pat Dugger
Subject: LFUCG Hazard Mitigation Plan Steering Committee

Greetings All,

I am writing to request your participation on our Hazard Mitigation Steering Committee for the 2018 update to the LFUCG Hazard Mitigation Plan. Your unique expertise and role in the community enables you to offer valuable contributions to the planning process. The Steering Committee Kick-Off Meeting will be held from 0900-1200 on February 15th, at the Public Safety Operations Center, 115 Cisco Road.

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility. Lexington's current plan will expire on March 21, 2018.

We will hold 4 Steering Committee meetings/workshops in conjunction with 3 public meetings/workshops throughout the planning process during which we will ask for your participation in developing the plan. Additionally, we will have smaller meetings in which we may ask for you to contribute based on your specific expertise or the agency/organization you represent.

Thank you for your participation in this important project. Please feel free to nominate someone else from your agency if you are unable to participate. We look forward to seeing you at 0900 on February 15.

Sincerely,

Pat Dugger
Director
LFUCG Department of Emergency Management

LFUCG 2018 Hazard Mitigation Plan Update

Steering Committee Kick-Off Meeting
February 15, 2018
9:00 am-11:30 am

Agenda	
Welcome	**Tim Brandewie, DEM**
Hazard Mitigation Planning 101	**Josh Human, Stantec**
Hazard Ranking & Identification Exercises	**John Bucher, Stantec**
Data Needs & Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility. Lexington's current plan will expire on March 21, 2018.

The updated plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Lexington-Fayette Urban County Council for adoption.

Contacts

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Josh Human
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502.618.5873

John Bucher
Stantec
john.bucher@stantec.com
502.212.5044

Data Needs - Capability and Vulnerability Assessments

The list below includes examples of the types of data we will need to complete the capability and vulnerability assessments for the Hazard Mitigation Plan. Where applicable, data should be in a GIS format.

1. **Past Presidential Disaster Declarations**
   Any information on their past presidential declarations. When they happened, what hazards were involved, how many people were effected etc…

2. **Past Significant Hazard Events**
   - With estimated losses
   - With estimated recovery costs
   - With estimated non-recovered costs
   - NFIP costs/payouts/claims
   - Locations of past hazard events

3. **Community Profile & Capabilities**
   - Population composition
   - Community history
   - Population growth trends/rates
   - Land area and Geography
   - Climate
   - Land Use trends
   - Housing composition
   - Economic makeup
   - Transportation corridors (HAZ/MAT)
   - Related plans, initiatives, ordinances, and policies
   - Staff with related responsibilities
   - Completed mitigation actions and related projects (planning, development, capital improvement)

4. **Critical or Vulnerable Facilities**
   - EMS locations
   - Hospitals
   - Fire stations
   - Medical complexes
   - Outpatient care centers
   - Long Term Care Facilities
   - Emergency Operation Centers
   - Shelters
   - HazMat sites
   - Mobile home parks
   - Roads
   - Schools
   - Police
   - Structures of economic significance
   - Historic Structures
   - Government owned buildings
   - Retail centers

5. **Infrastructure & Property Data**
   - Dams
   - Floodplains
   - Tornado sirens
   - Tornado shelters
   - Roads
   - Railroads
   - Airports
   - Residential/Commercial/Industrial buildings (PVA preferably in a GIS format)
   - Utilities
     - Sewer treatment sites
     - Water pumping stations
     - Electric generation and/or transmission
     - All lines/pipelines
     - Flood water pumping stations
     - Flood wall

LFUCG 2018 Hazard Mitigation Plan
Steering Committee Kick-off
January 30, 2018 10:00am-12:00pm

LEXINGTON

Stantec

EMERGENCY MANAGEMENT

Name	Title	Department	Email	Phone
Ralph McCracken		Lex Fay County Health Dept	Ralph.McCracken@lfchd.gov	859-899 4242
Tom Martin	SENIOR PLANNER	LFUCG Div of Planning	[illegible]@lexingtonky.gov	258-3182
John Bobzel	PIO	Lexington EMA	JBobzel@lexingtonky.gov	280-8067
Greg Lubeck	Eng Sect Mgr	DWQ	glubeck@lexingtonky.gov	258 3446
Joe Bryant	Supervisor Building Insp.	BI	jbryant@lexingtonky.gov	258-3259
Alex Olszowy	MANAGER	BI	alexo@lexingtonky.gov	258-3257
Clayton Oliver	Emergency Management Specialist	UKPD	clayton.oliver@uky.edu	859-421-3[illegible]
Brad Kirchner	MANAGER	KAW	brad.kirchner@amwater.com	859-268-6373
Dustin Baker	GIS DEVELOPER	DWQ / CS / DES	dbaker@	859-258-3466
Jason Dyal	Training Manager	Lextran	JDyal@Lextran.com	859-361 1573
Kevin Brown	Dep. CAO	LFUCG	GBrown3@LexingtonKY.Gov	859-258-3133

LFUCG 2018 Hazard Mitigation Plan Steering Committee Kick-off January 30, 2018 10:00am-12:00pm

Name	Title	Department	Email	Phone
Patrick Johnston	Director Risk Mgt.	LFUCG-Div. Risk Mgt.	PatrickJ@lexingtonky.gov	859 258-3290
Rob Larkin	Major LFD Special Ops Cdr	LFUCG Fire	larkinr@lexingtonky.gov	859 599-1129
John Givens	Director Risk Mgt	Lextran	jgivens@lextran.com	859 244-2033
Chester L. Hicks	Administrative Officer	LFUCG - Env. Qual. + Public Works	chicks@lexingtonky.gov	859-258-3407
Laurel Wood	Business Continuity	UKPD-CMP	laurel.wood@uky.edu	859-257-6655
Mike Greene	Manager	Stantec	mike.greene@gmail.com	859 608 0309
Isabel G. Taylor	Multicultural Affairs Coord.	LFUCG/Global Lex	itaylor@lexingtonky.gov	859-258-3824
Nick Grinstead	Planner/Project Manager	UK-HMGP/KYEM	nick.grinstead@uky.edu	(859) 257-3807

Stantec

Meeting Notes

LFUCG Hazard Mitigation Plan Stakeholder Group Kickoff	
Date/Time:	February 15, 2018 / 9:00
Place:	LFUCG Public Safety Operations Center
Next Meeting:	April 18, 2018
Attendees:	Alex Olszowy, Brad Kinckiner, Chester Hicks, Clayton Oliver, Dustin Baker, Glenn Brown, Greg Lubeck, Isabel Taylor, Jason Dyal, Joe Bryant, John Bobel, John Givens, Laurel Wood, Nick Grinstead, Patrick Johnston, Ralph McCracken, Rob Larkin, Tim Brandewie, Tom Martin, Josh Human, John Bucher, Katherine Osborne, Mike Greene

Tim Brandewie offered a welcome with an introduction to the EOC and kicked-off the meeting.

Josh Human gave an overview of the agenda and asked the attendees to introduce themselves and say what their role is in relation to hazard mitigation.

Josh gave a detailed introduction to hazard mitigation planning.

John Bucher then led the group through a hazard ranking exercise that will help prioritize mitigation actions in the final plan.

- Question about whether or not FEMA would pay for mitigation actions related to extreme heat and cold. Typically not for individuals, charities and VOADs usually support vulnerable populations, FEMA may supplement shelter operations
- Comment that Extreme heat/cold should definitely be included, as they exacerbate other problems and increase Fire/EMS calls.
- Comment that we would need to be able to quantify expenses related to heat & cold.
- Clarification that wind storms are included in severe storms
- Question about cyber terrorism and technological hazards. They aren't directly covered by FEMA hazard mitigation plans, but can be addressed, because some of their consequences and prevention/response capabilities overlap with some natural hazards. We can identify assets important to technological events and label them critical facilities and protect them in ways similar to HazMat and other hazards.

Discussion about FEMA flood amps and how determined and if they compare substantial damage to repetitive loss. Not really an issue here, only 3 repetitive loss properties in Fayette County.

Josh described the data needs to complete the risk assessment.

Josh introduced the capability assessment and asked the group to look for it in their email, complete it, and return it.

Next meeting will be schedule for April 12.

Design with community in mind

hj v:\1756\active\175657174\gis\document\planning_process\meetings\stakeholders_kickoff_02152018\stakeholder_kickoff_meeting_notes.docx

4-18-18 Invite:

MAYOR JIM GRAY

LEXINGTON

PATRICIA L. DUGGER, RS MPA
DIRECTOR
EMERGENCY MANAGEMENT

Memorandum

To: Mitigation Plan Update Steering Committee Members
Fr: Patricia L. Dugger, RS, MPA
Subject: Risk Assessment Workshop
Date: April 9, 2018

Please join us for the Risk Assessment Workshop for the 2018 update to the LFUCG Hazard Mitigation Plan on Wednesday, April 18, 2018 at 2:00pm. The workshop will be held at the Fayette County Agricultural Extension Office, 1140 Harry Sykes Way, Lexington, KY 40504.

In the Risk Assessment Workshop, we will present the preliminary results of the risk assessment and ask for your help in identifying additional areas of concern. We will also ask for your help in locating critical facilities and vulnerable populations that deserve attention in the Hazard Mitigation Plan.

Thank you for your participation in this important project. Please feel free to nominate someone else from your agency if you are unable to participate. We look forward to seeing you at 2pm on April 18.

115 Cisco Road Lexington, KY 40504 tel: 859-280-8080 www.BeReadyLexington.com

LFUCG 2018 Hazard Mitigation Plan Update

Risk Assessment Stakeholder Meeting Workshop
April 18, 2018
2:00 pm – 4:00 pm
Fayette County Agriculture Extension Office
1140 Harry Sykes Way, Lexington, KY 40504

Agenda	
Welcome	**Tim Brandewie, DEM**
Capability Assessment Overview	**John Bucher, Stantec**
Risk Assessment Overview	**Josh Human & John Bucher, Stantec**
Mitigation Strategy Overview	**Josh Human, Stantec**
Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility.

The updated plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Lexington-Fayette Urban County Council for adoption.

Contacts

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John Bucher
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502.212.5044

LFUCG 2018 Hazard Mitigation Plan Steering Committee Risk Assessment Workshop
April 18, 2018 2:00pm - 4:00pm

LEXINGTON-FAYETTE EMERGENCY MANAGEMENT

LEXINGTON

Stantec

Name	Title	Department	Email	Phone
William Andrews	Geologist, Section Head	Ky Geological Survey	wandrews@uky.edu	859-323-0506
Brad Kinckner	Safety Lead	KY Am Water	brad.kinckner@amwater.com	859-268-6323
Theresa Owen	Project Engineer Coord.	LFUCG DWQ	towen@lexingtonky.gov	859-258-3426
Jason Dyal	Training Mgr Lextran	Lextran	JDyal@Lextran.com	859-361-1573
Rob Larkin	Major	Lexington Fire Dept	larkin@lexingtonky.gov	859 [illegible] 1129
Joe Bryant	Supervisor Building Inspector	Building Inspection	jbryant@lexingtonky.gov	859-258-3259
Chester Hicks	Administrative Officer	EQ + PW	chicks@lexingtonky.gov	859-258-3407
Tim Brandewie	EM Operations	LFUCG DEM	—	621-1681
Patrick Johnston	Director	LFUCG Risk Mgt.	patrickj@lexingtonky.gov	258-3290
Isabel Taylor	Multicultural Affairs Coord.	LFUCG/Global Lex	itaylor@lexingtonky.gov	258-3824

4-18-18 Public Invite:

MAYOR JIM GRAY

LEXINGTON

PATRICIA L. DUGGER, RS MPA
DIRECTOR
EMERGENCY MANAGEMENT

Lexington Residents Invited to First Mitigation Planning Public Meeting

(Lexington, KY – April 9, 2018) Lexington Emergency Management will host the first of three public meetings for the 2018 Update to the LFUCG Hazard Mitigation Plan at 6:00pm on Wednesday, April 18, 2018. The meeting will be held at the Fayette County Agricultural Extension Office, 1140 Harry Sykes Way, Lexington, KY 40504.

The hazard mitigation planning process is required under federal law to help communities better prepare for natural and hazardous-materials disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Mitigation plans must be updated and approved every five years to maintain eligibility. Lexington's current plan expires in 2018.

The April 18 meeting will be an interactive workshop, in which participants will be asked for their help in identifying areas that experience or have the potential to experience one of the hazards listed below. Participants will also be asked for help in locating critical facilities and vulnerable populations that deserve attention in the Hazard Mitigation Plan. The following hazards will be included in the plan:

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Extreme Cold
- Flood
- Hailstorm
- Hazardous Materials
- Karst/Sinkhole
- Landslide
- Mine Subsidence
- Severe Storm
- Severe Winter Storm
- Tornado
- Wildfires

The final plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to LFUCG Council for adoption.

More information is available from the Lexington Emergency Management website: BeReadyLexington.com. Information is also available on the DEM Facebook page – LexingtonKYEM – and also on Twitter - @lexkyem.

# # #

For more information, contact:
John Bobel
Public Information Officer
859-280-8067
jbobel@lexingtonky.gov

115 Cisco Road Lexington, KY 40504 tel: 859-280-8080 www.BeReadyLexington.com

Public Meeting
April 18, 2018
6:00 pm - 7:00 pm
Fayette County Agriculture Extension Office
1140 Harry Sykes Way, Lexington, KY 40504

Agenda

Welcome	**Tim Brandewie, DEM**
Hazard Mitigation Plan Overview	**Josh Human & John Bucher, Stantec**
Map Showcase	**Josh Human & John Bucher, Stantec**
Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility.

The updated plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Lexington-Fayette Urban County Council for adoption.

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John Bucher
Stantec
john.bucher@stantec.com
502.212.5044

LFUCG 2018 Hazard Mitigation Plan
Public Meeting - Risk Assessment
April 18, 2018 2:00pm - 4:00pm

Name	Title	Department	Email	Phone
Michael Kovash			Kovash@g.uky.edu	230-1018

LFUCG 2018 Hazard Mitigation Plan Stakeholder/Public Risk-Assessment Meeting

LFUCG 2018 Hazard Mitigation Plan / Stakeholder and Public Risk-Assessment Meeting

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Date/Time:	April 18, 2017 / 2:00 – 7:00 pm
Place:	LFUCG Cooperative Extension Service
Next Meeting:	May 1, 2018
Attendees:	14 – Tim Brandewie, Brad Kinckiner, Tom Martin, William Andrews, Patrick Johnson, Theresa Owen, Joe Bryant, Isabel Taylor, Jason Dyal, Chester Hicks, Rob Larkin, Luisa Trujillo, Josh Human, John Bucher: Public Meeting: Michael Kovash

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Tim Brandewie LFUCG Operations and Recovery Manager Safety welcomed and thanked all attendees.

Safety Moment – Tim explained the evacuation procedures and location or the nearest emergency exit.

Tim briefly explained the importance of having a Hazard Mitigation Plan. Tim, then introduced the Stantec team including Josh Human, Senior Hazard Mitigation & Resilience Leader, John Bucher, Senior Planner, and Luisa Trujillo, GIS Analyst and Planner.

Josh Human Stantec started the presentation for Risk Assessment. He asked the audience to introduce themselves and tell how their role relates to the hazard mitigation plan. Josh Human's presentation included a brief introduction to Hazard Mitigation 101 description, then he described the previous steps for the planning process. Then he introduced the methodology used by Stantec for the Risk Assessment. John Bucher expanded details about the methodology. He explained the use of the 100 Military grid with the purpose of avoiding data bias occurring while Census blocks or Census tracks that are not all the same size.

The next section involved a discussion about the Capability Assessment, which is a section of the Hazard Mitigation Plan that compiles and describes plans, ordinances, and other resources that are already in place in the city of Lexington and may contribute to identify funding opportunities and partnerships. The participants offered the following suggestions to contribute in the Capability Assessment:

- Greenways Plan as a natural resource plan - includes conservation of floodways
- Flood response – Included in EOP, also includes recommendations for planning and projects around WWTPs
- Disaster recovery covered in ESF-14 of EOP
- COOP from 2010 for pandemic flu, otherwise covered in some departmental plans.
- LFUCG does not have an evacuation plan in place yet.
- 6-year Traffic Improvement plan involves transportation planning projects such as a bridge replacement. These projects typically include flooding studies.
- Tree protection program/ordinance is in the developing process. The city's zoning ordinance has a tree coverage requirement.
- LFUCG Community Development Office oversees and supports other city departments in the applications for grants and administers CDBG funds.
- The city's Budget's Office maintains a list of capital improvement projects
- Some funding options include the the Sanitary Sewer Fund through the Impermeable fee, the Water Quality Management Fee, and the Urban Service Tax.

- The RMP (consent decree) funds storm water projects
- Both the Environmental Quality and Water Quality and Public Works departments have GIS capabilities.
- LFUCG has some mutual aid agreements with surrounding counties and an intergovernmental Storm Water agreement with Jessamine County.
- The city uses exaction fees on new development to fund required infrastructure improvements and amenities like parks and schools
- Agreement with KYTC for snow removal, also has a Snow and Ice Removal Plan
- Royal Springs Aquifer Committee – intergovernmental committee to protect water quality
- Purchase of Development Rights (PDR) Program used to protect open space and included in the floodplain management plan

After discussing the Capability Assessment, John Bucher described the Risk Assessment process by mentioning the Composite Exposure score which adds different variables such as Total Population, Infrastructure, Critical Facilities, Properties, Government Properties and Social Vulnerability. This last variable is composed of vulnerable populations (age under 5 and over 65), education of less than bachelor's degree, disability, poverty, no health insurance, unemployment and none or low level of English.

Isabel Taylor, Director of Multicultural Affairs, asked how the data about language was collected. John Bucher responded by saying that all the population information was collected from Census. Isabel suggested better language data from collected from the Fayette County Public Schools in 2009. Other member of the public agreed that there may be better data for language information in Lexington. Isabel added that the international population in Lexington, KY has significantly increased since 2009.

A suggestion was made to include UK student population in residence halls in the population exposure score.

Josh then introduced the Mitigation Strategy. He discussed the types of projects usually included and gave examples:

- Prevention
- Property Protection
- Structural Projects
- Natural Resource Protection
- Emergency Services
- Public Education and Awareness

The West Hickman WWTP plant was discusses as a potential mitigation action.

Josh then told the group that he will be sending a workbook for them to help with the Mitigation Strategy update. The workbook will have the mitigation actions from the previous plan and a space for the group to add a status update. The workbook will also have space for them to suggest new action. At the next meeting the group will discuss the mitigation strategy and work on completing the list of mitigation action.

A suggestion was made to have the committee evaluate the plan each time we have an event to see if there are actions that could have prevented damage that were not completed, was an action completed that prevented damage, or did the plan not include an action to address that hazard event.

To conclude the meeting, the Stantec team asked the audience if they have any more questions and suggested they contact the Stantec team directly with specific questions or suggestions. The next meeting's date TBA.

6-21-18 Invite:

LFUCG Hazard Mitigation Plan 2018 Update
Stakeholders Invitation

To: Stakeholder Group
From: Pat Dugger
Subject: LFUCG Hazard Mitigation Plan Steering Committee

Greetings All,

Please join us for the Mitigation Strategy Workshop for the 2018 update to the LFUCG Hazard Mitigation Plan on Thursday, June 21, 2018 at 2:00pm. The workshop will be held at the LFUCG Public Safety Operations Center, 115 Cisco Road, Lexington, KY 40504.

In the Mitigation Strategy Workshop, we will discuss your contributions to the Mitigation Strategy Workbook and the mitigation actions to be included in the draft plan. Potential actions may include physical projects, policy changes, and educational outreach.

Thank you for your participation in this important project. Please ask someone else from your agency to attend if you are unable to participate. We look forward to seeing you at 2pm on June 21.

Sincerely,

Patricia Dugger RS MPA
Director
LFUCG Division of Emergency Management

LFUCG 2018 Hazard Mitigation Plan Update

Mitigation Strategy Workshop
June 21, 2018
2:00 pm - 4:00 pm
LFUCG Public Safety Operations Center
115 Cisco Road, Lexington, KY 40504

Agenda

Welcome	**Tim Brandewie, DEM**
Planning Process Update	**Josh Human, Stantec**
Mitigation Strategy Overview	**Josh Human, Stantec**
Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility.

The updated plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Lexington-Fayette Urban County Council for adoption.

Contacts

Pat Dugger, Director
LFUCG DEM
patd@lexingtonky.gov
859.280.8060

Tim Brandewie, Emergency Operations Manager
LFUCG DEM
rbrandew@lexingtonky.gov
859.280.8054

Josh Human
Stantec
josh.human@stantec.com
502.618.5873

John Bucher
Stantec
john.bucher@stantec.com
502.212.5044

Mitigation Action Matrix Instructions

Column A, Action: Provides the Action number used within the 2013 LFUCG Hazard Mitigation Plan.

Column B, Category: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, Public Education/awareness

Column C, Timeframe (Years): Describe a timeframe goal for completion. Please provide as much detail on the timeframe of this action as possible. For example, it could be an Action that is completed annually, or it could have a goal to be done in 2 years.

Column D, Hazards Addressed: Describe the hazards that will be addressed through this Action. Our identified Hazards include (Dam Failure, Drought, Earthquake, Extreme Heat, Extreme Cold, Flood, Hailstorm, HazMat Karst/Sinkhole, Severe Storm, Severe Winter Storm, Tornado, Wildfires).

Column E, Description: Describe in detail the Mitigation Action/Project. We want you to review this column and make sure the way the Action is described is still valid or feel free to make changes according to your current desires for the Action. When creating a new Action please provide details about the new Action.

Column F, Offices Responsible: Identifies the LFUCG departments and other outside organizations that are responsible for leading, participating, and working to complete this Action item. Please update this field to reflect current office titles and add offices that should participate or lead the Action.

Column G, Funding/Budget Considerations: Provide as much detail here as possible. If you do not have detail feel free to use words like Grant, Internal, Departmental and others to describe the funding in general terms.

Column H, Comments: Provide detailed comments about the implementation or enhancements of the Action item. Has this Action item been completed, by whom and when, has there been a new Action added in its place that replaces this one, and or was this Action item edited to reflect changes needed.

Column I, Edits: Provide your contact information to the edits you made for tracking purposes.

LFUCG 2018 Hazard Mitigation Plan Steering Committee Mitigation Strategy Workshop

June 21, 2018 2:00pm - 4:00pm

LEXINGTON

Stantec

Name	Title	Department	Email	Phone
Tim Brandewie	Fayette DEM	DEM	Rbrandewie@lexingtonky.gov	859 621-1681
Josh Human	Stantec		josh.human@stantec.com	502 618-5873
Barrett Schoeck	Emerg Prep Coor.	LFCHD	barrettc.schoeck@ky.gov	859 595-0400
Theresa Owen	DWQ Proj. Eng Coord.	DWQ	towen@lexingtonky.gov	859-258-3426
Dustin Baker	DES/IT/GIS/DWQ	ES / DWQ	dbaker@lexingtonky.gov	x3414
John Bissell	PIO	DEM	JBissell@lexingtonky.gov	x8706
Patrick Johnston	Director, Risk Mgt.	Risk Mgt.	PatrickJ@lexingtonky.gov	859-258-3290
John Bucher	Stantec		johnbucher@stantec.com	

Stantec

Meeting Notes

LFUCG 2018 Hazard Mitigation Plan Stakeholder Mitigation Strategy Meeting

Date/Time:	June 21, 2017 / 2:00 pm
Place:	LFUCG Public Safety Operations Center
Next Meeting:	TBD
Attendees:	8 – Tim Brandewie, Patrick Johnston, Theresa Owen, Barrett Schoeck, Dustin Baker, John Bobel, Josh Human, John Bucher

Tim Brandewie LFUCG Operations and Recovery Manager Safety welcomed and thanked all attendees.

Josh Human then gave an update in the planning process and a brief recap of the history of mitigation planning in Fayette County. A question was asked about how we wtill inform the public about the upcoming public meeting. LFUCG DPS will utilize social media, press releases, and the DPS email list.

John Bucher gave an overview of the public survey results. 392 views, 137 started, 50 complete.

Josh then introduced the mitigation strategy and described mitigation goals, action items, and the action plan. There was a question about goal #4 and it was reworded as "Increase public and private understanding of hazard mitigation through mitigation education and awareness of natural and man-made hazards."

Josh gave an overview of the types of actions typically found in mitigation plans:

1. Prevention
2. Property Protection
3. Natural Resource Protection
4. Structural Projects
5. Emergency Services
6. Public Education and Awareness

The group then discussed the status of actions from the 2013 plan and considered inclusion of newly proposed actions from the stakeholder group. The discussion and decisions were captured in the updates Mitigation Strategy Workbook. There was a question about funding goals or actions. FEMA funds actions, as long as they relate to the goals. Actions can be written broad enough to include projects not yet identified. Question/comment about whether or not daylighting Town Branch could be covered under a mitigation action and funded by FEMA. If the project includes flood or other mitigation, FEMA funding is possible if included in a mitigation action.

Josh then described the next steps, which include finalizing the risk assessment and mitigation strategy before creating the draft plan to be introduced at upcoming stakeholder group and public meetings.

3-1-19 Invite:

MAYOR LINDA GORTON

LEXINGTON

PATRICIA L. DUGGER, RS MPA
DIRECTOR
EMERGENCY MANAGEMENT

Lexington Residents Invited to Final Mitigation Plan Public Meeting

Lexington, Kentucky (March 1, 2019) - Lexington Emergency Management will host the final public meeting for the 2018 Update to the LFUCG Hazard Mitigation Plan at 2:00pm on Thursday, March 7, 2019. The meeting will be held at the Public Safety Operations Center located at 115 Cisco Road in Lexington.

The hazard mitigation planning process is required under federal law to help communities better prepare for natural and hazardous-materials disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Mitigation plans must be updated and approved every five years to maintain eligibility. Lexington's current plan expires in 2018.

The March 7 meeting will review the final draft. Committee members and the public will be asked for their help in identifying areas that may have been overlooked, or corrections that need to be made. A publicly available, online version of the draft plan will be made available next week prior to the meeting. The following hazards will be included in the plan:

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Extreme Cold
- Flood
- Hailstorm
- Hazardous Materials
- Karst/Sinkhole
- Landslide
- Mine Subsidence
- Severe Storm
- Severe Winter Storm
- Tornado
- Wildfires

The final plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to LFUCG Council for adoption.

More information is available from the Lexington Emergency Management website: BeReadyLexington.com. Information is also available on the DEM Facebook page – LexingtonKYEM – and also on Twitter - @lexkyem.

###

For more information, contact:
John Bobel
Public Information Officer
859-280-8067
jbobel@lexingtonky.gov

LFUCG 2018 Hazard Mitigation Plan Update

Hazard Mitigation Plan Draft Review
Stakeholder and Public Meeting
March 7, 2019
2:00 pm - 4:00 pm
LFUCG Public Safety Operations Center
115 Cisco Road, Lexington, KY 40504

Agenda

Welcome	**Tim Brandewie, DEM**
Hazard Mitigation Plan Overview	**Josh Human, Stantec**
Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility.

The updated plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Lexington-Fayette Urban County Council for adoption.

Contacts

Pat Dugger, Director
LFUCG DEM
patd@lexingtonky.gov
859.280.8060

Tim Brandewie, Emergency Operations Manager
LFUCG DEM
rbrandew@lexingtonky.gov
859.280.8054

Josh Human
Stantec
josh.human@stantec.com
502.618.5873

John Bucher
Stantec
john.bucher@stantec.com
502.212.5044

LFUCG 2019 Hazard Mitigation Plan Steering Committee/Public Draft Plan Meeting

March 7, 2019: 2:00pm - 4:00pm

LEXINGTON FAYETTE EMERGENCY MANAGEMENT · LEXINGTON · Stantec

Name	Title	Department	Email	Phone
Josh Human	Sr. Associate	Stantec	josh.human@stantec.com	502-876-0844
Dustin Baker	GIS Developer	LFUCG GIS	dbaker@	x3414
Chester Hicks	Admin. Officer	LFUCG-EQPW	chicks@gmail.com	x3407
MIKE SKIDMORE	MANAGER - SAFETY/LC	RISK MGT.	MSKIDMOR@lexingtonky.gov	425-2478
Laurel Wood	Business Continuity	UKPD-CMP	laurel.wood@uky.edu	859-257-6655
Vanessa Gross	Program Specialist	Social Services	vgross@lexingtonky.gov	x4340
TIM BRANDENBURG	OPS MGR	LFUCG DEM	tbrandenb@ " "	"

LFUCG 2019 Hazard Mitigation Plan Stakeholder/Public Draft Review Meeting

Date/Time:	March 7, 2019 / 2:00 pm
Place:	LFUCG Public Safety Operations Center
Next Meeting:	TBD
Attendees:	8 – Tim Brandewie, Patrick Johnston, Chester Hicks, Dustin Baker, John Bobel, Mike Skidmore, Laurel Wood, Vanessa Grossl, Josh Human

Tim Brandewie LFUCG Operations and Recovery Manager Safety welcomed and thanked all attendees.

Josh Human then gave an update in the planning process and a brief recap of the history of mitigation planning in Fayette County. Next he gave a deep dive overview of each section of the newly developed Hazard Mitigation Plan.

Several mitigation project ideas were discussed including the composition and implementation of the planning process. The group was appreciative of the work everyone had put in and was looking forward to the final Draft.

Lastly, Josh and Tim described the last steps including the draft plan being out for public review.

Public Review Documentation:

Lexington Updates Hazard Mitigation Plan – Be Ready Lexington

BE READY

Lexington Updates Hazard Mitigation Plan

The final draft for the 2018 Update to the LFUCG Hazard Mitigation Plan is now completed, and ready for public review.

View the 2018 plan update here.

The hazard mitigation planning process is required under federal law to help communities better prepare for natural and hazardous-materials disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Mitigation plans must be updated and approved every five years to maintain eligibility. Lexington's current plan expires in 2018.

The federal Disaster Mitigation Action of 2000 requires that a community have an approved mitigation plan in order to be eligible for post-disaster federal funding for projects and planning. It requires that a planning process be established and that the process involve stakeholders and residents at all levels, including vulnerable populations.

The planning process involves the development of a risk assessment as well as the

TAP

Appendix B: LFUCG Stakeholder List and Attendance

LFUCG Steering Committee

Name	Organization	Title	E-Mail	Attendance			
				30-Jan	18-Apr	21-Jun	7-Mar
Alex Olszowy	LFUCG Building Inspections	Manager	alexo@lexingtonky.gov	1			
Brad Kinckiner	Kentucky American Water	Manager	Brad.Kinckiner@amwater.com	1	1		
Chester Hicks	LFUCG Environmental Quality	Administrative Officer	chicks@lexingtonky.gov	1	1		1
Clayton Oliver	University of Kentucky Police Department	Emergency Management Specialist	Clayton.Oliver@uky.edu	1			
Dustin Baker	LFUCG Water Quality	GIS Developer	dbaker@lexingtonky.gov	1		1	1
Glenn Brown	LFUCG Mayor's Office	Deputy Chief Administrative Officer	gbrown3@lexingtonky.gov	1			
Greg Lubeck	LFUCG Water Quality	Engineering Section Manager	glubeck@lexingtonky.gov	1			
Isabel Taylor	LFUCG Global Engagement Center	Multicultural Affairs Coordinator	itaylor@lexingtonky.gov	1	1		
Jason Dyal	Lextran	Training Manager	jdyal@lextran.com	1	1		
Joe Bryant	LFUCG Building Inspections	Supervisor Building Inspections	jbryant@lexingtonky.gov	1	1		
John Bobel	DEM	Public Information Officer	jbobel@lexingtonky.gov	1		1	
John Givens	Lextran	Director of Risk Management	jgivens@lextran.com	1			
Laurel Wood	University of Kentucky PD	Business Continuity	laurel.wood@uky.edu	1	1		1
Nick Grinstead	University of Kentucky HMGP-KYEM	Planner	nick.grinstead@uky.edu	1			
Patrick Johnson	LFUCG Risk Management	Director	patrickj@lexingtonky.gov	1	1	1	1

Ralph McCracken	Lexington-Fayette County Health Department		ralph.mccracken@ky.gov	1			
Rob Larkin	LFUCG Fire	Major	larkinr@lexingtonky.gov	1	1		
Tim Brandewie	Lexington DEM		Rbrandew@Lexingtonky.gov	1	1	1	1
Tom Martin	LFUCG Division of Planning	Senior Planner	tmartin@lexingtonky.gov	1	1		
Brad Stone	Public Works		kwente@lexingtonky.gov				
Brian Claypool	LGE-KU		Brian.Claypool@lge-ku.com				
Brian Gathy	UK Mitigation		bdgath2@uky.edu				
Chris sweat	Lexington Fire		SweatC@Lexingtonky.gov				
David O'Neill	PVA		david.oneill@ky.gov				
Doreen Birkholz	Lexington DEM	Information Systems Specialist	dbirkhol@lexingtonky.gov				
Doyle Rambo	CERT		doyle.rambo@insightbb.com				
Drew Andrews	KY Geological Survey		wjandr00@email.uky.edu		1		
James Currens	KGS		currens@uky.edu				
Luke Mathis	FCPH		LukeJ.Mathis@ky.gov				
Matt Crawford	KGS		mcrawford@uky.edu				
Rob Walter	Code Enforcement		Rwalter@Lexingtonky.gov				
Tom Wade	Lexmark		tomwade@lexmark.com				
Barrett Schoeck	Lexington-Fayette County Health Department	Emergency Program Coordinator	barrett.schoeck@ky.gov			1	
Theresa Owen	LFUCG Water Quality	Project Engineer	towen@lexingtonky.org		1	1	
Mike Skidmore	Risk Management	Safety Manager	mskidmore@lexingtonky.gov				1
Vanessa Grossl	Social Services	Program Specialist	vgrossl@lexingtonky.gov				1
				19	12	6	7

Appendix C: Mitigation Action Workbook Instructions

Update 2013 LFUCG Mitigation Action Workbook

Mitigation Action Workbooks are used to identify potential hazard Mitigation Actions that the City of Lexington will consider to reduce the negative effects of their identified hazards. The workbooks provide a simple yet effective method of organizing potential hazard Mitigation Actions in a user-friendly manner that can easily be incorporated into the update of the Lexington Fayette County Hazard Mitigation Plan.

The workbooks are to be used as part of a strategic planning process and are designed to be:

a.) Completed electronically (workbooks and instructions are e-mailed to members of the LFUCG Steering Committee)

b.) Reviewed with your department/organization for implementation and further consideration

c.) Returned according to the contact information provided below

Please return all completed worksheets no later than June 18, 2018 to:

Josh Human, Project Manager
josh.human@stantec.com

INSTRUCTIONS

Each Mitigation Action should be considered as a separate local project, policy, or program and each individual Action should be entered into a separate row within the Workbook. Identifying the implementation requirements for each Action will help lay the framework for our Mitigation Strategy section, which will create the blue print for reducing the community's overall vulnerability and risk. Detailed explanations on how to use and complete each tab of the Workbook are provided below.

During this exercise we want you to re-visit the Action items that your Office was identified as a participant and provide detailed feedback on the status of each the Action items. For example, this Action item was completed in 2015 by the Division of Planning through a new Hazard Overlay Zone. It is important for us to tell a story of Mitigation Action implementation and through this exercise we hope that you can help identify our successes. Also, we want to add new Mitigation Actions to the current update to the plan. So please feel free to add new Action items once you have reviewed your current Actions under Tab 2 of the Excel file

You have received an Excel File called "LFUCG_Mitigation_Action_Workbook_2013_Update". Within the Excel file you will find two tabs (Office Action Matrix & 2013 Action Plan).

Tab1: Office Matrix: The Office Matrix tab found at the bottom left of the Excel file provides you with the following:

Column A, Office: Describes the office as seen within the 2013 Hazard Mitigation Plan Mitigation Strategy section and found in Tab 2's column F (Offices Responsible).

Column B, Office Definition: Provides further definition for the Office described in Column A.

Column C, Number of Actions: Provides a breakdown of the total number of action items (found on Tab 2) identified for each participating Office.

Column D, Action Number: Provides the office with the corresponding Action Number found in Tab 2's column A (Action). You should use this column to identify and review the Action items that your office was identified to participate. This column is here to make it easier on you to find your specific Action items, but we do not want to **discourage you from reviewing all of the Action items** while also providing feedback.

Tab2: 2013 Action Plan: The 2013 Action Plan tab found at the bottom of the Excel file provides you with the following:

Column A, Action: Provides the Action number used within the 2013 LFUCG Hazard Mitigation Plan.

Column B, Timeframe (Years): Describe a timeframe goal for completion. Please provide as much detail on the timeframe of this action as possible. For example, it could be an Action that is completed annually, or it could have a goal to be done in 2 years.

Column C, Hazards Addressed: Describe the hazards that will be addressed through this Action. Our identified Hazards include (Dam Failure, Drought, Earthquake, Extreme Heat, Extreme Cold, Flood, Hailstorm, HazMat Karst/Sinkhole, Severe Storm, Severe Winter Storm, Tornado, Wildfires).

Column D, Description: Describe in detail the Mitigation Action/Project. We want you to review this column and make sure the way the Action is described is still valid or feel free to make changes according to your current desires for the Action. When creating a new Action please provide details about the new Action.

Column F, Offices Responsible: Identifies the LFUCG departments and other outside organizations that are responsible for leading, participating, and working to complete this Action item. Please update this field to reflect current office titles and add offices that should participate or lead the Action.

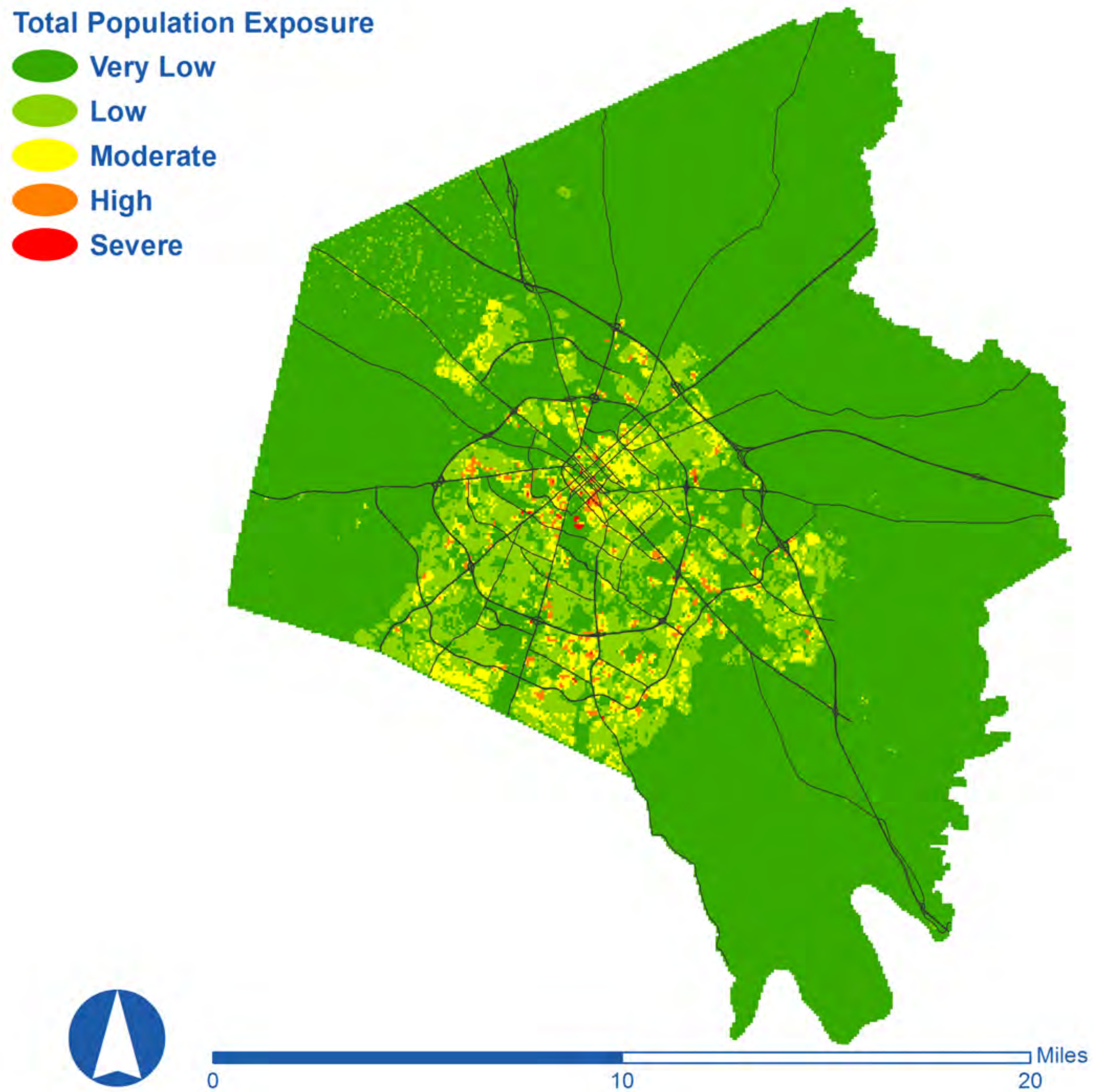
Column G, Funding/Budget Considerations: Provide as much detail here as possible. If you do not have detail feel free to use words like Grant, Internal, Departmental and others to describe the funding in general terms.

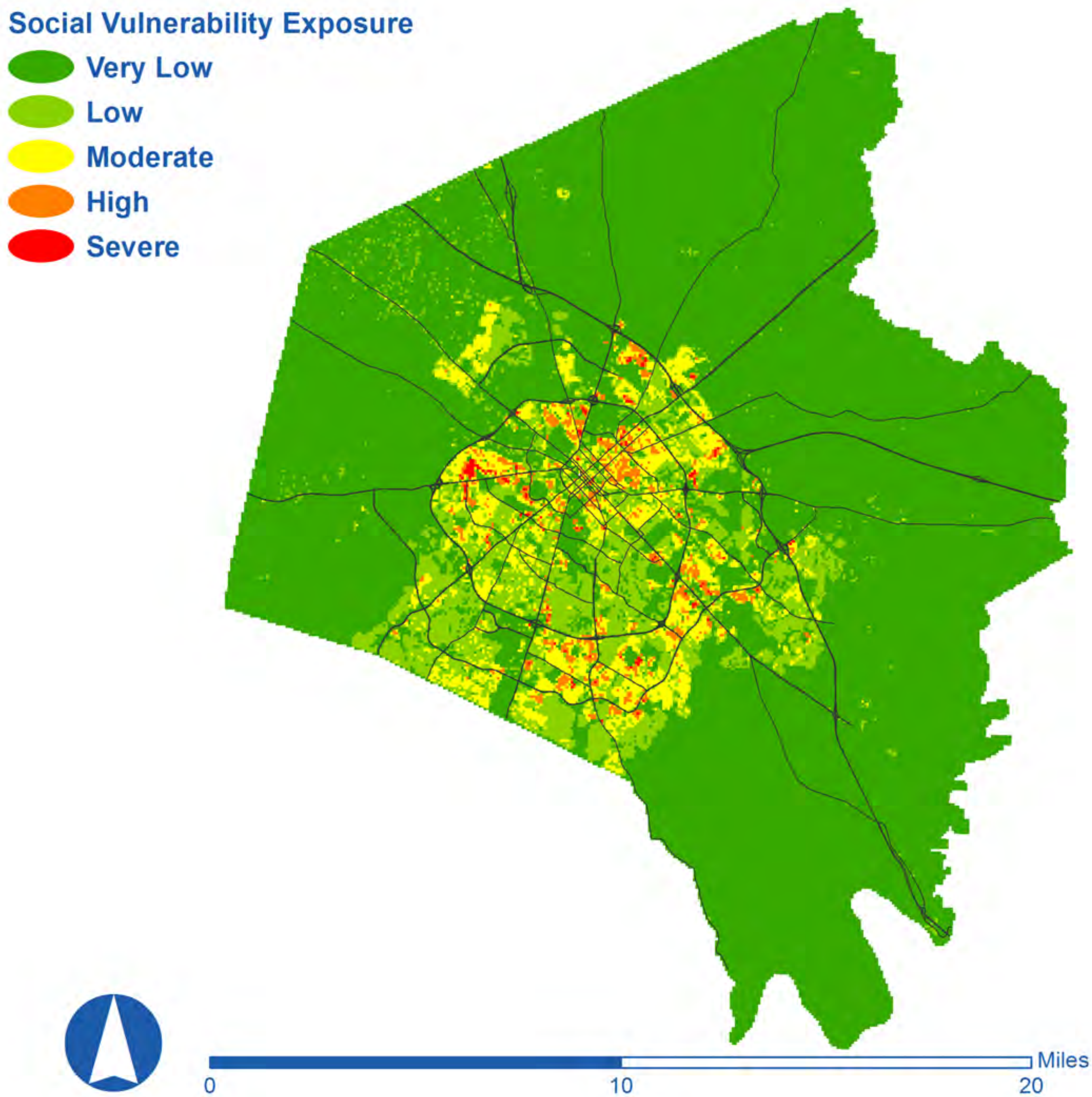
Column H, Comments: Provide detailed comments about the implementation or enhancements of the Action item. Has this Action item been completed, by whom and when, has there been a new Action added in its place that replaces this one, and or was this Action item edited to reflect changes needed.

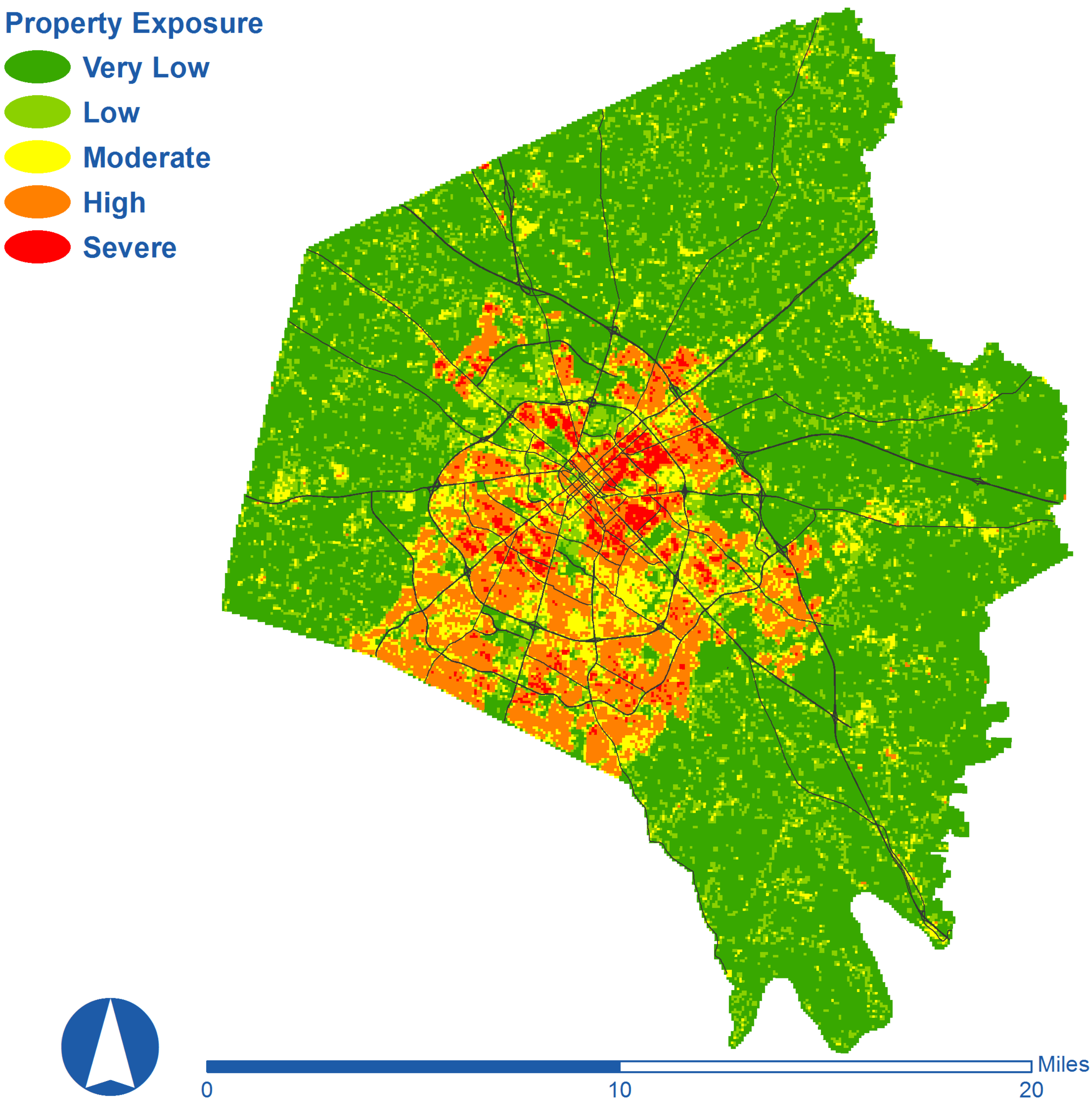
Column I, Edits: Provide your contact information to the edits you made for tracking purposes.

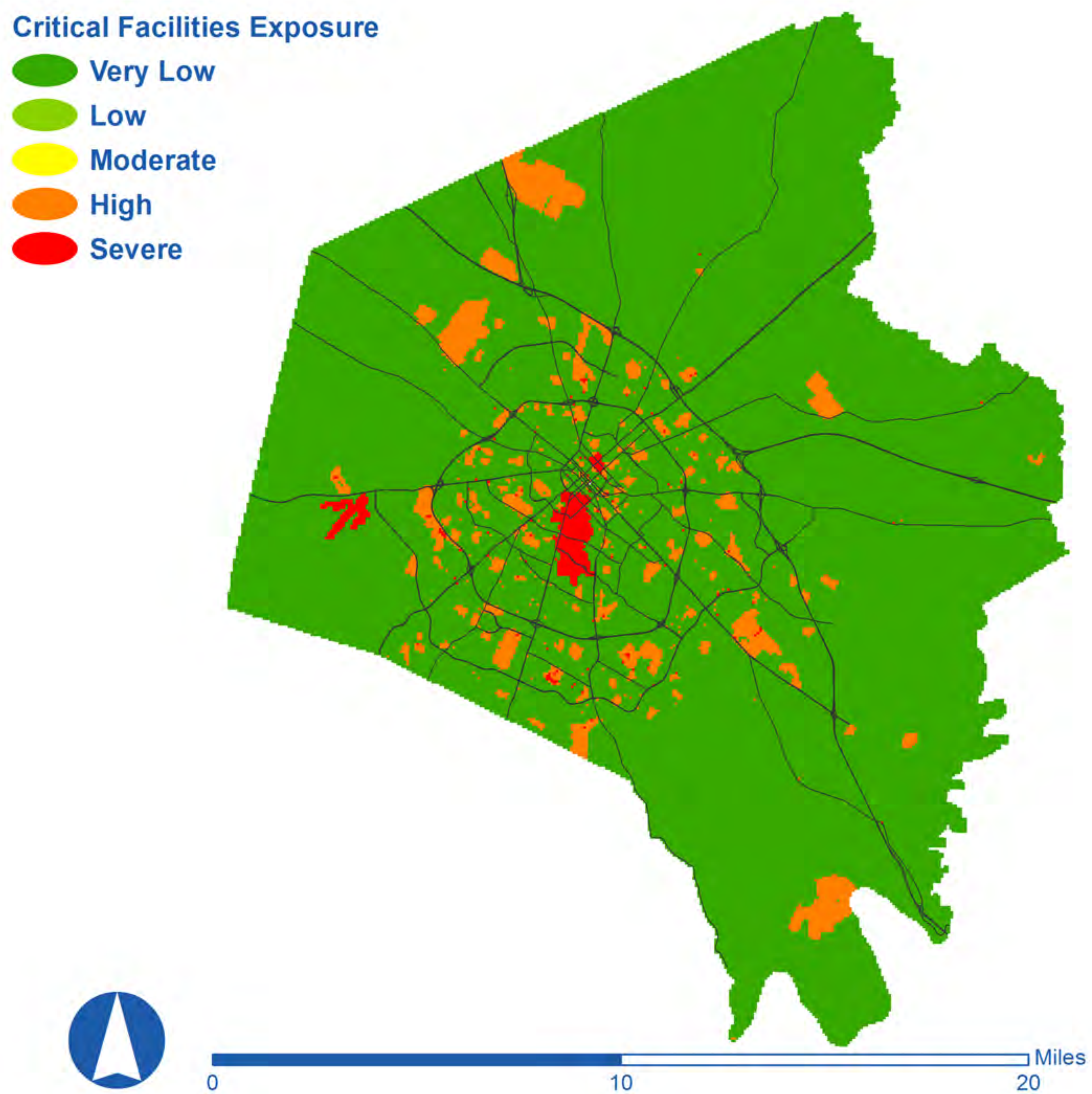
Lastly, please feel free to add new Action items at the bottom of Tab 2 and fill out all of the requested information in columns B-H. Our main desires for this process is to identify Mitigation Action success as well as capture new Mitigation Action items that will be added to this plan. We will review the Mitigation Strategy at our next meeting and will finalize it after the meeting is held. This step of the Hazard Mitigation Plan is the most important one as it provides the blue print for Hazard Mitigation Action over the next 5 years.

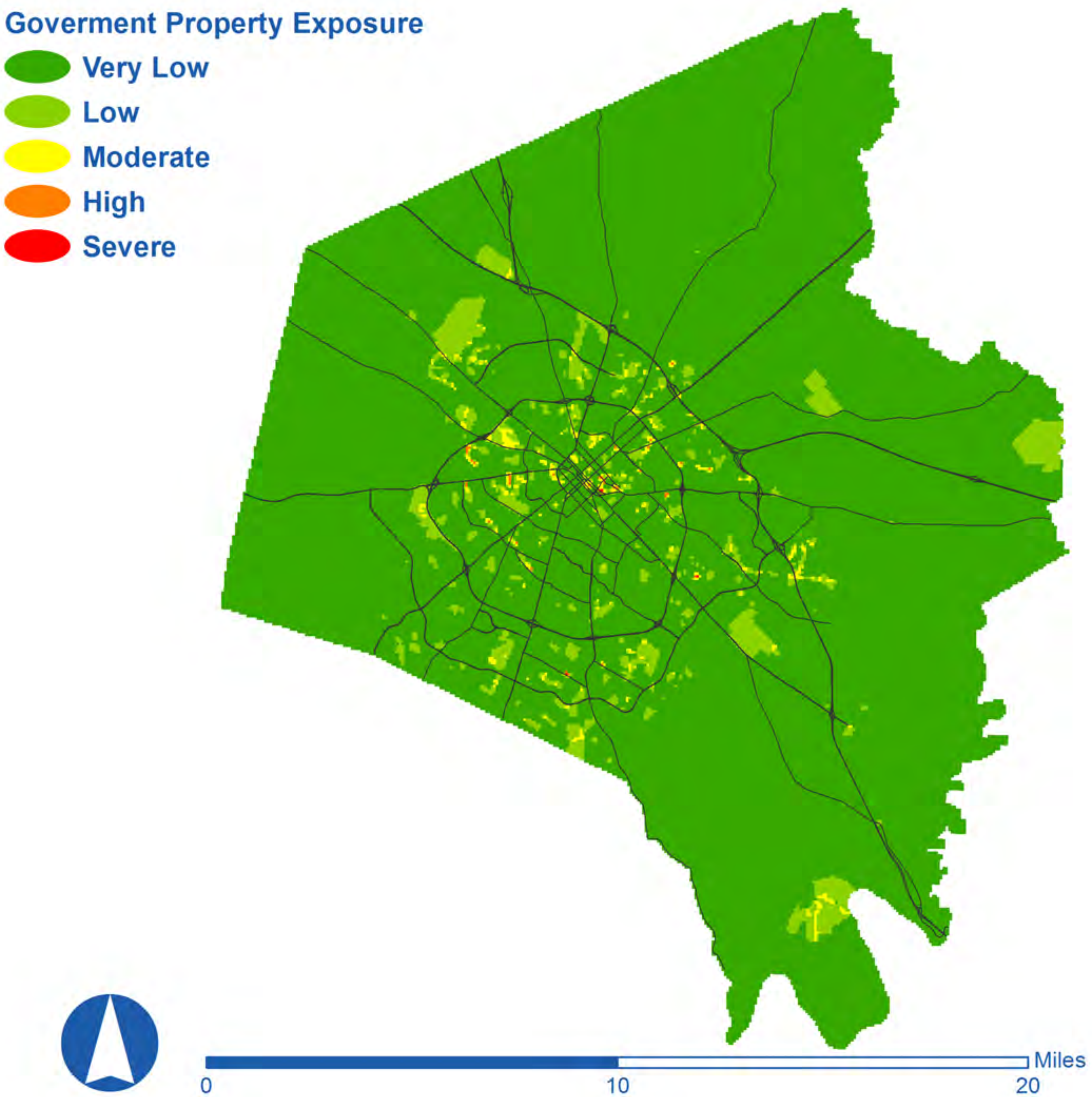
Appendix D: Exposure Maps



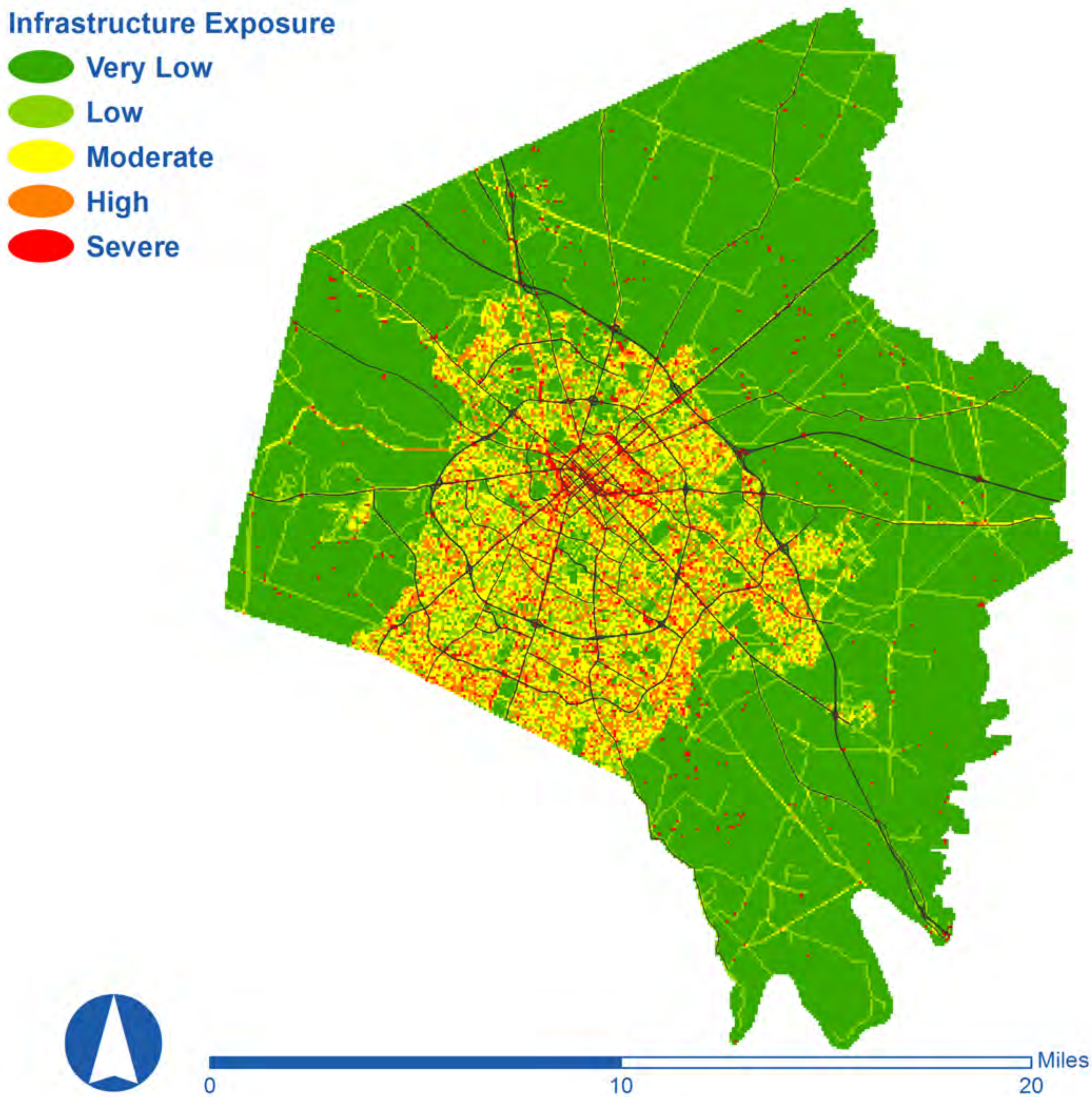

Social Vulnerability Exposure
Very Low
Low
Moderate
High
Severe
Miles
0
10
20


Property Exposure
Very Low
Low
Moderate
High
Severe
Miles
0
10
20


Critical Facilities Exposure
Very Low
Low
Moderate
High
Severe
Miles
0
10
20



Goverment Property Exposure
Very Low
Low
Moderate
High
Severe
0
10
20
Miles


Infrastructure Exposure
Very Low
Low
Moderate
High
Severe
Miles
0
10
20

Appendix E: HAZUS Earthquake Report

HAZUS
EARTHQUAKE • WIND • FLOOD • TSUNAMI

FEMA

RiskMAP
Increasing Resilience Together

Hazus: Earthquake Global Risk Report

Region Name: Fayette_KY_EQ

Earthquake Scenario: Annualized Loss LFUCG

Print Date: January 24, 2019

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

HAZUS EARTHQUAKE · WIND · FLOOD · TSUNAMI

FEMA

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Kentucky

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 285.47 square miles and contains 82 census tracts. There are over 123 thousand households in the region which has a total population of 295,803 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 106 thousand buildings in the region with a total building replacement value (excluding contents) of 38,703 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,976 and 809 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 106 thousand buildings in the region which have an aggregate total replacement value of 38,703 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 80% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 11 hospitals in the region with a total bed capacity of 2,086 beds. There are 92 schools, 1 fire stations, 2 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 45 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 2,785.00 (millions of dollars). This inventory includes over 141.67 miles of highways, 159 bridges, 5,913.59 miles of pipes.

Table 1: Transportation System Lifeline Inventory

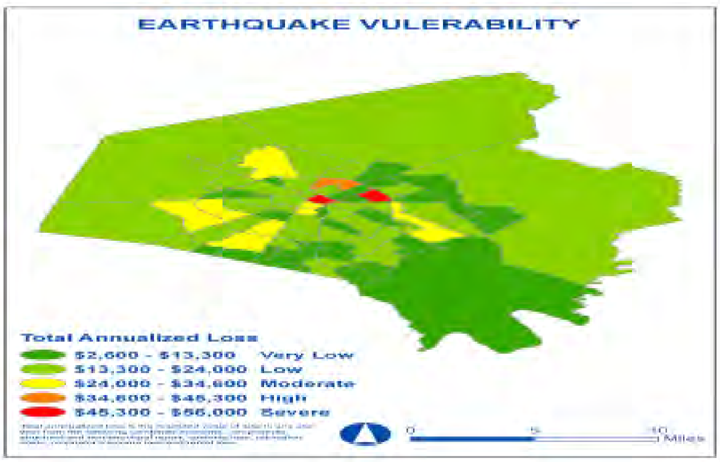
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	159	194.1528
	Segments	116	1583.5619
	Tunnels	0	0.0000
		Subtotal	**1777.7147**
Railways	Bridges	13	1.4847
	Facilities	2	5.3260
	Segments	90	99.6411
	Tunnels	0	0.0000
		Subtotal	**106.4518**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	5	5.3410
		Subtotal	**5.3410**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	1	10.6510
	Runways	2	75.9280
		Subtotal	**86.5790**
		Total	**1,976.10**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	95.1705
	Facilities	3	97.9020
	Pipelines	0	0.0000
		Subtotal	**193.0725**
Waste Water	Distribution Lines	NA	57.1023
	Facilities	3	195.8040
	Pipelines	0	0.0000
		Subtotal	**252.9063**
Natural Gas	Distribution Lines	NA	38.0682
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**38.0682**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	3	323.4000
		Subtotal	**323.4000**
Communication	Facilities	16	1.5680
		Subtotal	**1.5680**
		Total	**809.00**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



Scenario Name	Annualized Loss LFUCG
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

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Direct Earthquake Damage

Building Damage

Hazus estimates that about buildings will be at least moderately damaged. This is over % of the buildings in the region. There are an estimated buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

Complete
Extensive
Moderate
Slight

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 2,086 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	11	0	0	0
Schools	92	0	0	0
EOCs	0	0	0	0
PoliceStations	2	0	0	0
FireStations	1	0	0	0

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Transportation Lifeline Damage

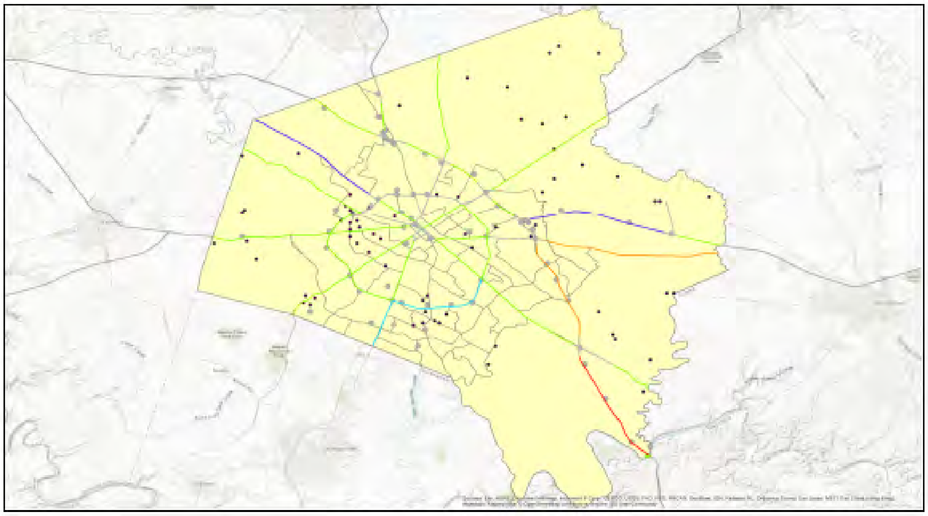

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Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	116	0	0	0	0
	Bridges	159	0	0	0	0
	Tunnels	0	0	0	0	0
Railways	Segments	90	0	0	0	0
	Bridges	13	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	2	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	5	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	0	0
	Runways	2	0	0	0	0

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 % After Day 1	with Functionality > 50 % After Day 7
Potable Water	3	0	0	0	0
Waste Water	3	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	3	0	0	0	0
Communication	16	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	2,957	0	0
Waste Water	1,774	0	0
Natural Gas	1,183	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water						
Electric Power						

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.08	0.01	0.00	0.00
	Single Family	0.10	0.01	0.00	0.00
	Total	0	0	0	0
2 PM	Commercial	0.22	0.03	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.10	0.02	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.03	0.01	0.00	0.00
	Other-Residential	0.01	0.00	0.00	0.00
	Single Family	0.02	0.00	0.00	0.00
	Total	0	0	0	0
5 PM	Commercial	0.18	0.02	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.02	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.02	0.00	0.00	0.00
	Other-Residential	0.03	0.00	0.00	0.00
	Single Family	0.04	0.01	0.00	0.00
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 1.30 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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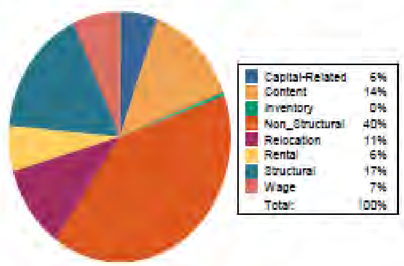
Building-Related Losses

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

The total building-related losses were 1.30 (millions of dollars); 29 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 44 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

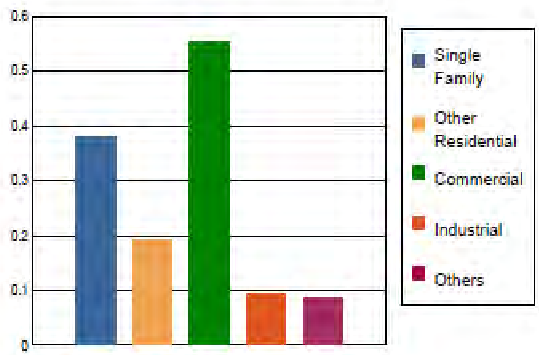


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0034	0.0786	0.0041	0.0040	0.0901
	Capital-Related	0.0000	0.0014	0.0687	0.0024	0.0012	0.0737
	Rental	0.0107	0.0176	0.0458	0.0013	0.0020	0.0774
	Relocation	0.0370	0.0114	0.0665	0.0063	0.0173	0.1385
	Subtotal	**0.0477**	**0.0338**	**0.2596**	**0.0141**	**0.0245**	**0.3797**
Capital Stock Losses							
	Structural	0.0651	0.0298	0.0848	0.0190	0.0191	0.2178
	Non_Structural	0.2080	0.1050	0.1435	0.0341	0.0310	0.5216
	Content	0.0585	0.0230	0.0620	0.0207	0.0135	0.1777
	Inventory	0.0000	0.0000	0.0015	0.0045	0.0002	0.0062
	Subtotal	**0.3316**	**0.1578**	**0.2918**	**0.0783**	**0.0638**	**0.9233**
	Total	**0.38**	**0.19**	**0.55**	**0.09**	**0.09**	**1.30**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1583.5619	0.0000	0.00
	Bridges	194.1528	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**1777.7147**	**0.0000**	
Railways	Segments	99.6411	0.0000	0.00
	Bridges	1.4847	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	5.3260	0.0000	0.00
	Subtotal	**106.4518**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	5.3410	0.0000	0.00
	Subtotal	**5.3410**	**0.0000**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	10.6510	0.0000	0.00
	Runways	75.9280	0.0000	0.00
	Subtotal	**86.5790**	**0.0000**	
	Total	**1,976.09**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	97.9020	0.0000	0.00
	Distribution Lines	95.1705	0.0000	0.00
	Subtotal	**193.0725**	**0.0000**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	195.8040	0.0000	0.00
	Distribution Lines	57.1023	0.0000	0.00
	Subtotal	**252.9063**	**0.0000**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	38.0682	0.0000	0.00
	Subtotal	**38.0682**	**0.0000**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	323.4000	0.0000	0.00
	Subtotal	**323.4000**	**0.0000**	
Communication	Facilities	1.5680	0.0000	0.00
	Subtotal	**1.5680**	**0.0000**	
	Total	**809.02**	**0.00**	

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Kentucky					
	Fayette	295,803	28,868	9,834	38,703
Total Region		**295,803**	**28,868**	**9,834**	**38,703**

Appendix F: CRS Crosswalk

CRS Step	LFUCG Activity	Possible Points	Anticipated Points	Documentation	Notes
		382	271		
1. Organize to prepare the plan.		**15**	**13**		
a. Involvement of Office Responsible for Community Planning	Division of Planning on Steering Committee	4	4	3.1.2, Appendix B	Steering Committee called the Stakeholder Group for this plan update
b. Planning committee of department staff	Building Inspections, Planning, Environmental Quality and Public Works, Water Quality, Emergency Management, Health, Fire, Risk Management, Mayor's Office, Global Engagement Center, Police	9	9	3.1.2, Appendix B	
c. Process formally created by the community's governing board		2	0		
2. Involve the public.		**120**	**70**		
a. Planning process conducted through a planning committee	Steering Committee includes stakeholders who are not LFUCG staff; Committee will meet 5 times; 7 of 21 (33%) are not LFUCG staff	60	30	3.1.2, Appendix B	7 of 22 = 32%
b. Public meetings held at the beginning of the planning process	April 18 Public Kickoff	15	15	3.1.2, Appendix A	
c. Public meeting held on draft plan	draft plan will be open for public comment in July/August, draft plan will be submitted to and approved by LFUCG Council	15	15	3.1.2, Appendix A	

CRS Step	LFUCG Activity	Possible Points	Anticipated Points	Documentation	Notes
		382	271		
d. Other public information activities to encourage input	project website, public survey,	30	10	3.1.2, Appendix E	
3. Coordinate with other agencies.		**35**	**15**		
a. Review of existing studies and plans [REQUIRED]	Capability Assessment	5	5	5.1, 5.2	
b. Coordinating with communities and other agencies	engage with LG&E/KU, KAW, KGS, NWS, UK EM, KY Division of Forestry for data and projects; keep records of contacts	30	10	3.1.2, Section 4	Data for the risk assessment provided by KGS, NWS/NCEI, Division of Forestry. Lextran, KY American Water, and UK participated in the stakeholder group meetings
4. Assess the hazard.		**35**	**35**		
a. Plan includes an assessment of the flood hazard [REQUIRED] with: (1) A map of known flood hazards; (2) A description of known flood hazard; (3) A discussion of past floods	Section 4 Risk Assessment	15	15	4.9.1, 4.9.2, 4.9.3, 4.9.4	
b. Plan includes assessment of less frequent floods	Risk Assessment, meetings	10	10	4.9.2	
c. Plan includes assessment of areas likely to flood	Risk Assessment, meetings	5	5	4.9.2, 4.9.3	
d. The plan describes other natural hazards [REQUIRED FOR DMA]	Risk Assessment, meetings	5	5	4.4 through 4.18	
5. Assess the problem.		**52**	**41**		

CRS Step	LFUCG Activity	Possible Points	Anticipated Points	Documentation	Notes
		382	271		
a. Summary of each hazard identified in the hazard assessment and their community impact [REQUIRED]	Risk Assessment	2	2	4.4 through 4.18	
b. Description of the impact of the hazards on:		N/A	N/A		
(1) Life, safety, health, procedures for warning and evacuation	Risk Assessment	5	5	4.4 through 4.18	Identify and Profile sub-sections and Profile Risk Table
(2) Public health including health hazards to floodwaters/mold	Risk Assessment	5	5	4.4 through 4.19	Identify and Profile sub-sections and Profile Risk Table
(3) Critical facilities and infrastructure	Risk Assessment	5	5	4.3 and 4.4 through 4.19	Included in Exposure, described in 4.3
(4) The community's economy and tax base	Risk Assessment	5	5	4.4 through 4.19	Identify and Profile sub-sections and Profile Risk Table
(5) Number and type of affected buildings	Risk Assessment	5	5	4.3 and 4.4 through 4.19	Included in Exposure, described in 4.3
c. Review of all damaged buildings/flood insurance claims	Risk Assessment	5	5	4.9.3, 4.9.4	
d. Areas that provide natural floodplain functions		5	0		
e. Development/ redevelopment/ Population Trends		7	5	4.19	
f. Impact of future flooding conditions outline in Step 4, item c		8	4	4.9.4	Highlights areas likely to be flooded and exposure in those areas.
6. Set Goals [REQUIRED].	Section 6 Mitigation Strategy - mitigation goals	**2**	**2**	6.1	
7. Review possible activities.		**35**	**35**		

CRS Step	LFUCG Activity	Possible Points	Anticipated Points	Documentation	Notes
		382	271		
a. Preventive activities (required for any Step 7 points)	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.2	
b. Floodplain Management Regulatory/current & future conditions	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.3	
c. Property protection activities	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.4	
d. Natural resource protection activities	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.5	
e. Emergency services activities	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.6	
f. Structural projects	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.7	
g. Public information activities	Steering Committee meetings to discuss actions and prioritization	5	5	6.3, 3.1.8	
8. Draft an action plan.		**60**	**50**		
a. Actions must be prioritized [REQUIRED]	Mitigation Strategy. prioritization exercise				
(4) Recommendations for activities from five of the six categories	Mitigation Strategy - mitigation actions	45	45	6.2, 6.3	
b. Post-disaster mitigation policies and procedures		10	0		
c. Action items for mitigation of other hazards	Mitigation Strategy - mitigation actions	5	5	6.2, 6.3	
9. Adopt the plan.	**LFUCG Council Adoption**	**2**	**2**	7	

CRS Step	LFUCG Activity	Possible Points	Anticipated Points	Documentation	Notes
		382	271		
10. Implement, evaluate and revise.		**26**	**8**		
a. Procedures to monitor and recommend revisions [REQUIRED]	mitigation action	2	2	7	
b. Same planning committee or successor committee that qualifies under Section 511.a.2 (a) does the evaluation	mitigation action calling for SC to meet regularly	24	6	7	

Appendix G: 2013 Mitigation Strategy Status, Successes and Revision Report

Action	Description	Status, Successes
1.1.1	Research and determine best practices, standard equipment, and human capital needed by the fire departments, law enforcement and other public agencies to respond to, and recover from, natural hazard events.	This is done on an annual basis and was kept as an Action moving forward. LFUCG will conduct a commodity study which may highlight additional equipment needs. A special emphasis should be focused on the bi-lingual population when considering this Action. In doing annual reviews of THIRA, EOP, exercises and real-world events inventory equipment, best practices, and staffing to increase target capabilities of public safety and other agency's with grant and or local funds.
1.1.2	Inventory existing local and regional fire department, law enforcement, and equipment from other public agencies to determine which additional natural and man-made hazards related equipment and personnel is needed.	LFUCG will conduct a commodity study which may highlight additional equipment needs.
1.1.3	Utilizing available grant sources, purchase the required fire department and law enforcement equipment, and training needed for public agencies to respond to, and recover from, natural hazard events.	See Actions 1.1.2 and 1.1.1 for updates on this Action.
1.1.4	Ensure First Responders and Fayette County School District Staff have access to and are trained on how to use I-Speak cards, telephone, and in-person interpreters for emergency purposes.	Multicultural Affairs Coordinator is in the process of training all LFUCG Public Safety personnel on communication techniques with the limited English-speaking public.
1.1.5	Provide cross-cultural communication training to first responders to educate and assist with cross-cultural education with the LEP population.	This training is available through LFUCG's GLOBAL LEX center, but has not been utilized by many other outside agencies since this recommendation was made a few years ago.
1.1.6	Upgrade existing DEM facilities for a stand-alone Emergency Operations Center.	Completed in October of 2016. This Action was modified to cover future enhancement needs.
1.1.7	Explore funding opportunities for community tornado shelter construction in accordance with FEMA guidelines.	Since the last Plan two Tornado shelters were built, one on Versailles Road and one on Thompson Road. This Action was maintained as it is still a need for LFUCG.
1.1.8	Obtain funding to enhance and upgrade existing outdoor warning systems.	Added 3 new sirens since 2013, Raven Run, Hisle Park and Picadome. Downtown Police Building siren in progress. Currently DEM is trying to upgrade to 800 radio system.
1.1.9	Continue to seek and obtain funding through the Chemical Stockpile Emergency Preparedness Program (CSEPP) for planning, training, and exercising with the depot, surrounding counties, and the state of Kentucky.	Funding has continued over the last 5 years, but new funding needs to be identified.
1.2.1	Conduct outreach to educate citizens on how to receive up-to-date evacuation instructions, shelter-in-place procedures, and information pertaining to all hazards.	New Apps were acquired in 2017 to enhance LFUCG's capabilities, Deaflinks and LexAlerts.

Action	Description	Status, Successes
1.2.2	Install flood marker signs that include both a "Road May Flood" sign, as well as signage indicating water depth.	DEM is currently working toward implementing this project.
1.3.1	Request that natural hazard mitigation assessments be conducted on the current utility and communication infrastructure and the conclusions to be provided to DEM.	Progress has been made with this action. The action was re-worded for this version of the plan.
1.3.2	As resources permit, conduct resilience assessments on LFUCG owned and operated buildings to ensure that they are resistant to natural and man-made hazard events.	DEM completes assessments periodically but LFUCG is looking to enhance this action over the 1 to 3 years through a potential project.
1.3.3	As resources permit, conduct updates, maintenance and training on Emergency Plans of LFUCG owned and operated buildings.	The LFUCG has an internal Emergency Planning Committee made up of members from various divisions (Risk Mgt., DEM, Fire, Facilities Maintenance) that assess, and review emergency actions plans for each division. Meetings are held with Directors and Fire Marshalls in critical structures to assure knowledge of plans with periodic drills to test plans are being performed.
2.1.1	Promote, encourage, and participate in the development of a system of accessing and sharing local data on infrastructure, critical facilities, population, and hazardous material sites between private and public interests.	GIS, along with DEM representatives, have leveraged our ArcGIS Online presence to interface with WebEOC to use and consume our Enterprise GIS and WebEOC Board data in web maps and apps published for use in the EOC during any activation. These same data streams can also be published to the public, without sensitive or restrictive data. This action was kept but re-worded.
2.1.2	Identify consistent data sources for the creation of systemic LEP population data collection/dissemination protocol. Data collection from schools, universities, health providers, and refugee resettlement groups is critical and difficult to access.	Currently Multi-Cultural Affairs is working with the Fayette County Schools and GIS department to enhance this action.
2.2.1	Develop inventory of farmland in order to build a business plan.	Completed
2.3.1	Provide information to the development community through publications and electronic resources about residential floodproofing, tornado safe rooms and community tornado shelters, as well as guidelines and criteria for construction.	LFUCG DEM developed a brochure called Disaster Resistant Home.
2.3.2	As resources allow, implement an acquisition program that targets environmentally sensitive land and land located within a floodplain. Projects would include a cost-benefit analysis and purchases of development rights that offer financial incentives in exchange for removal of future development rights.	DWQ is currently looking at acquiring two properties in conjunction with stormwater improvement projects.

Action	Description	Status, Successes
2.3.3	When resources permit, work to purchase and demolish flood prone structures that meet NFIP/CRS guidelines for repetitive loss or for having repeated or extensive flood damage.	2013-2014- acquired two properties on Walhampton Dr. to construct a detention basin. 2015- 4 properties on Clarksdale Ct., 2 properties on Ft. Sumter Dr., 1 property on Gayle Dr., 1 property on Clays Mill Rd., 2 properties on Lafayette Pkwy., 2016- 3 properties on Elam Park, 1 property on Clarksdale, 1 property on Gayle Dr. 2017- 1 property on Gayle Dr.
2.3.4	To seek and request consistent funding sources for the completion of prioritized stormwater projects in accordance with identified priority storm water projects.	Water Quality Management Fee (WQMF) was established to provide a consistent funding source. Other sources will be reviewed over the five years.
2.3.5	Review and implement proposed Greenway Manual in alignment with revisions to the Stormwater Manuals and related regulations	Completed
3.1.1	Obtain funding to hire a planner for the DEM	Completed
3.1.2	Better integrate ESF-5 and 14 into the planning process for the Emergency Operations Plan	Completed
3.1.3	Conduct an exercise with a priority of focusing on mitigation and recovery.	Still a need.
3.1.4	Better incorporate regional and state assets/resources into pre-disaster planning programs	Over the last 5 years DEM and the business community have engaged more frequently. DEM has created a position in the EOC (Business Liaison)
3.1.5	Once available, explore the opportunity to participate in the Commonwealth Hazard Assessment Mitigation Planning System (CHAMPS) as advised by KyEM.	LFUCG DEM has used CHAMPS when submitting Hazard Mitigation projects to the State.
3.2.1	Continue efforts to bring more neighborhoods, including LEPs, into the Neighborhood Emergency Network (NEN) and the Community Emergency Response Team (CERT). Develop a neighborhood ready notification tree.	On-going
3.2.2	Obtain funding and support for CERT supplies and equipment, volunteer coordination, and recognition/appreciation events for volunteers.	DEM conducts two courses per year and has trained nearly 300 to date.
3.2.3	Continue to enhance LEP partnerships; invite LEP reps to participate in public safety planning and exercises.	Multicultural Affairs and GLOBAL LEX staff are providing the linguistic and cultural assistance to DEM as requested and are currently planning to work very closely with DEM on outreach, communication and LEP partnerships for the stated purposes.
3.2.4	Increase business and private sector (i.e. the Lexington Chamber of Commerce) involvement in the emergency management system.	Over the last 5 years DEM and the business community have engaged more frequently. DEM has created a position in the EOC (Business Liaison)
3.3.1	Review, assess, and make recommendations on hazard related laws, regulations, codes, policies, and other guidelines.	On-going

Action	Description	Status, Successes
3.3.2	Combine and submit annual request for mitigation project updates and annual reporting for FMA, HMGP, and PDM	This action was deemed to be covered under the Plan Maintenance and removed.
4.1.1	Provide multi-lingual disaster related information to LFUCG agencies, media, and other LEP organizations, CERT, and the public at-large through publications and electronic resources about emergency procedures. Continue processes to evaluate prevalent languages for Fayette county.	Inclusion of the International Red Cross.
4.1.2	Identify source (such as FEMA) and disseminate educational information in top foreign (macro) languages like Spanish, French, Swahili, and Arabic as funds allow.	It was decided to combine this action with Covered 4.1.1.
4.2.1	Develop an internal outreach program, targeting new members of the Planning Commission and Division of Planning staff for the purpose of educating and providing informational materials about all hazards planning, it's importance when considering land use planning, and existing and planned mitigation efforts by DEM.	Looking champions to move this action forward.
4.2.2	When funding permits, conduct hazard mitigation related training seminars and workshops for local building code enforcement officials.	Still a need.
4.3.1	Insure Lexington-Fayette's Local Channel 185 to digital media subscribers in order to receive public safety messages.	This action was re-worded.
4.3.2	Encourage the incorporation of available hazard mitigation education and outreach programs/products into school programs including LEP students and their families who are not culturally or linguistically prepared.	Recommend FCPS principals, FRYSC and ESL teachers specifically be part of education and outreach programs that include LEP expert agencies and personnel.
4.3.3	Encourage and leverage national, state, or local resources already available in other languages to be made available to general public and LEP communities.	Combined under 4.1.1.
5.1.1	Design a methodology and system to better archive and manage local data types after a natural and/or man-made hazard event.	This action was re-worded and combined with 5.1.2. The Emergency Planning Task Force is looking into how to implement this action.
5.1.2	Maintain the gathering and archiving of local data on infrastructure, critical facilities, population, and hazardous material sites as they pertain to the risk assessment section of this plan.	This action was re-worded and combined with 5.1.1. The Emergency Planning Task Force is looking into how to implement this action.
5.2.1	Share and distribute CRS and Lexington-Fayette County Floodplain Management Plan annual reports to LFUCG agencies and other steering committee members for review.	LFUCG does this as part of our CRS requirements on a yearly basis.
5.2.2	Merge future HMP annual progress reporting process with CRS FMP annual reporting process as outlined in the plan maintenance section of this plan.	This action was deemed to be covered under the Plan Maintenance and removed.

Action	Description	Status, Successes
5.3.1	Conduct outreach with the land use planning and development community for the purpose of incorporating mitigative building and development best practices into existing plans, policies, and procedures.	This is currently being done but needs to be better coordinated.
5.3.2	Enhance and design a new outdoor warning system for the community with buffered areas demonstrating reach and at-risk populations. Map the current siren area.	Completed

Appendix H: FEMA's Mitigation Action Evaluation Worksheet

Worksheet 6.1
Mitigation Action Evaluation Worksheet

Mitigation Action Evaluation Worksheet

Use this worksheet to help evaluate and prioritize each mitigation action being considered by the planning team. For each action, evaluate the potential benefits and/or likelihood of successful implementation for the criteria defined below.

Rank each of the criteria with a -1, 0 or 1 using the following scale:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Example Evaluation Criteria

Life Safety – How effective will the action be at protecting lives and preventing injuries?

Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?

Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.

Political – Is there overall public support for the mitigation action? Is there the political will to support it?

Legal – Does the community have the authority to implement the action?

Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?

Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Administrative – Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?

Local Champion – Is there a strong advocate for the action or project among local departments and agencies that will support the action's implementation?

Other Community Objectives – Does the action advance other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the comprehensive plan?

Appendix I: Acronyms

CAO Office	Chief Administrative Office
CBRNs	Chemical, biological, radiological, or nuclear hazardous materials
CERT	Community Emergency Response Team
CFA	Code of Federal Regulations
CHAMPS	Commonwealth Hazard Assessment Mitigation Planning System
COOP	Continuity of Operations Plan
CRS	Community Rating System
CSEPP	Chemical Stockpile Emergency Preparedness
CTP	Cooperating Technical Partners Program Management
DEM	LFUCG Division of Emergency Management
DFIRMs	Digital Flood Insurance Rate Maps
DMA 2000	Disaster Mitigation Act of 2000
DWQ	Division of Water Quality (LFUCG)
EOC	Emergency Operations Center
ESF	Emergency Support Function
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance Grant Program
GIS	Geographic Information Systems
HAZMAT	Hazardous Materials
HMGP	Hazard Mitigation Grant Program
KDOW	Kentucky Division of Water
KGS	Kentucky Geological Survey
KRS	Kentucky Revised Statutes
KyEM	Commonwealth of Kentucky Division of Emergency Management
KYTC	Kentucky Transportation Cabinet
LEP	Limited English-Speaking Population
LEPC	Fayette Local Emergency Planning Committee
LexTran	Lexington Transit Authority
LFUCG	Lexington Fayette Urban County Government
MSA	Metropolitan Statistical Area
NCDC	National Climatic Data Center
NEN	Neighborhood Emergency Network
NOAA	National Oceanic and Atmospheric Administration
NFIP	National Flood Insurance Program
NWS	National Weather Service
PDM	Pre-Disaster Mitigation Grant Program
PDR	Purchase of Development Rights Program
PDSI	Palmer Drought Severity Index
PGA	Peak Ground Acceleration
PPE	Personal Protective Equipment
RL	Repetitive Loss
SA	Spectral Acceleration
SRL	Severe Repetitive Loss
TIH	Toxic Inhalant Exposure
UK	University of Kentucky
USGS	United States Geological Survey

Appendix J: Plan Maintenance Forms

The below form may be distributed to responsible agencies for the purpose of updating the status of action items. Another method of gathering updates to mitigation action items might be to distribute the "Mitigation Action Workbook" excel workbook to Steering Committee Members to make direct changes.

Subject: Annual Report Status of Mitigation Action Items and Projects

Report Date: MM/DD/YYYY

Purpose of Annual Reporting: On an annual basis the Division of Planning and the Division of Emergency Management (DEM) has committed to tracking and monitoring action items on the Hazard Mitigation Plan (HMP) and the Floodplain Management Plan (FMP). As a responsible agency to the proposed action items, your cooperation in completing the below forms will allow DEM and Planning to conduct a thorough update on each mitigation project and action item.

Updating Your Projects: To find your agency's pre-identified mitigation projects and action items, please refer to the provided spreadsheet which lists mitigation action items and projects from the previous year. If your agency has procured new projects that are not listed and demonstrate the accomplishment of an action item, please provide information on the new project in one of the below forms. Please complete the below forms, save the document with your agency name and return to <name/agency name here> at <email address here>.

Name of Reporter:

Email Address:

Telephone #:

INDIVIDUAL PROJECT PROGRESS REPORT #1

Addressed Action Item: Refer to accompanying spreadsheet with listed action items.

Project Title:

Responsible Agency: <Select Agency> **If other, please specify:**

Status of Project: <Select Status>

If stand-alone project, please enter dates:

Start Date: Click here to enter a date. **End Date:** Click here to enter a date.

Funding Source:

Cost of Project *<Type of Cost>* Enter amount here.

If this project is new, please describe: Enter project description here.

Problems/Obstacles & Proposed Corrective Action:

Additional Comments: Enter comments here.

The below form may be utilized for recording needed and anticipated amendments to the plan.

Lexington-Fayette County Hazard Mitigation Plan

Plan Amendment Form

Amendment Sponsor: ________________________________

Amendment #: ________________________________

Date: MM/DD/YYYY

Current Text: ____

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Section:____________________ Page__________ Line__________

Amended Text: ____

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Section:____________________ Page__________ Line__________

Purpose of Amendment: ____

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Appendix K: Plan Adoption Letter

Appendix L: Local Mitigation Plan Review Tool