Lexington Fayette County
Hazard Mitigation Plan 2012

Prepared by the
Division of Emergency Management and
Lexington-Fayette Urban County Government

LEXINGTON FAYETTE EMERGENCY MANAGEMENT

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Lexington Fayette County

Hazard Mitigation Plan
2012

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Executive Summary

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act enacted under the Disaster Mitigation Act of 2000 (DMA 2000) provided new and revitalized approaches to mitigation planning. Section 322 established a new requirement for Local Mitigation Plans, and authorized up to 7% of Hazard Mitigation Grant Program (HMGP) funds available to a State to be used for development of State, Tribal, and Local Mitigation Plans. The revised guidance emphasizes the need for State, Tribal, and Local entities to closely coordinate mitigation planning and implementation efforts. The most successful of these plans – where practical, meaningful mitigation actions have been the result – have two common elements:

Mitigation Plan Five-Year Update Requirement

Updates as required at 44 CFR §201.6(d)(3). The mitigation planning regulation states:

A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.

- Comprehensive risk assessments that form a solid foundation for decision-making; and
- Input from a wide range of stakeholders who would play a role during implementation of recommended mitigation actions at the Federal, State, and Local levels.

The DMA 2000 emphasizes greater interaction between State and Local mitigation planning activities, and highlights the need for improved linkage of hazard and capability analyses to State and Local hazard mitigation strategies.

The implementation of planned, pre-identified, cost effective mitigation actions based on a sound hazard identification and risk assessment will make a major contribution to reducing Lexington Fayette County's disaster losses.

The purpose of the Lexington Fayette Urban County Government (hereafter referred to as "LFUCG") Hazard Mitigation Plan Update is to provide guidance for hazard mitigation within the jurisdictional boundaries of Lexington Fayette County. It identifies and updates hazard mitigation goals, objectives, and recommended mitigation actions for local government that will reduce injury and damage from natural and man-made hazard events.

Hazard mitigation, defined by the Federal Emergency Management Agency (FEMA) is any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards, is crucial to the citizens residing within the jurisdictional boundaries of Lexington Fayette County. Because of the risk and exposure to many kinds of natural and man-made hazard events, in particular floods, tornados, severe storms and severe winter storms, among others, Lexington Fayette County understands the need for improved information for decision-making in disaster planning.

Recognizing that the impact and effects of most disaster events can be lessened by mitigation planning and preventative measures, the LFUCG Hazard Mitigation Plan Update has been revised to re-establish and improve it as a planning guide for Lexington Fayette County. The updated plan identifies cost

effective mitigation measures to reduce or eliminate the long-term risk to human life and property from both natural and man-made hazard events.

The plan update is the result of a systematic evaluation of the nature and extent of the vulnerability posed by the effects of natural and man-made hazards present and includes a five-year action plan to minimize future vulnerability and plan maintenance strategy to keep track of progress in doing so.

The LFUCG Mitigation Plan adheres to the guidelines outlined in 44 CFR, Section 201.6. 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. Man-made hazards were added to the plan which created the all-hazard approach. As a result, there are 13 hazards, including Hazardous Materials (HAZMAT).

The Lexington Fayette County mitigation planning update effort is a result of the partnership created by the Kentucky Emergency Management Agency (KyEM) and the LFUCG Division of Emergency Management (DEM) through a Mitigation Planning Grant. The LFUCG Hazard Mitigation Plan Update was prepared by The Center for Hazards Research and Policy Development (CHR) at the University of Louisville, with support from Moore Enterprises and Stantec, all in close coordination with the LFUCG DEM and in cooperation with the Plan Steering Committee and Local stakeholders, hereafter referred to as "Planning Team."

The LFUCG Hazard Mitigation Plan Update has incorporated local mitigation experiences, reviewed and listed a variety of mitigation projects, and examined the strategies and action items found in other current and up-to-date local, regional, and state plan documents. Throughout the planning process, LFUCG DEM has taken advantage of the collective mitigation knowledge of many State, Federal, and Local officials, as well as representatives from both the public and private sectors; all designed to help safeguard the citizens of Lexington Fayette County. As such, the plan update should significantly contribute to the mitigation of future local disasters. Without the help and coordinated assistance of all of the above mentioned groups, this program would not be the success it is in Lexington Fayette County.

This plan is designed to provide a blueprint for local hazard mitigation activities and is structured to serve as a basis for specific hazard mitigation efforts for any disaster. The natural hazards categories included in the updated plan are consistent with the 2010 Kentucky State Hazard Mitigation Plan.

Sections of the Plan Update

The updated plan uses the same planning process as the 2006 plan and stakeholders are again at the center of the process. This plan was developed using broad based and diverse community participation activities, and contains the following five sections, plus appendices, including acronyms and references (See Appendix 1.1 and Appendix 1.2):

1. Planning Process
2. Risk Assessment
3. Mitigation Strategy
4. Plan Maintenance Procedures
5. Plan Approval

The following is an overview of the planning process utilized by the Planning Team.

1. Planning Process

The planning process included the review of Lexington Fayette County's current hazard mitigation plan, other mitigation plans, and strategies including a review and analysis of the potential hazards significant to the area. Key stakeholders were identified and organized into a steering committee. This was conducted by DEM staff in conjunction with the Planning Team and this list was reviewed by the Director of DEM for approval.

2. Risk Assessment

This step involved developing a profile for Lexington Fayette as well as the identification, compilation and integration of the existing hazard databases throughout Lexington Fayette County into one managed, county-level database. This provided the necessary information for the steering committee to examine past occurrences of hazards, assess probabilities, and create appropriate mitigation strategies. The Planning Team spent considerable time identifying and profiling the primary hazard events that are significant to Lexington Fayette County. Once the hazards were identified, vulnerability was assessed at the Census Block level and with priority on critical facilities.

3. Mitigation Strategy

This step included the drafting of hazard mitigation goals, objectives and actions by the steering committee. The mitigation strategy was based on the review of the risk assessment process and feedback provided during public meetings. The Project Team then worked to assess Lexington Fayette County's current capabilities in order to create a viable mitigation strategy containing over 45 action items, 23 of which are new to the plan update.

4. Plan Maintenance Procedures

The Planning Team worked to develop a strategy for plan maintenance that includes implementation, monitoring and updating, with a particular focus on collaboration with other LFUCG public agencies to allow for better incorporation of existing planning mechanisms.

5. Plan Approval

The plan submittal process began with DEM submitting the plan to 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.

Once certified approvable by FEMA, DEM submitted the plan to LFUCG Council for formal adoption and then resubmitted to State and FEMA for final review and approval. A signed copy of the executed Resolution and formal Adoption by the LFUCG is included in Appendix 2.1.

1.0 Introduction

1.1 Overview

Mission Statement:

The Lexington Fayette County Hazard Mitigation Plan is designed to sustain the community by mitigating damage and losses caused by all hazards.

The discussion, then approval of the above updated mission statement at the first Steering Committee meeting, was the first commitment by the Steering Committee to the mitigation plan update process. As a result of intensive participation in the plan development process, Lexington Fayette County was able to outline a thorough list of committed mitigation action items to pursue. This policy document demonstrates Lexington Fayette County's commitment to reducing the risks from natural and man-made hazards, and should serve as a guide for all levels of local decision makers.

Mitigation Planning Requirements
44 CFR Part 201

Text boxes in this color and shape are used throughout the plan to summarize the regulations in 44 CFR Part 201.

Exact CFR references applicable to each section help the reader understand the rule and/or planning requirements.

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, including the Bluegrass Area Development District (BGADD) and University of Kentucky;

- 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 Lexington Fayette County's blueprint for reducing potential losses identified in the risk assessment.

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.

1.2 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 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 124% from 131,906 in 1960 to 295,803 in 2010, with an increase of 13.5% for the last decade.

Population Growth in Fayette County & the Fayette Metro Area

	1980	1990	2000	2010
Fayette County	204,165	225,336	260,512	295,803
7 county metro area total	370,981	405,936	479,198	555,015*
Fayette Co. as % of metro	55.0%	55.5%	54.4%	53.3%
State	3,660,777	3,685,296	4,041,769	4,339,367

Source: US Census Bureau, Census of Population, 1980-2010
**The MSA was redefined to 6 counties sans-Madison. Madison county's Total Population has been added for continuity.*

In the seven-county (Fayette, Jessamine, Woodford, Scott, Bourbon, Clark, Madison) MSA, the population has increased from 479,198 in 2000 to 555,015 in 2010, a 15.8% increase for the area. Fayette County, as a percentage of the MSA population, has declined from 56.3% in 1970 to 54.4% in 2000. 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 2010 data showing Fayette County population comprising 53.3% of the MSA population.

At 44.9% and 49.6%, both Fayette County and the entire metro area have grown more rapidly than the percentage growth of the state as a whole (18.5%) over this time period. Based on the 2000 Census data, projections used in Lexington Fayette County's 2007 Comprehensive Plan Update[1] estimates the future

population of the urban county to continue growing at the current 15% decennial rate, for an increase to 327,341 in 2020 and 358,122 in 2030[1].

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 2010. The percentage of persons 18 to 64 years of age increased from 60% of the total population in 1970 to 68% of the 2010 population. 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 11% of the 2010 population. This reflects increased longevity and the choice of Lexington as a place for retirement by many people.

According to the U.S. Department of Commerce, the population by race and Hispanic origin from 2009 shows 81.1% (240,401) white, 13.8% (40,903) black, and 3.1% Asian (9,311) to name the highest documented percentages. Of the total population, regardless of race, 6.6% or 19,654 individuals are of Hispanic Origin.

**Population and Percent by Age Category
Lexington Fayette County, 1980-2010**

Age	Total Pop.	% Pop.	Total Pop.	% Pop.
	1980		1990	
0-17	51,667	25	50,460	22
18-64	134,952	66	152,603	68
65+	17,546	9	22,303	10
Total	204,165	100	225,366	100
	2000		2010	
0-17	55,533	21	62,633	21
18-64	181,146	70	202,032	68
65+	23,833	9	31,138	11
Total	260,512	100	295,803	100

Source: US Census, Bureau,
Census Population, 1970-2010

[1] The 2007 Comprehensive Plan for Lexington Fayette County, Kentucky, 250

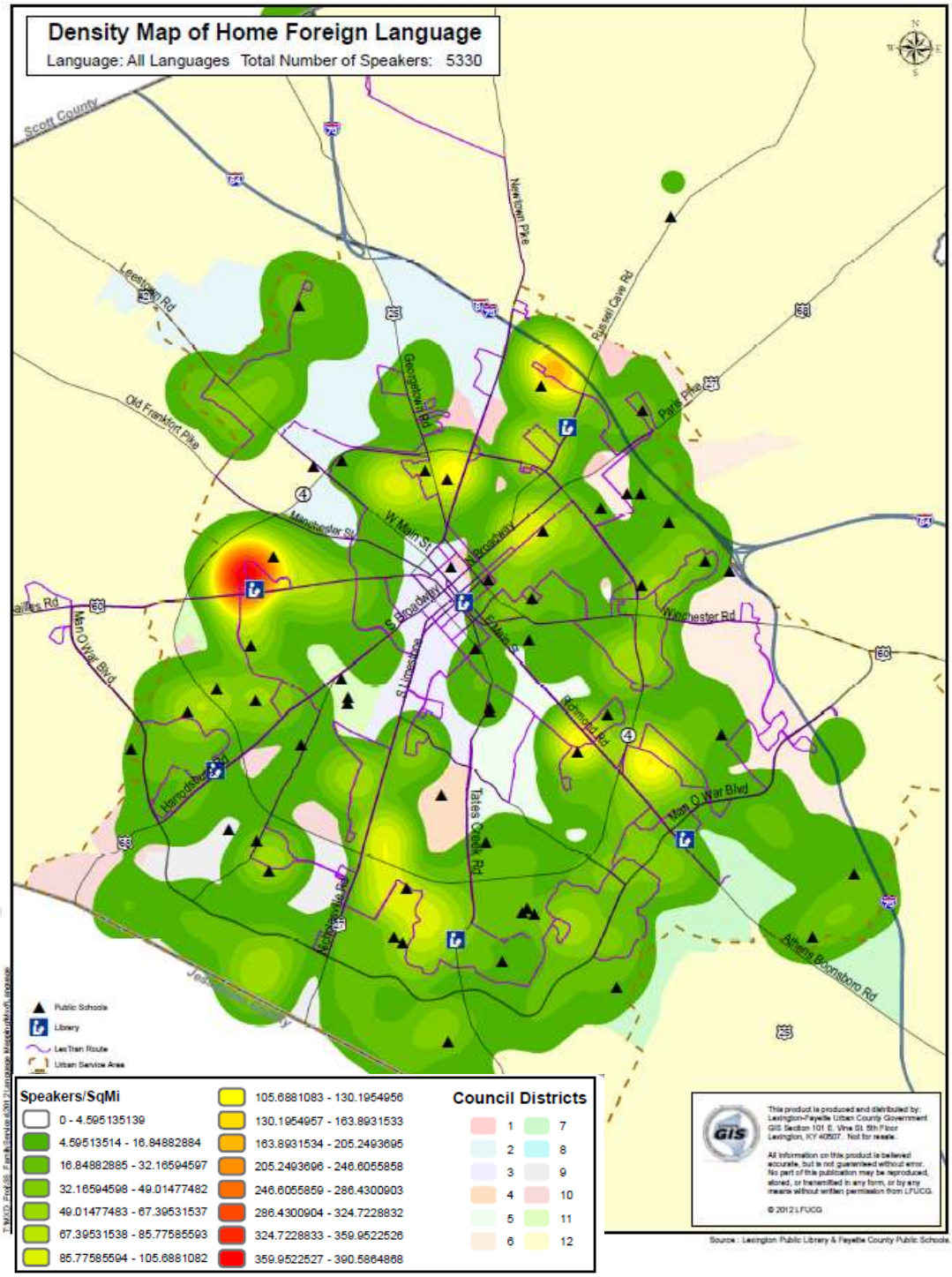
Foreign Language Distribution

Since 2005, the foreign language speakers in Fayette County have grown 186%. It is estimated by LFUCG Multi-cultural Affairs that some 43,460 non-English speakers make up the total immigrant population. A 4.1% growth from 2010 to the first half of 2012 means today more than 15.4% of Fayette residents are foreign language speakers. At this rate, by 2014, it is estimated that close to 20% of County residents may not communicate well in English. Emergency preparedness and response efforts must be targeted to include this rapid and unprecedented growth in immigrant population and number of foreign languages.

Data on immigrant children learning English, otherwise categorized as English Language Learners (ELL), from Fayette County Public Schools shows that:

- In 2005 there were 27 languages represented - 66% Spanish; by 2012, there were 88 languages represented - 48.7% Spanish
- In 2005 there were 1,520 ELL students, by the first semester of 2012 there were 4,346 ELL students.
- In 2012 the top 10 foreign languages spoken at home by ELL are:
    1. Spanish
    2. Arabic and Chinese
    3. Japanese
    4. Swahili
    5. Nepali
    6. French
    7. Korean
    8. Vietnamese
    9. Gujarati
    10. Russian

With LFUCG GIS department and the Fayette County Public Schools, foreign language maps were produced which include schools and LexTran routes, in addition to the top home foreign language spoken. Below is a map showing all foreign languages spoken at home with a total of 5,330 speakers. Additional maps for each of the top ten languages can be accessed on the multi-cultural section of the LFUCG website.


Density Map of Home Foreign Language
Language: All Languages Total Number of Speakers: 5330
Scott County
Leestown Rd
Old Frankfort Pike
Georgetown Rd
Newtown Pike
Russell Cave Rd
Paris Pike
W Main St
E Broadway
S Broadway
S Limestone
E Main St
Winchester Rd
Man O War Blvd
Harrodsburg Rd
Romany Rd
Tates Creek Rd
Nicholasville Rd
Athens Boonsboro Rd
Public Schools
Library
LexTran Route
Urban Service Area
Speakers/SqMi
0 - 4.595135139
4.59513514 - 16.84882884
16.84882885 - 32.16594597
32.16594598 - 49.01477482
49.01477483 - 67.39531537
67.39531538 - 85.77585593
85.77585594 - 105.6881082
105.6881083 - 130.1954956
130.1954957 - 163.8931533
163.8931534 - 205.2493695
205.2493696 - 246.6055858
246.6055859 - 286.4300903
286.4300904 - 324.7228832
324.7228833 - 359.9522526
359.9522527 - 390.5864868
Council Districts
1
2
3
4
5
6
7
8
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11
12
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Source : Lexington Public Library & Fayette County Public Schools

Population Distribution

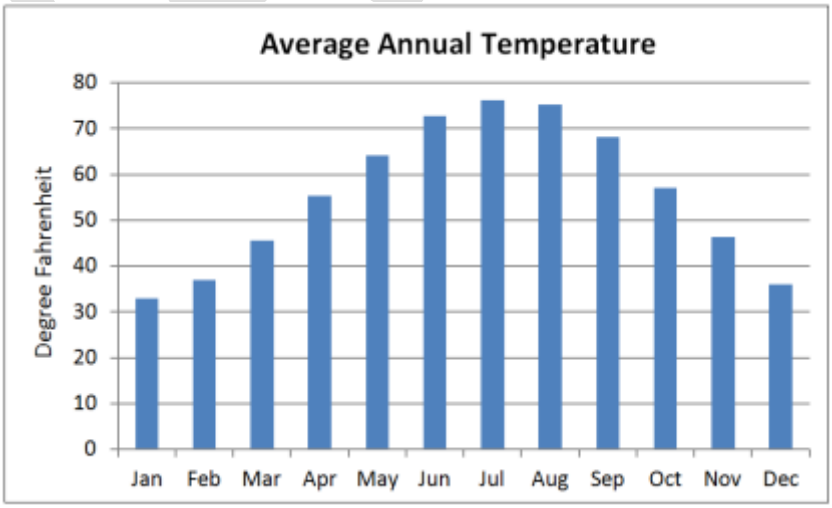
The distribution of urban to rural growth has also dramatically changed. In 1960, 83.6% of the urban population lived inside New Circle Road. In 2000, that had dropped to 43%[2].

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 4.6% in 2000. "The Urban Service Area boundary has 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."[3]

Climate

Monthly mean temperatures in Lexington Fayette County range from a high of 76.2 degrees in July to a low of 32.9 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 45.9 inches of precipitation falls in the spring. Storms happen year-round; however most storms occur between March and September.



[2] ibid, 252
[3] ibid, 252

Normal Climate & Average Weather in Lexington Fayette, Kentucky												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
*Average temperature (°F)	32.9	36.9	45.5	55.3	64.2	72.7	76.2	75.3	68.1	57.0	46.3	36.0
Days with precipitation	12	11	13	12	12	11	11	9	8	8	11	12
Wind speed (mph)	10.5	10.5	10.8	10.4	8.6	7.9	7.2	6.8	7.6	8.1	9.8	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
Snowfall (in)	5.8	4.7	2.7	0.3	0	0	0	0	0	0	0.6	1.9
*National Climatic Data Center (NCDC) 1981-2010 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. Floodplains, areas of slope in excess of 15%, sinkhole areas, significant tree stands, and other general environmental areas are among the concerns addressed in the Land Subdivision Regulations within LFUCG's 2007 Comprehensive Plan. Additional review of the regulations related to steep slopes, fill materials and method of placement, springs, and large topographic changes resulting from development may need to occur to ensure that these issues are being adequately addressed.

Land Use and Planning

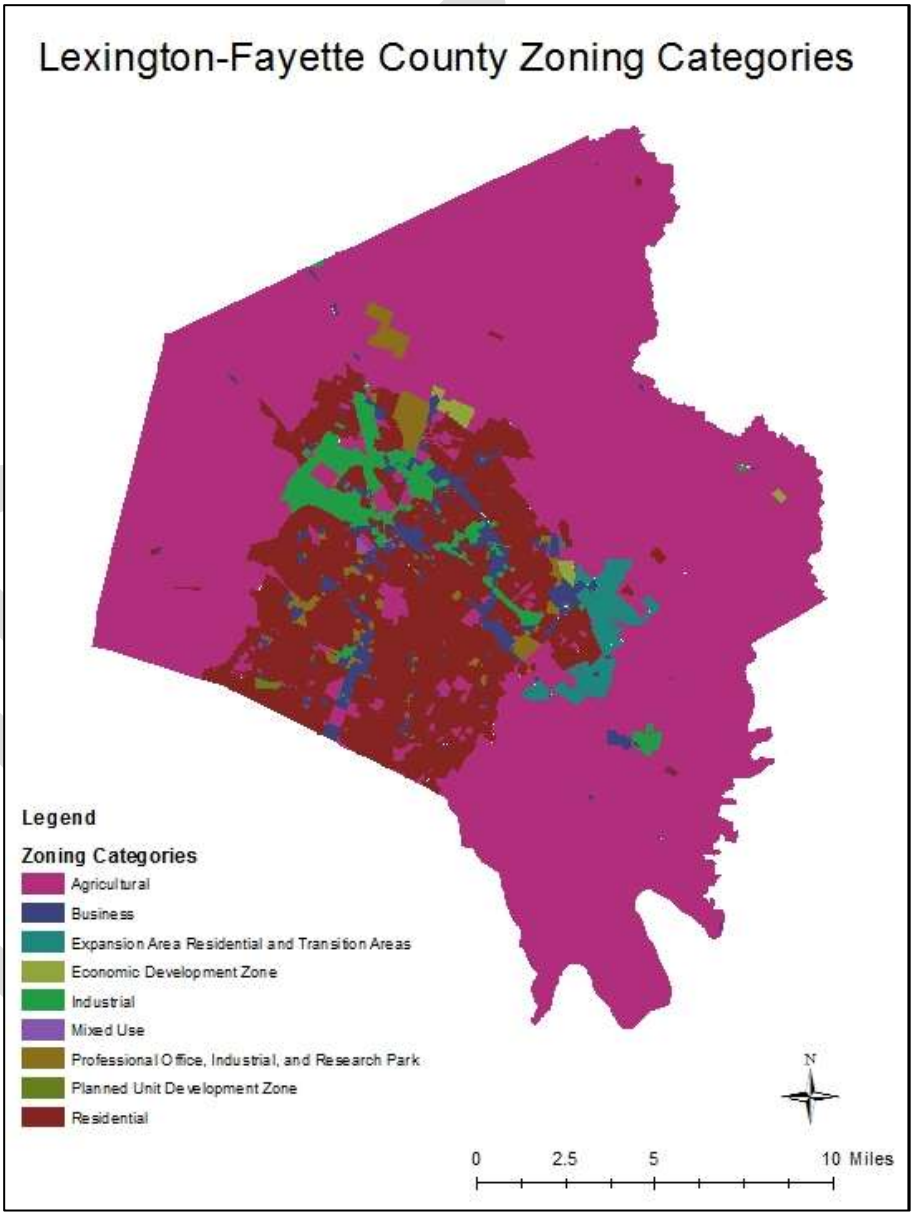
Lexington Fayette County is located in the heart of central Kentucky's Bluegrass Region. The terrain is rolling hills with some deep streambeds. Principal streams are the Kentucky River and Elkhorn Creek. The following subsections outline the County's rural preservation, housing, economy, tourism, and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

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.

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 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.



Lexington Fayette County Zoning Categories
Source: Department of Planning, 2011

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 are located within 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 comprises 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 survey was completed in January 2000. At that time, approximately 14,000 acres, or 25% of the land, in the Urban Service Area were undeveloped. About 10% of this, or 1,400 acres, is environmentally sensitive with floodplains, areas of steep slopes, or sinkholes. About eight acres of the developed urban lands are classified as geologic hazard areas. In the vacant and agricultural lands to be developed (including current expansion areas and land bypassed by development due to specific problems) some 340 acres, or 2% of the land, are identified as geologic hazard areas. These areas will either require extensive geotechnical analysis before development or they will need to be left as open space.

Housing

According to the 2010 U.S. Census, Lexington Fayette County has a total of 135,160 housing units, 12,117 (9.0%) of which are recorded as vacant. Of the total occupied units, 68,818 (56.0%) are owner-occupied and 54,225 (44.0%) are renter-occupied. The ratio for occupancy to number of owner-occupied housing units is 2.4 individuals per unit, whereas the ratio for renter-occupied housing units is 2.2.

Housing values are mixed throughout Lexington Fayette County. There is only one Census Tract in the County that has housing values in the highest range of $450,000 to $625,000. This Census Tract, located in the northwestern part of the county, is the location of many thoroughbred horse and racing farms.

The southwestern and southeastern regions of Lexington Fayette County have housing units mostly ranging from $122,800 to $181,100 or $189,600 to $298,300 in value. The northern and eastern regions of the County consists predominately of housing units with values of $72,900 to $119,800. The only

areas with housing values in the $0 to $69,600 range are in the central areas of the County in or near urban Lexington.

Overall, the housing value of $72,900 to $119,800 appears to be the primary housing value for the entire Lexington- Fayette County area.

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. As the site of the University of Kentucky, Transylvania University, the Lexington Theological Seminary, and many well-known homes and shrines, the city is of exceptional cultural and historical interest.

Lexington, the primary urban center of Central Kentucky, supports four universities, in addition to six other post-secondary educational institutions, 109 schools, 11 hospitals, 83 shopping centers, 19 nursing homes, and approximately 169 daycare centers.

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
ITT Technical Institute, Lexington Campus
Lexington Theological Seminary
National College, 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 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	12,278
Lexington Fayette Urban County Government	Local Government	4,057
Fayette County Public Schools	Local Education	3,558
Lexmark International Inc.	Global Headquarters	2,800
Baptist Healthcare System Inc.	Healthcare	2,496
St. Joseph Hospital	Healthcare	2,300
ACS, a Xerox Company	Outsourcing & Technical Support	2,100
Wal-Mart	Retail	2,027
Lockheed Martin	Contract Support Services	1,750
Kroger	Retail	1,665
Veterans Medical Center	Healthcare	1,500
Lexington Clinic	Healthcare	1,300
Amazon.com	Distribution	1,200
Trane Lexington	Manufacturing	1,000
Meijer	Retail	675
Ashland Consumer Markets (Valvoline)	Headquarters	658
Gall's Inc.	Distribution	596
Cardinal Hill Rehabilitation Hospital	Healthcare	560

Federal Bureau of Prisons	Federal Government	560
IBM Global Services	Information Technology	552
UPS	Logistics	537
Link-Belt Construction Equipment Company	Manufacturing	525
Bluegrass Community and Technical College	Higher Education	500
Schiender Electric	Manufacturing	500
Webasto Sunroofs Inc.	Manufacturing	450
	TOTAL	**46,144**
*Source: Commerce Lexington Inc. Economic Development. Web Address: http://locateinlexington.com/Data-Facts---Figures-Major-Employers.aspx		

Geology of Fayette County

According to the Kentucky Geological Survey (KGS), limestone is the chief geologic resource in the county, with two 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.

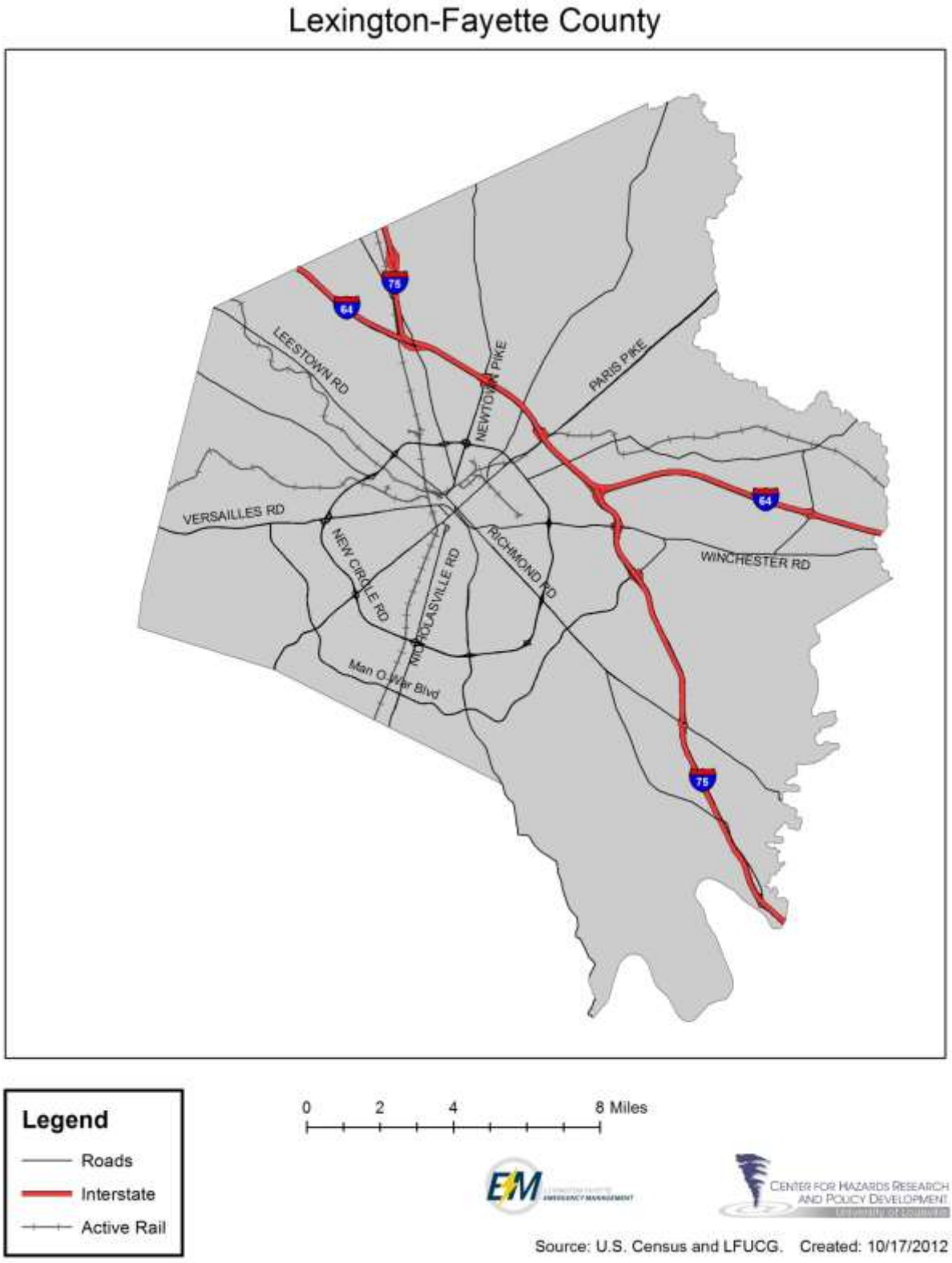
Arts, Entertainment, and Recreation Statistics in Fayette County						
2007 NAICS code	**Meaning of NAICS code**	**Number of Establishments**	**Receipts/Revenue ($1,000)**	**Annual Payroll ($1,000)**	**Number of Paid Employees**	**Sales, Receipts, or Revenue Estimated (%)**
71	Arts, entertainment, and recreation	135	148,681	52,993	2,322	9.2
711	Performing Arts, spectator sports, and related industries	56	84,263	31,395	942	9.0
712	Museums, historical sites, and similar institutions	10	D	D	b	D
713	Amusement, gambling, and recreation industries	69	D	D	g	D
Source: U.S. Census Bureau. Location: www.census.gov *D – Withheld to avoid disclosing data for individual companies; data not included in higher level totals* *b – 20 to 99 employees* *g – 1,000 to 2,499 employees*						

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. Bluegrass Field 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.

Transportation in and out of the area includes a regional airport called Bluegrass Field, two railway companies, Norfolk Southern Railway System and RJ Corman Railroad Group, and Greyhound Bus Lines. Lexington Fayette County includes approximately 1,172 miles of urban, county, and state maintained roads as outlined in the map.


Lexington-Fayette County
LEESTOWN RD
NEWTOWN PIKE
PARIS PIKE
VERSAILLES RD
NEW CIRCLE RD
NICHOLASVILLE RD
RICHMOND RD
WINCHESTER RD
Man O War Blvd
75
64
Legend
Roads
Interstate
Active Rail
0 2 4 8 Miles
Source: U.S. Census and LFUCG. Created: 10/17/2012

2.0 Prerequisites

2.1 Adoption by the Local Governing Body

Adoption by the local governing body demonstrates a commitment to fulfilling the hazard mitigation goals and actions outlined in the plan (See Appendix 2.1 for Plan Adoption Documents). 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 prerequisite before the plan can be approved by FEMA.

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).

2.2 Hazard Mitigation Plan Adoption, Submission and Approval Process

The plan will be formally adopted by the LFUCG Council prior to submittal to FEMA for final approval. The approval will at a minimum include the endorsement of the LFUCG Council. 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 begins with DEM submitting the plan to the KyEM for review and comment and then incorporating any revisions. KyEM submits the plan to FEMA Region IV for approval, pending local adoption status.

Once the plan is certified approvable by FEMA, DEM submits the plan to LFUCG Council for formal adoption and then resubmits to State and FEMA for final review and approval. A signed copy of the executed Resolution and formal Adoption by the LFUCG will be included in the final plan.

Plan Evaluation Methodology: FEMA reviewers document their evaluation of the plan using the Local Mitigation Plan Review Crosswalk/Guide. Local Mitigation Plans are approved when they receive a "Satisfactory" for all requirements under 44 CFR §201.6. Except for prerequisites that are met before the plan can be approved, the reviewer evaluates requirements based on the following system:

N Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments are provided.

S Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

3.0 Planning Process

Mitigation planning is the systematic process of organizing technical, financial, and human resources, learning about the hazards that can affect a community, setting clear goals to reduce a community's vulnerability to identified hazards, and implementing an effective mitigation strategy. Laying the foundation of an effective mitigation planning process is the first step in making a community more disaster resistant.

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 rule.

The following section demonstrates the achievement of the Lexington Fayette County Hazard Mitigation Plan development process by describing the Planning Team, Steering Committee and public participation, and the incorporation of existing planning mechanisms. Since the previous plan development, thirteen additional organizations participated in an advisory role for the plan update process.

3.1 Documentation of the 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.

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.

3.1.1 Planning Team

The LFUCG Hazard Mitigation Plan was prepared by the CHR at the University of Louisville, under the direction of LFUCG's DEM, and in cooperation with all stakeholders in the process.

The Planning Team oversaw the plan development strategy and coordination of the development process for the strategy. Following is a description of the Planning Team comprised of engineers, planning experts and mitigation specialists (See Appendix 3.1 for Planning Team Contact Information).

- DEM staff
  - Patricia Dugger, Director
  - Stephen Jackson, Operations Manager
- The University of Louisville CHR team comprised of
  - Dr. David Simpson, Executive Director
  - Josh Human, Director
  - Andrea Pompei, Project Manager
  - Nathan Bush, Graduate Research Assistant
- Mike Greene, Stantec
- Pamela Moore, Moore Enterprises

The planning process began in October of 2011 with the Planning Team organizing the process in the following manner:

Step 1 – Planning Process
Step 2 – Risk Assessment
Step 3 – Mitigation Strategy
Step 4 – Plan Maintenance Procedures
Step 5 – Plan Approval

An all-hazards approach ensures that staff, programs, construction standards, and public information messages are consistent and mutually supportive. The planning process in theory is linear, but in practice became a series of iterations as the Planning Team worked to design a system that accommodated an exceedingly broad-based mitigation process. As existing programs were identified and new ideas and recommendations generated, each step had to be re-evaluated for sufficient information and direction to accommodate new information.

3.2 Public and Local Agency Involvement

Local Mitigation Plan Documentation

§201.6(b) requires the plan to contain a discussion of how the planning process involved local agencies and other interests and how the planning process allowed for public comment.

§201.6(c)(1)-The Hazard Mitigation Plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

A local Plan Development Team designed and developed the plan. The Plan Development Team is comprised of the Planning Team and the steering committee. The Plan Development Team roles, agendas, and schedule are outlined in this section.

The existing Plan Development Team members, as well as others, were requested to serve as public and private stakeholders for the five-year plan update. The steering committee represents hazard-related agencies/organizations from local, state, and federal agencies, as well as community representatives, local business leaders, academia, government, businesses, public health, neighborhoods, citizens, and volunteer/public service organizations. New members were added to the steering committee to address man-made hazards and to provide citizen input.

The steering committee includes a cross-section of the community. As public and private stakeholders, the committee contributed to open public involvement and advised their constituents of the planning process. The committee is composed of staff from those community departments that will be implementing the majority of the plan's recommendations and represent the public at-large.

After identifying potential local stakeholders, the Director of DEM sent a request asking for assistance and participation in the planning process (as outlined to the right). The request asked that each local agency assign a liaison to work on the steering committee. A schedule of four steering committee meetings was set and all liaisons were invited to attend. The purpose of these meetings varied, but the main objective was the development of dialogue among the multiple agencies throughout Lexington Fayette County who deal with all hazards and their effects.

Invitations and reminders to the meetings were sent via email and follow-up telephone calls were made to encourage attendance.

The listed stakeholder agencies (See Appendix 3.2) were key contributors to the development of the plan, demonstrated not only by attendance at the steering committee and public meetings, but also in their role as active providers of data and

Planning Phases
Stakeholder Committee Timeline

1. **The Planning Process**
   - Convene a Committee
   - Review and Incorporation of Materials
2. **Risk Assessment**
   - Identify Hazards
   - Profile Hazard Events
   - Assess Vulnerability: Identifying Assets and Estimating Potential Losses
   - Analyzing Development Trends: Population and Land Use
3. **Mitigation Strategy**
   - Outline Problems and Concerns
   - Develop Local Hazard Mitigation Goals and Objectives
   - Identify and Analyze Mitigation Measures
   - Develop Implementation of Mitigation Measures in a Five-Year Action Plan
4. **Plan Maintenance Procedures**
   - Develop Process for Monitoring, Evaluating & Updating the Plan
   - Include Implementation Through Existing Programs and Five-Year Action Plan
   - Develop method for continued Advisory Committee and Public Involvement
5. **Plan Approval**
   - Submit Draft Plan to KyEM & FEMA for Review (Revise Accordingly)
   - Public Meeting
   - Adoption by Local Governing Body

information to assist with the development of the profiles and risk assessments:

3.2.1 Steering Committee Meetings

The Planning Team conducted four meetings of the steering committee which allowed an interactive feedback process to take place among all of the representatives of local agencies and concerned organizations. Those meetings are described in detail below and the agendas and supporting documentation are located in Appendix 3.3.

Steering Committee Agencies

- American Red Cross Bluegrass Chapter
- Citizen Corps Council
- Columbia Gas
- Community Emergency Response Teams
- Department of Public Safety
- Division of Building Inspection
- Division of Code Enforcement
- Division of Emergency Management
- Division of Fire and Emergency Services
- Division of Planning
- Division of Water Quality
- KY American Water
- KY Bluegrass Area Development District
- KY Geological Survey
- KY Hazard Mitigation Grant Program Office
- LFUCG GIS
- Lextran
- LGE KU
- Local Emergency Planning Committee
- Mayor's Office
- Multi-Cultural Affairs
- Property Valuation Administration
- Public Works
- Risk Management
- University of Kentucky Crisis Management
- Windstream

Steering Committee Meeting I: November 2, 2011

To orient the steering committee members prior to the first meeting, a preparatory handout was distributed via email. This front and back handout answered questions such as:

- What is the purpose of updating the plan?
- What are the benefits of mitigation planning?
- What are the four phases of updating the plan?
- Which hazards will be examined?
- Where are we now in the planning process?
- What type of information is needed from the steering committee members?

The first meeting (See Appendix 3.4 for invitation, agenda, and other meeting handouts) began with introductory comments and an explanation of the hazard mitigation planning process by Josh Human and Andrea Pompei of CHR. This was followed by an introduction of the project team and steering committee, identification of roles on the Plan Development Team and a definition of plan objectives. The risk assessment portion of the plan was explained and the new methodology for deriving vulnerability scores was introduced [Vulnerability Score = (Exposure Score x Risk Score)]. A discussion of the plan development timeline, plan mission statement, objectives of the plan, mitigation strategy, and stakeholder partnering commitment also followed.

The discussion of grant requirements and tracking time was led by Patricia Dugger, Director of LFUCG's DEM. An outline of information and data needs was presented by Josh Human. The national and regional importance of this process was addressed by a discussion of the unpredictable nature of hazardous events and a brief discussion of the occurrences since the last plan.

A break out session concluded the meeting. This included a Hazard Identification Exercise that allowed stakeholders to interact with large-format printed maps of Lexington Fayette County. Colored dots were placed on the map where known hazard events have occurred. The dots were coded to match a data sheet filled out to reflect the nature of the specified dot. The exercise was digitized into a database that was then used as an input in GIS.

In general, the main purpose of the meeting was to give an overview of the process, start a discussion on hazardous areas and events within the county and to work with the invited stakeholders to determine data needs and availability. The meeting participants engaged in a dialogue that targeted key hazards that occur in Lexington Fayette County. Stakeholders identified the types of applicable data their respective agencies maintain and made arrangements for transfer to the CHR to help inform the risk assessment portion of the plan. Types of hazard-related data and information offered by the stakeholders included Geographic Information Systems (GIS) files, official reports, plans, surveys, and past hazard information.

Steering Committee Meeting II: February 1, 2012

In the second meeting (See Appendix 3.5 for invitation, agenda, and other meeting handouts), the preliminary results of the risk assessment were shared and the Planning Team began to build the "Mitigation Strategies" section of the plan. Steering committee members were expected to provide information on and identify completed, existing and future mitigation planning efforts. During this meeting, the mitigation strategies section from the previous plan was revisited as a basis for creating the updated version.

In order to facilitate the process of updating, changing, and adding new mitigation action items, steering committee members were presented with an overview of and handout outlining the six mitigation action categories to help identify projects that could be added to the Five-Year Action Plan. In addition to identifying new items, this discussion was an opportunity to obtain status updates on the original action items from the 2006 Plan.

Social media, such as Twitter, was utilized to include the public in the plan development process during Steering Committee meetings.

Steering Committee Meeting III: March 21, 2012

At the third meeting (See Appendix 3.6 for invitation, agenda, and other meeting handouts), the primary focus was to continue developing the "Mitigation Strategies" section of the plan. The meeting began with a review by Josh Human, CHR Director, of accomplishments to-date in the planning process for the purpose of bringing new committee members up-to-speed. Then a short informational video was shown titled "Hazard Mitigation & How it Can Help You", a video produced by the University of Kentucky in coordination with the University of Kentucky HMGP Office. This video introduced the topic of hazard mitigation, the development of a hazard mitigation plan, and eligible projects of the program. After this video, several members of the Steering Committee provided "mini" presentations; short 10-15 minutes presentations that provided an overview of each organization, and mitigation actions that are planned or have been accomplished. The intent of these presentations was to continue to educate the steering committee about and highlight existing mitigation efforts taking place in Lexington Fayette County. Lastly, a mitigation strategy update was provided by Andrea Pompei from CHR to solicit additional feedback and build consensus among the steering committee for the updated Five-Year Action Plan.

Steering Committee Meeting IV: September 27, 2012

At the fourth meeting (See Appendix 3.7 for agenda), the primary focus was to share and solicit feedback on the final draft of the mitigation strategy and plan maintenance procedures, and introduce mitigation grant and funding opportunities. The meeting began with an introduction from Pat Dugger, Director of DEM, followed by a mitigation plan update presentation given by Josh Human and Andrea Pompei of CHR. Steering committee members and the public were provided the download link for draft plan review 10 days prior to the meeting and allowed an additional week for review in follow-up.

In detail, the introduction of the draft plan document, mitigation strategy, and plan maintenance section included a demonstration of the functionality of the "Fiver Year Mitigation Planning Workbook". Steering committee members provided feedback on the workbook, mitigation strategy and plan maintenance procedures. More incorporation of the Limited English Proficiency (LEP) population in the "Community Profile" and mitigation strategy was addressed and changes made accordingly.

Second, Esther White, of the Kentucky Hazard Mitigation Grant Program Office provided a presentation that included an overview of FEMA's various funding programs. Discussion took place about the grant application process and how to utilize the Kentucky Hazard Mitigation Grant Program Office as a resource during grant application development. The Meeting Facilitators encouraged the steering committee to review the draft documents in the upcoming week, record comments, and return for incorporation into the plan. The draft documents were made publicly accessible on the project website.

3.2.2 Open Public Involvement

The public was involved in the plan update, just as during the previous plan development. The Planning Team increased the number of methods used to involve the public and provided opportunities for public comment throughout the plan update process. The following steps describe methods of public involvement. Please see Appendix 3.8 for additional documentation.

1. **Public Meeting Announcements:** To encourage public involvement, both steering committee and public meetings were advertised by public meeting announcements through Lexington Fayette County.

2. **Publicly Accessible Project Website:** An alternative mode of informing the public about the planning process was through the development of a publicly accessible project website[4]. The website provided the steering committee meeting announcements and schedules, updates on the draft plan and planning process for review, and forms for public comment that could be submitted electronically or through the mail.

The above Twitter post during Steering Committee Meeting 2 demonstrates the utilization of social media to involve the public during the plan development process.

3. **Public Involvement in Social Media:** Social Media, including Twitter, was used as an alternative method of engaging the public during the planning process. Updates were provided on "@CHR_PD" and "@LexKYEM" on Twitter.

4. **Open Steering Committee Meetings:** All of the steering committee meetings were advertised to the public for participation through each of the above described methods.

5. **Special Presentations:** One special presentation was held during a working session for the LFUCG Planning Commission in order to introduce the draft hazard mitigation plan and solicit feedback on incorporating land use planning with hazard mitigation planning methods.

[4] Website Address: www.lexington-mitigation.org

3.3 Incorporation of Existing Plans

The Planning Team reviewed several local agencies' plans to identify programs and policies that currently promote or could potentially further mitigation initiatives in Lexington Fayette County. Early in the process, the Planning Team assisted in collecting the best available data required to complete the risk assessment and ensured coordination with relevant Federal and State agencies for input and technical assistance. The Planning Team coordinated with numerous agencies seeking local hazard data, existing plans, partnerships, common goals, projects, and commitment to a hazard mitigation plan.

Local Mitigation Plan
Existing Plans and Reports

§201.6(b): The plan must address how existing plans, studies, reports, and technical information were reviewed, and if appropriate, incorporated into the plan.

Additionally, local stakeholder agencies were requested to review common problems, development policies, mitigation strategies, and inconsistencies and conflicts in policies, plans, programs, and regulations. The Planning Team also coordinated with experts from local agencies and universities and researched national data hazard sources to ensure all available information was reviewed and presented to the steering committee and used in the risk assessment.

The following is a list of reports, plans, and manuals containing information that was incorporated into the Lexington Fayette County Hazard Mitigation Plan:

Reports

- Updated Digital Flood Insurance Rate Maps (DFIRMs)
- Letters of Map Revisions in compliance with the National Flood Insurance Program (NFIP)
- Kentucky Transportation Cabinet Maintenance Costs since 2000

Plans and Manuals

- Kentucky State Hazard Mitigation Plan
- Floodplain Management Plan
- Emergency Operating Procedures
- 2007 Comprehensive Plan
- Zoning Ordinance
- Article 19 – Floodplain Conservation and Protection
- Subdivision Regulations
- Construction Inspection Manual
- Geotechnical Manual
- Greenways Master Plan
- Infrastructure Development Manual
- Roadway Manual
- Rural Service Area Land Management Plan
- Sanitary Sewer Manual
- Park Land Priority and Acquisition Study
- Rural Service Area Land Management Plan
- Storm Water Manual
- Structures Manual
- Sinkhole Ordinance
- Mining Ordinance

4.0 Risk Assessment

The 2012 LFUCG Hazard Mitigation Plan update reviews the communities Risk's over the last five years. This section will be used as the blueprint for the mitigation strategy. The Risk Assessment section has been redesigned from the 2006 Plan to enhance the flow of the information provided throughout the section so that a holistic analysis and review is developed for each identified hazard within the 2012 LFUCG Hazard Mitigation Plan.

While developing the 2006 Plan, best available data was used for the Risk Assessments. To enhance and update the plan, better or more detailed data was required in order to better utilize local GIS capabilities and to perform an accurate risk assessment to indicate 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 landuse and development trends should be included in this analysis.

Specifically, better data allows Lexington Fayette County to enhance their vulnerability assessment and improve their mitigation action identification process. The Assessing Vulnerability sections demonstrate an enhanced vulnerability model from the model developed for the 2006 Plan. This model has improved local data inputs as well as a more refined geospatial unit of assessment. The 2012 Plan is developed using Census Block boundaries instead of Census Tract boundaries (2006) which provides an enriched view of where Lexington Fayette County has Risk and Vulnerability. This model served as a vital part in defining the following sections.

- Assessing Vulnerability Overview
- Assessing Vulnerability: Identifying Structures
- Assessing Vulnerability: Estimating Losses

- Assessing Vulnerability: Analyzing Development Trends

The "Individual" risk assessment sections for all 13 hazards provide a comprehensive overview and an improved workflow. Each hazard section is developed independently and will be defined through the following three steps:

1. Identify Hazard
2. Profile Hazard
3. Assessing Vulnerability: Overview
    a. Hazard Vulnerability Score
4. Assessing Vulnerability: Identifying Structures and Estimating Losses

The new workflow provides the end user a complete description of each hazard within each section. This has changed from the 2006 Plan where each Hazard was identified in one section, profiled in another section and then each Hazard's Vulnerability Assessment was developed.

Throughout the Risk Assessment, GIS spatial data provides the baseline for the Risk Assessments developed for the 2012 LFUCG Hazard Mitigation Plan. The Risk Assessment is broken down into two separate sections that are combined to provide an overall "Vulnerability Score" for each identified hazard. The individual scores (Exposure and Risk) provide a unique look into the community. The Exposure Score portrays where the communities "Assets" are located that could be vulnerable and the Risk Score defines what part of the community is at risk from each hazard. The maps developed through this process are used whenever possible to convey where spatially defined at-risk areas are located. GIS production and the maps created from this production provide a visual tool for analysis. Data, maps, research, and guidance were developed using the best available data and the approved 2010 Kentucky Hazard Mitigation Plan, as well as many other sources, see References.

4.1 Identify Hazards Overview

This section provides a complete overview and definition of each hazard that could potentially affect the Lexington Fayette County community. A complete understanding of each hazard better prepares decision makers, local agencies and residents on the causes of, potential damages contributed to, and possible scenarios of each hazard.

Risk Assessment Hazard Description Requirement

§201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

A list of U. S. natural hazards includes:

- Avalanche
- Coastal Storms
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hailstorm
- Hurricane
- Mine Subsidence
- Severe Winter Storm
- Tornado
- Tsunami
- Volcano
- Wildfire
- Windstorm

Natural Hazards not Identified in the 2012 LFUCG Hazard Mitigation Plan

Some natural hazards have little or no effect on the Lexington Fayette County area or in Kentucky and will not be addressed in this plan. This determination does not preclude the plan from including these hazards in future updates of the plan as new information is discovered concerning these types of hazards. Any new information on hazard identification will be included in future updates of this plan. Following are the natural hazards that will *not* be addressed in the 2012 LFUCG Hazard Mitigation Plan.

Avalanche: The topography and climate of the Lexington Fayette County area are not conducive to the occurrence of avalanches. No historical events have been recorded in the Lexington Fayette County area; and, as a result, this hazard is not addressed in the plan.

Coastal Storms: The Lexington Fayette County area is more than 400 miles from the Gulf of Mexico coast and over 500 miles from the Atlantic Ocean coast. The immediate effects of coastal storms (hurricanes, storm surge and tsunamis) are not felt in the Lexington Fayette County area. The secondary effects or remnants of hurricanes may produce severe storms and flooding in the Lexington Fayette County area and those hazards are addressed.

Volcanoes: More than 50 volcanoes in the U. S. have erupted one or more times in the past 200 years. Volcanoes produce a wide variety of hazards that can kill people and destroy property. Active volcanoes in North America are in California, Oregon, Washington, Alaska, Mexico, Canada, and the Caribbean islands. Large explosive eruptions can endanger people and property hundreds of miles away and even affect global climate. However, there are no active volcanoes within 1,000 miles of the Lexington Fayette County area. Volcanic activity as a hazard is judged to be minimal and will not be addressed in this plan.

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. Man-made hazards were added to the 2012 Plan. Hazardous Materials (HAZMAT) was added as an identified hazard for Lexington Fayette County.

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 (13) hazards are assessed in this Local Hazard Mitigation Plan:

- Dam Failure
- Drought
- Earthquake
- Flood
- Hailstorm
- HAZMAT
- Karst/Sinkhole
- Landslide
- Mine Subsidence
- Severe Storm
- Severe Winter Storm
- Tornado
- Wildfire

Each hazard will have an individual "Identify" section where the hazard will be defined.

4.2 Profiling Hazards Overview

Profiling Hazards Requirement

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

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.

The Lexington Fayette County Hazard Profiles have been created using the best available data from a variety of resources, including but not limited to the National Climatic Data Center (NCDC), National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), Kentucky Office of Geographical Information, Kentucky Geological Survey (KGS), Kentucky State Climatology Center, Midwestern Regional Climate Center (MRCC), FEMA Hazard Mapping website, multiple local agencies and local newspaper articles, as well as the approved 2010 Kentucky State Hazard Mitigation Plan and the 2006 Lexington Fayette County Hazard Mitigation Plan.

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

The following table displays past presidential declaration occurrences which provides background on the type, of natural disasters which have affected Lexington Fayette County. The Disaster Declarations in orange occurred since the 2006 LFUCG Mitigation Plan.

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, Landslides	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		

Profiling Hazards

The profile section of the plan provides historical context and develops future probabilities for each of the identified Hazards. In order to stream line the dissemination of this information the Planning Team developed a common format for each Hazard.

Each Hazard Profile will contain the following information:

- A Hazard/Threat summary table, which summarizes the overall risk.
- 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.

The Planning Team created a standardized "Hazards/Threat Table" for each of the hazards. The tables provide a consistent view of each hazard and a general understanding of the risk each hazard has on the community by displaying the following data elements:

- Period of Occurrence
- Number of Events to Date
- Annualized Probability
- Probability of event(s)
- Warning Time
- Potential Impacts
- Potential of injury or death
- Potential duration of facility shutdown
- Past Damages
- Extent

Understanding risk and each hazards potential effect on the Lexington Fayette County 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 .

RISK MATRIX

Hazard Type	Time Period	Range – Years of Data Collection	Frequency	Total Losses	Probability	Average Consequences	Average Annual Risk
Dam Failure	N/A	0	0	$0	0.00	$0	$0
Drought/Extreme Temperature	1960-2011	51	94	$9,420	1.84	$100	$185
Earthquake	1811-2011	200	0	$0	0.00	$0	$0
Flooding	1967-2011	44	39	$7,516,407	0.89	$192,728	$170,827
Hail	1960-1993/ 2006-2011	38	63	$5,367,600	1.66	$85,200	$141,253
HAZ-MAT	2005-2011	6	41	$0	6.83	$0	$0
Karst/Sinkhole *	N/A	0	717	$0	0.00	$0	$0
Landslide	1981-2009	28	9	$3,167	0.32	$352	$113
Mine Subsidence	N/A	0	0	$0	0.00	$0	$0
Severe Storm	1960-2011	51	94	$12,047,737	1.84	$128,167	$236,230
Severe Winter Storm	1960-2011	51	27	$4,682,219	0.53	$173,416	$91,808
Tornado	1963-2011	48	13	$19,874,303	0.27	$1,528,793	$414,048
Wildfire	2005-2011	6	2	$0	0.33	$0	$0
TOTAL DAMAGES			**1,099**	**$49,500,853**		**$2,108,756**	**$1,054,464**

**Karst Frequency is based on Sinkhole occurrences*

4.3 Assessing Vulnerability Overview

Assessing Vulnerability Requirement

§201.6(c)(2)(ii): [The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

The Assessing Vulnerability section uses best available data from national, state, and local data sources and was created using best available data and modeling techniques. The model used for the LFUCG Hazard Mitigation Plan is based on the State's Hazard Vulnerability Assessment Model as well as the 2006 LFUCG Hazard Mitigation Plan Vulnerability Assessment Model.

This model is very flexible and can be adjusted to fit the data and needs of multiple users. These estimates provide an understanding of relative risk and potential losses from hazards. 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).

The 2012 Vulnerability Assessment incorporates multiple models in use and integrates them into a specific model for the LFUCG Hazard Mitigation Plan. FEMA requires State and Local partners to assess the jurisdiction's overall vulnerability to population, property, infrastructure, critical facilities, and government owned facilities. The Planning Team, using the best available data and methods, determined vulnerability for the Lexington Fayette County community.

One of the most important steps in creating a Vulnerability Assessment Model is to define the planning area. During the creation of the 2006 Plan the 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 2012 Plan refines 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). This Census Block model produced the following improvements:

1. Better hazard scenario assumptions
2. Better dollar allocation
3. Better policy decisions
4. Better visuals
5. ***Better tool for locals***

Producing a vulnerability model at this level allows Lexington Fayette County to allocate their limited resources to a very specific area where mitigation action should be reviewed. The Census Blocks that were used are the smallest geographic unit used by the U.S. Census Bureau to capture data.

4.3.1 Vulnerability Assessment Methodology

There are multiple models that attempt to determine risk and hazard vulnerability. The Planning Team relied heavily on CHR's knowledge of the "Risk Assessment" research field to develop the Vulnerability Assessment Model used for the LFUCG Hazard Mitigation Plan. In order to follow and comprehend the Hazard Vulnerability Assessment Model the following definitions are very important to review:

- ***Hazard Identification***: A hazard is considered to be anything which either threatens the residents of a community or the things that they value.
- ***Exposure***: Your community's assets: People, Property, Critical Facilities and Infrastructure potentially exposed to a hazard.
- ***Risk***: Risk (R) equals your hazard probability (P) times the hazard consequences (C) ($R = P \times C$) and or your area specific probability based on geographic hazard layers.
- ***Vulnerability***: Defines what part of your "exposure" is at "risk" to each "hazard"

CHR's staff researched and conducted test runs to develop an updated methodology. The revised 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 planning scenarios. As mentioned, to facilitate data collection and analysis, the Census Block boundaries were used to organize the data inputs. This approach enabled the creation of a Vulnerability Score for each Census Block and for each hazard. This created a refined vulnerability assessment for the 2012 LFUCG Hazard Mitigation Plan.

4.3.2 Vulnerability Assessment Model

Hazard Vulnerability Score = Exposure Score X Risk Score

The model was designed to achieve a "Vulnerability Score" which is the foundation in the vulnerability/risk assessment. This Vulnerability Score was built on multiple layers of data and provides the foundation for the Mitigation Plan. Unlike several "Risk Assessment Models" developed this particular model provides a common score that is used to compare each hazard to each other.

The Hazard Vulnerability Score provides a visual display of the potential extent each hazard poses for Lexington Fayette County. The vulnerability scores are displayed at the Census Block level providing an enhanced local assessment where risk and vulnerabilities are located within more defined areas.

Definitions of Exposure Score

In order to define Lexington Fayette County's vulnerability, it was critical to complete an inventory of County assets. These identified assets comprise Lexington Fayette County's Exposure Score. Each of the following Ranks were classified (0-3) using the Natural Breaks classification choice (which breaks data into like classes) and added to together to complete a specific areas (Census Blocks) Exposure Score

Exposure Score = Population Rank + Property Rank + Critical Facility Rank

1. **Population Rank:** Comprised of Population Density data acquired from the 2010 Census to create the *Population Density Score* (0-3) along with the Social Vulnerability *SOVI Score* (0-3) which was comprised of 9 different Social Vulnerability variables from the Census.

    - % Population under 5 or over 65, Per Capita Income, Limited English, Female Head Household, Less than a 12th grade education, Renters, Mobile Homes, No Car, Public Assistance

2. **Property Rank:** Comprised of improvement values per block using local PVA data supplemented with 2010 Census property values to create the *Property Value Score (0-3)* along with the *Median Property Age Score (0-3)* which was comprised of 2010 Census median age property data supplemented with PVA median age property data.

3. **Critical Facilities Rank:** Comprised of multiple Critical Facilities (Points and Lines) across the Lexington Fayette County planning area retrieved from local LFUCG GIS layers.

    - Schools, Police, Fire, Hospitals, Special Needs Facilities (Adult Daycare, Assisted Living, Family Care, Long Term Care, Retirement Homes), Jails, Government Owned Sites (Bldgs.), Airport, Bridges, Communication Sites, Sewer, Power, Water were used to create the *Critical Facilities Score* (0-3)
    - Line data included Road, Rail, Sewer, Transmission were used to create the *Critical Infrastructure Score* (0-3)

The Exposure Score reveals where you have assets to lose. This data is critical for Emergency Managers to use in order to comprehend where high concentrations of need could be during a disaster and before (See Appendix 4.1 for Exposure Maps).

Maps are used whenever possible to display data in a visually representation which provides the end user a comprehensive view of where there is potential Vulnerability.

4.3.2.2 Definitions of Risk Score

The second variable created for the Hazard Vulnerability Score is the Risk Score.

Risk Score = Annualized Loss Score and/or Spatial Score

Annualized Loss Score = (Probability x Consequences)

- Developed at the county level (See Risk Matrix)
- Key for Estimating losses for all hazards (Data Permitting)
- Probability Loss Estimation Model

The Annualized Loss Score provides a probability based Risk Score that is based on past occurrences and consequences from those occurrences. This type of model uses historical data to predict the future by providing an understanding of which hazards affect a community more frequently and which hazards pose a higher potential magnitude.

The Annualized Loss Score does not provide depth to the overall Risk Score due to the fact that the calculation is currently captured at the County level. The Risk Score attempts to assign Risk to geographically specific areas (Census Blocks). Currently, this data is aggregated across each Census Block equally which creates a complete reliance on the Exposure Score to provide geographic variances. Therefore any hazard that completely relies on Annualized Loss for their Risk Score will resemble the Exposure Score. These maps will display where there is more vulnerability based on there being more assets (Exposure).

Spatial Score = Geographic Area Affected

- This score is fed by geographic GIS layers used as Hazard Boundaries i.e. Flood Zones (DFIRM), Dam Inundation Zones, Kentucky Geologic GIS layers (Karst and Sinkholes)
- LFUCG, Repetitive Loss, NOAA hazard occurrence points, Hazard ID Exercise Points
- Percent of the planning area effected by the GIS hazard boundary layers and or number of occurrences (Exercise Points) located in the planning area (Census Block)
- Geographically Predictive Loss Estimation Model

The Spatial Score is developed by creating a Hazard Zone Score and Hazard Occurrence Score. For example, the flood hazard provides a Flood Zone from the DFIRMs which can be used to geographically represent areas of high risk. These Hazard Zones are overlaid on the planning areas (Census Blocks) and weighted based on the percent of area the Hazard Zone covers within each planning area. Hazard Occurrence data is also used to identify areas of high risk. For example, the Planning Team developed a Hazard Identification exercise (See Appendix 3.4). This exercise allowed local community stakeholders a chance to describe spatially where on a map there are areas of high risk by placing a dot on a known area of concern. These dots were transcribed into a GIS file that was then used to create a Hazard Occurrence Score for the Spatial Score variable. Each individual Spatial Score varies according to the data available.

Stakeholder Hazard Identification Exercise Tabulation
November 2, 2011

Some hazards have both scores while others have only the Annualized Loss Score or the Spatial Score. The individual Risk Score for each hazard will be described within the Assessing Vulnerability section of each hazard.

The Risk Score assigns a hazard/risk variable to the Hazard Vulnerability Score. An *Annualized Loss Score* (See Risk Matrix) was created for each hazard where data permitted and was added to the hazards *Spatial Score* where data permitted to create Hazard Risk Score. Each variable was calculated and then ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe), using the Natural Breaks (Jenks) classification, which breaks data into like classes.

It is important to note that the Risk Score is developed based on the representation of a hazard affecting an area, either based on past occurrence or a scientifically based study (i.e. flood study DFIRM). This makes the Risk Score particularly useful for land use planning and future development decisions. The Vulnerability Score adds current assets (Exposure Score) to the model which is vital when dealing with emergency management planning issues. This is pointed out to display the multiple uses of the data created during this process.

Lexington Fayette County Hazard Vulnerability Score

After the Exposure Score and the Risk Score were determined, the equation was set into motion to produce a Hazard Vulnerability Score for each identified hazard. The Hazard Vulnerability Scores contain some bias toward the more populated areas in the county. This is due to a correlation between more populated areas and a tendency to have higher numbers of assets (Exposure Variables). This resulted in higher populated areas having greater exposure in general. However, with the data provided, other equations can be developed with or without one or more variables, or a different weighting system. The goal of this model was to assess the most vulnerable areas throughout Lexington Fayette County. Given the most populated areas have the most at risk, this model achieved that goal.

It is important to note that the extent ranking was changed for the 2012 Plan in order to put more emphasis on each ranking (1 moved from Low to Moderate, 2 moved from Medium to High, and 3 moved from High to Severe). The extent ranks provide the viewer a relative scale for understanding the level of risk each hazard poses in a particular planning area and where there could be potential losses.

4.3.3 Assessing Vulnerability: Identifying Structures and Estimating Potential Losses

A key piece to any Risk Management system is to understand a community's potential losses. The Planning Team decided to capture loss using two different methodologies. The two methodologies differ in that one is a community level analysis where the other is geo-spatially specific. These methodologies provide the community with an enhanced view of loss estimation compared to the 2006 Plan. The two models that were used for the 2012 LFUCG Hazard Mitigation are the ***Average Annualized Loss Model*** and the ***Hazard Boundary Overlay Loss Estimation Model***.

Average Annualized Loss Model

This model uses probability and past consequence data to calculate an Average Annualized Loss for several of the identified hazards (See Risk 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 27 severe winter storms occurrences throughout the county over the last 51 years, there is an annual occurrence ratio of 0.53 (probability). Next, the average consequences of each event are calculated by dividing the total losses ($4,682,219) by the frequency (27) of the event, giving an Average Consequence of $173,416.

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 $91,808 worth of damages will be sustained from a Severe Winter Storm.

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). The capture of this type of data is a Mitigation Action item for this plan. Lexington Fayette County will work with the state's Commonwealth Hazard Assessment Mitigation Planning System (CHAMPS) system to capture this type of data in the future.

As mentioned data capture limits the effectiveness of this model. The Planning Team was able to acquire sufficient data to develop an Average Annualized Loss estimate for the following seven (7) Hazards: Drought, Flooding, Hail, Severe Storm, Severe Winter Storm, Tornado and Landslide.

Using the Average Annualized Loss model, Lexington Fayette County is able to predict which Hazards will potentially occur more often as well as identify which Hazards can cause the most damage on an annual basis. Reviewing the data demonstrates that the Tornado Hazard has the highest average annual cost potential at $414,048. Severe Storms ($236,230), Flooding ($170,827) and Hail ($141,253) and rank highly as well and should rank highly when reviewing potential dollar saving Mitigation Project ideas.

Hazard Boundary Overlay Loss Estimation Model

In order to identify specific areas of potential loss within a community the Hazard Boundary Overlay Loss Estimation model provides an appropriate methodology. This model uses geo-spatial technology (GIS) to identify assets located within specific hazardous areas within a community. In order to perform this model the community must have a robust asset data base as well as an understanding of geo-spatial hazard identification.

LFUCG is fortunate to have ample local GIS data to work with for this model. The Planning Team used local PVA data to develop a comprehensive data set of structures and replacement costs. The next step is to acquire hazard boundary data which again LFUCG is fortunate to have several datasets of hazard boundary data.

For example, to develop the results for this methodology a flood hazard boundary (DFIRM) would be overlaid onto a building layer; the structures located within the DFIRM layer would be identified using GIS spatial analysis. The next step is to add value to those structures identified as being vulnerable. As discussed, the Planning Team used local PVA data to develop a comprehensive data set of structures and replacement costs for Lexington Fayette County. The structures located within the hazard layers were identified and designated as vulnerable and then estimated to be damaged during an event.

A key piece to this model is the Hazard Boundary data. Some hazards have mapped hazard boundaries or occurrence point data that was used in the development of the *Spatial Score* component of the **Risk Score**. These hazard boundary GIS spatial layers were used as the baseline for this model. Currently the following seven (7) Hazards have sufficient data to perform the Hazard Boundary Overlay Loss Estimation Model: Dam Failure, Flood, HAZMAT, Karst/Sinkhole, Landslide, Tornado and Wildfire.

This methodology reflects potential losses based on where the hazards have been located via Hazard Boundary maps in correlation with the built environment. This model reflects the Hazard Vulnerability Score model but adds potential damage to the equation. The model typically over estimates the potential damage but does provide the user an understanding of where mitigation projects should occur based on high exposure in correlation with high risk.

Loss estimation development is a very complicated process and can be accomplished through several methodologies. Two separate models were built to capture potential loss in order better allocate and prioritize limited mitigation funds. The Average Annualized Loss model depicts the hazards that most commonly affect the community and the Hazard Boundary Overlay Loss Estimation model displays the potential worst case scenario loss areas. Both models have limitations based on uncertainties resulting from approximations and simplifications which are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters).

4.4 Dam Failure Identification

Description

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

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:

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	

Likelihood of Occurrence

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.

4.4.1 Dam Failure Profile

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**
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**

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:

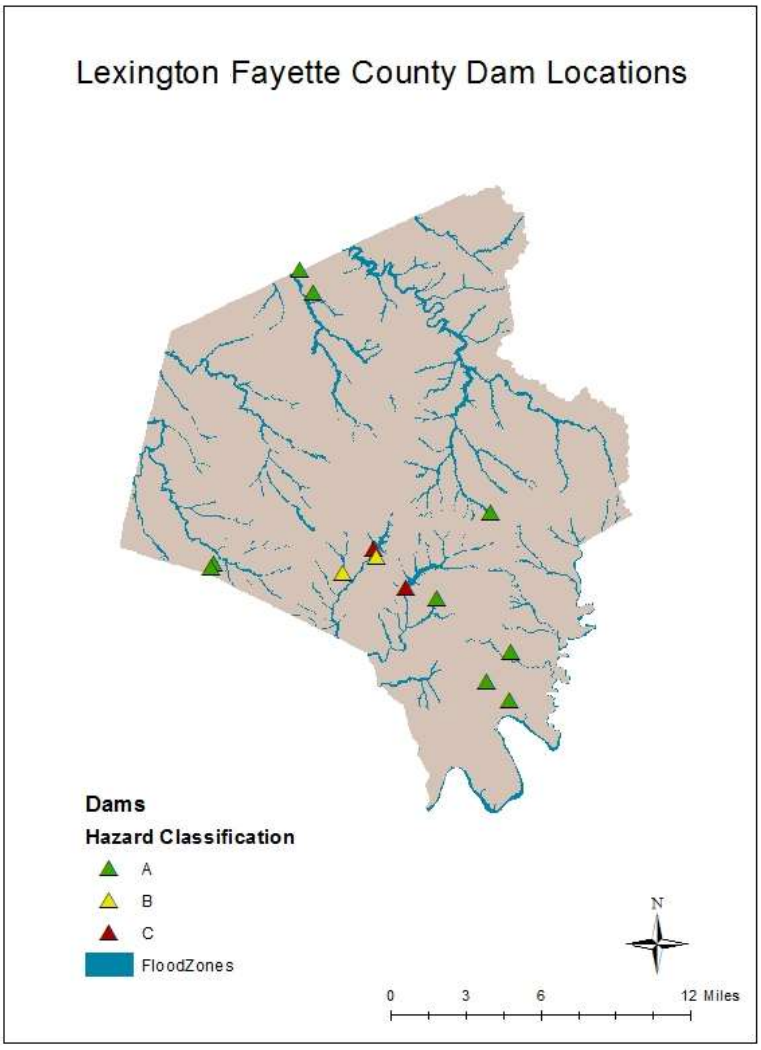
- Is 25 feet or more high from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the Natural Resources and Environmental Protection Cabinet;
- Has or will have an impounding capacity of 50 acre feet or more at the maximum water storage elevation.

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.

Historical Impact

At this time, there are no reported dam failures within Lexington Fayette County. As seen in the Dam Locations map below, the County does contain at least eight dams in rural areas. 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 the LFUCG, there are 13 locally owned dams within the County. These dams are rated with classifications and the aggregate totals of each classification appear in the Lexington Fayette County Dam Inventory table.

The following map demonstrates the 13 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. "Built in the 1920s, the Dix Dam Hydro Station is capable of producing up to 24 megawatts. Situated on the banks of Lake Herrington, the Dix Dam Hydro Station is adjacent to KU's E.W. Brown Generating Station. The palisades around the facility also provide sanctuary for the endangered grey bat."[5]

Dam Classification	
Dam Classifications	**Number of Dams**
Class A (Low)	9
Class B (Moderate)	2
Class C (High)	2
TOTAL	**13**

Dam Inventory List	
Name	**Type**
Walnut Hall Farm Lake	Private
Kentucky Horse Park Lake	DOP
Greenbrier Estates Lake	Private
Lexington Reservoir #3	Private
Schneider Lake	Private
Firebrook #1	Private
Firebrook #2	Private
Levy Lake	Private
Jacobson Reservoir	Municipal
Wingameek Farm lake	Private
Sharp Lake	Private
Kelly Lake	Private
Hidden Hollow Lake	Private

[5] http://www.lge-ku.com/environment_hydro.asp

4.4.2 Assessing Vulnerability Overview: Dam Failure

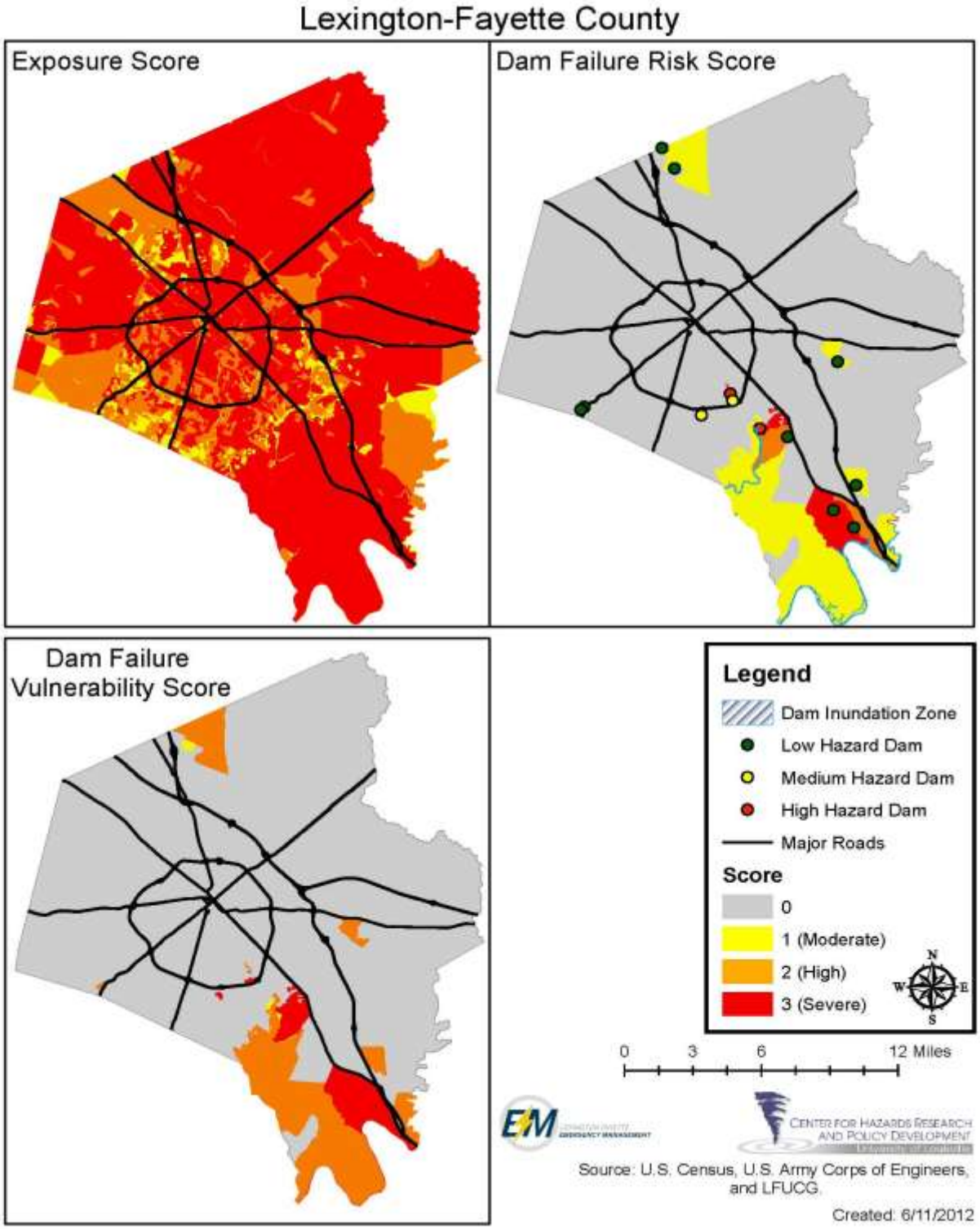
Dam Failure Vulnerability Score = Exposure Score X Risk Score

The Dam Failure Vulnerability Score was determined by creating a Dam Failure Risk Score multiplied by the Exposure Score. The Risk Score for Dam Failure was derived from a Spatial Score. The Spatial Score was developed by using Dam location data and Dam inundation data. The Dam location data which was used to create the Hazard Occurrence Score, was determined by first counting and categorizing local Dams within each Census Block. Each dam was rated as high, medium, and low hazard dams according to Federal Guidelines for Dam Safety Classifications (2004). A high hazard dam was given a score of 3, medium a score of 2, and low a score of 1. Scores for high, medium, and low hazard dams were then added together to produce a component of the total Dam Failure Risk Score and ranked for each Census Block 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

In order to calculate the Hazard Zone Score of the Dam Failure Risk Score two Dam Inundation GIS layers were used to calculate the percent of the Census Block affected by the inundation areas. The two inundation areas were derived from the Jacobson Reservoir and the Dix Dam (located in Mercer and Garrard County). The percentage of the area affected by the inundation areas were then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The Dam Failure Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and the ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The Dam Failure Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Dam Failure Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Dam Failure Vulnerability Score equation.



4.4.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Dam Failure

In order to determine structures that are vulnerable and estimated to be damaged during a Dam Failure the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the two Dam inundation maps that were provided by the LFUCG GIS office (Jacobson Reservoir and Dix Dam). These inundation maps display areas that would be flooded if the Dam's fail, thus were used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

Dam Failure Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	3	$290,000
Residential	92	$19,834,170
Government	0	$0
Total	**95**	**$20,124,170**

There has not been any data captured at this point to create an Annualized Loss number for Dam Failure.

4.5 Drought Identification

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.
- In 1998, over 2 billion dollars in property loss was credited to drought in the United States.

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.

4.5.1 Drought Profile

SUMMARY OF DROUGHT RISK FACTORS	
Period of occurrence:	**Summer months or extended periods of no precipitation**
Number of events:	**94**
Annualized Probability:	**1.84 (Approx. Months a Year)**
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:	**$9,420**
Extent (Date, Damages, Scale/Size):	**1952-55, Unknown Damages, -5.74 (PDSI)**

Historical Impact

Lexington Fayette County 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.

- 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

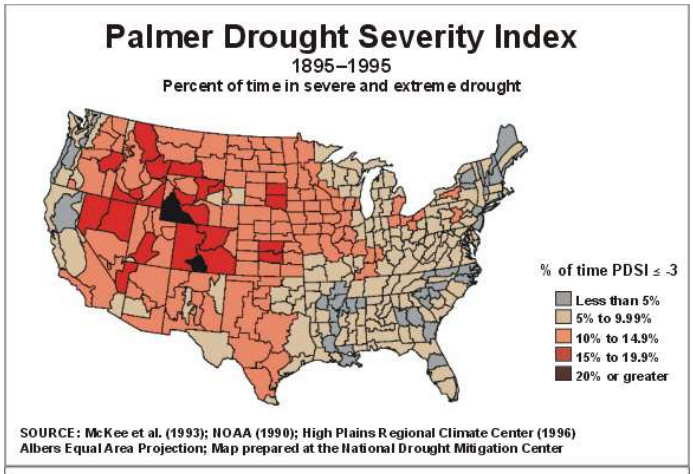
Historically Significant Drought Events	
Time Period	**PDSI Rating**
May 1930 – December 1931	-4.73
Fall 1939 – Spring 1942	-3.97
1944	-4.35
Summer 1952 - Winter 1955	-5.74
1963 – 1964	-3.43
1988	-4.27
1999 – 2001	-5.27
2007	-3.64
Source: http://www.kyclimate.org/graphlets/ddsg.html	

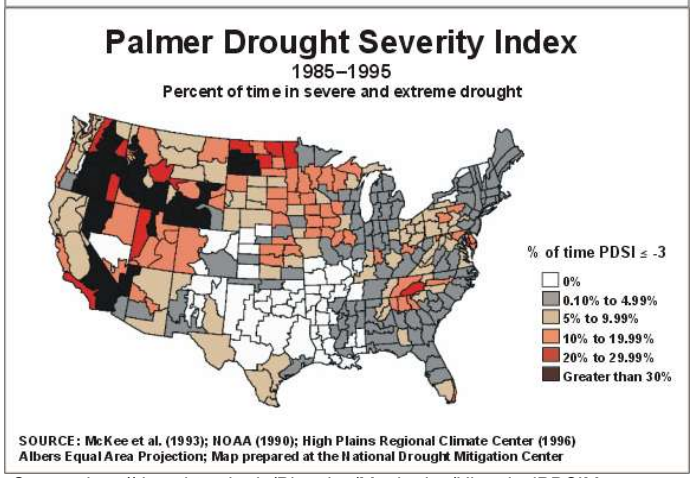
in and out of severe conditions without escaping the moderate category until January 1955.

- 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 61 separate months in **moderate**, 24 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 1960-2009 (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
	Moderate: 61				Severe: 24				Extreme: 9				61 24 9
Source: http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers.php													**94**





Source: http://drought.unl.edu/Planning/Monitoring/HistoricalPDSIMaps.aspx

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 of Kentucky (which includes Lexington Fayette County) is within the 5% to 9.99% range.

- For the 10-year interval of 1985-1995 the Bluegrass climate zone had a severe drought rating of 5% to 9.9%, 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

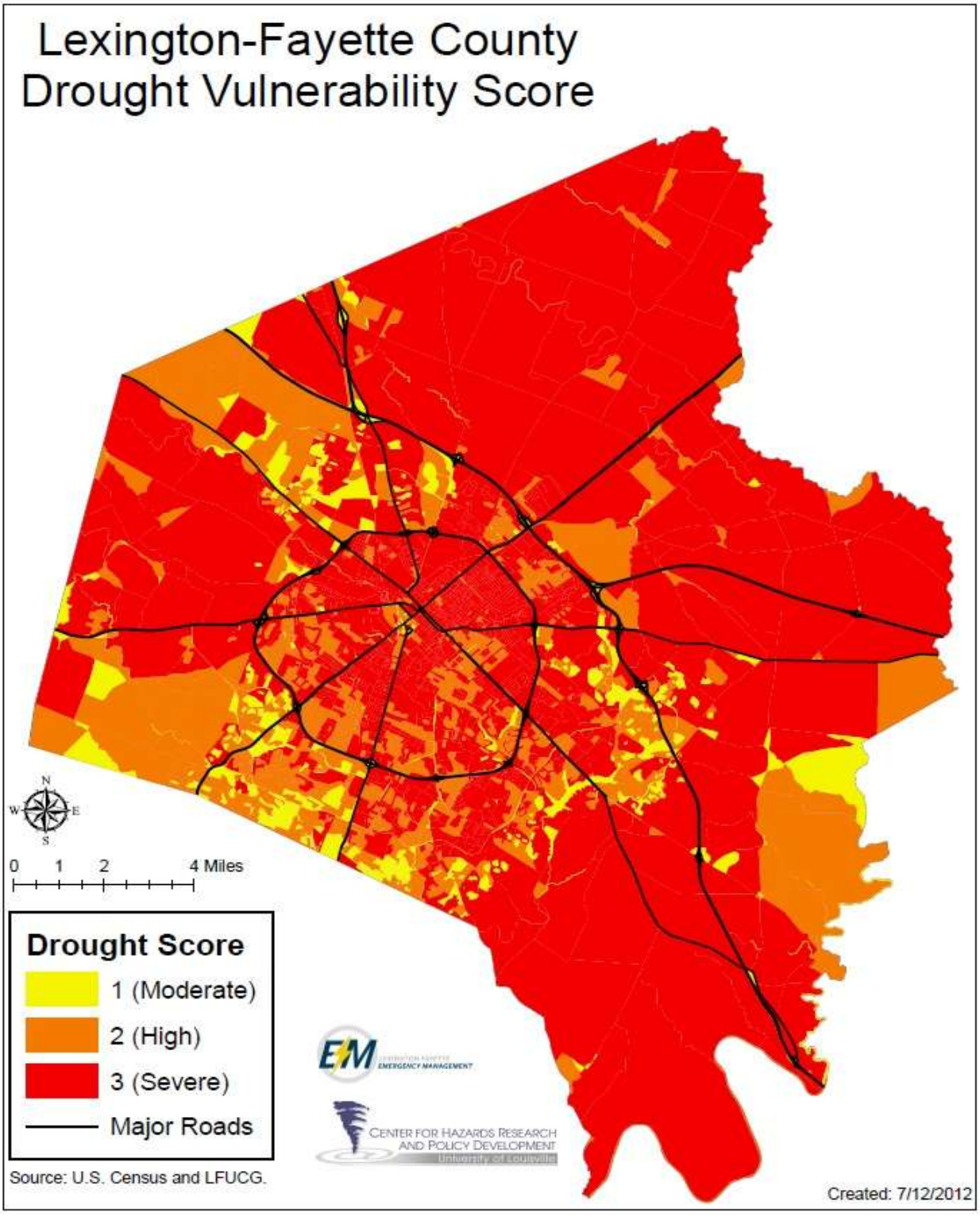
During periods of drought in Lexington/Fayette County, some activities that rely heavily on high water usage may be impacted significantly. These activities include agriculture, tourism, wildlife protection, municipal water usage, commerce, recreation, wildlife preservation, and electric power generation.

4.5.2 Assessing Vulnerability Overview: Drought

Drought Vulnerability Score = Exposure Score X Risk Score

The Drought Vulnerability Score was determined by creating a Drought Risk Score multiplied by the Exposure Score. Lexington Fayette County has no real spatial data that can be calculated to determine vulnerable areas to drought, which would be used to develop a Drought Spatial Score. Drought is the type of hazard that typically affects a county the size of Lexington Fayette equally. With that being said the Annualized Loss Score data is the only component of the Risk Score. Using this type of county wide data does not provide geographically specific areas of Risk. Therefore, when executing the calculation of the Drought Vulnerability Score it is basically dependent on the Exposure Score. The Exposure Score does provide a visual display of areas that could be harder hit by drought based on the exposure that is within each Census Block.

The following map displays the areas that could be more vulnerable to Drought based on there being more assets (Exposure).



4.5.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Drought

Identifying individual structures and estimating potential losses from Drought is a challenging endeavor. Without any current spatial data that identifies Drought hazard boundaries, it is assumed that the entire county has equal vulnerability and the potential to be damaged from Drought. That being stated it is assumed that each structure within Lexington Fayette County has an equal chance of being affected by Drought. In order to estimate which structures could be damaged from a Drought it is assumed that all structures could be damaged which accounts for 140,951 structures valued at $24,769,019,964, although this is highly unlikely.

There has been data captured to derive an Annualized Loss number for Drought, which states that Lexington Fayette County will average $185 of loss per year.

4.6 Earthquake Identification

Description

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.

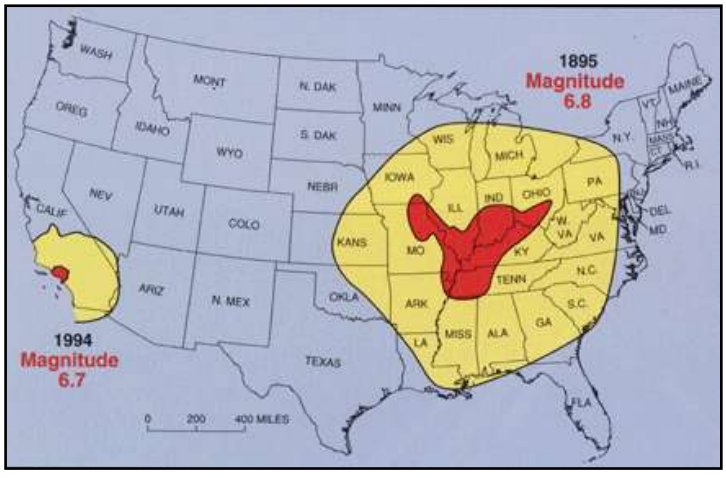
The Richter magnitude scale measures an earthquake's magnitude using an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. The earthquake's magnitude is expressed in whole numbers and decimal fractions. Each whole number

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



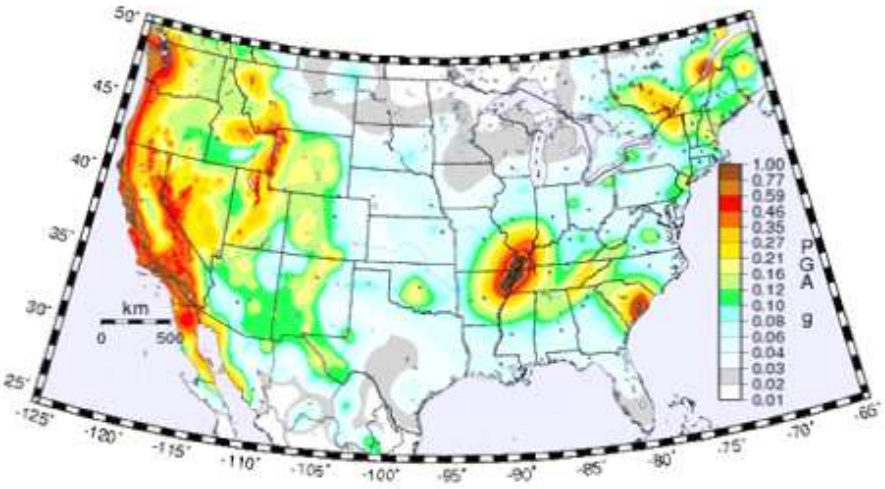
Earthquakes in the central or eastern United States affect much larger areas than earthquakes of similar magnitude in the western United States. For example, the San Francisco, California earthquake of 1906 (magnitude 7.8) was felt 350 miles away in the middle of Nevada, whereas the New Madrid earthquake 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.

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.

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		

PGA with 2% in 50 year PE. BC rock. 2008 USGS



Source: http://earthquake.usgs.gov/hazards/products/

This figure corresponds to the 2008 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.

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.

4.6.1 Earthquake Profile

SUMMARY OF EARTHQUAKE RISK FACTORS	
Period of occurrence:	**Unknown**
Number of events: (1811-2011)	**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 of facility shutdown:	**None to slight chance**
Past Damages:	**Unknown**
Extent (Date, Damages, Scale/Size):	**02/07/1811, Unknown Damages, VI Intensity**

Historical Impact

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 effecting 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
09/07/1988		4.6	Sharpsburg, Bath Co
09/08/1990		3.3	Olympia
09/05/2005		2.5	Sharpsburg, Bath 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

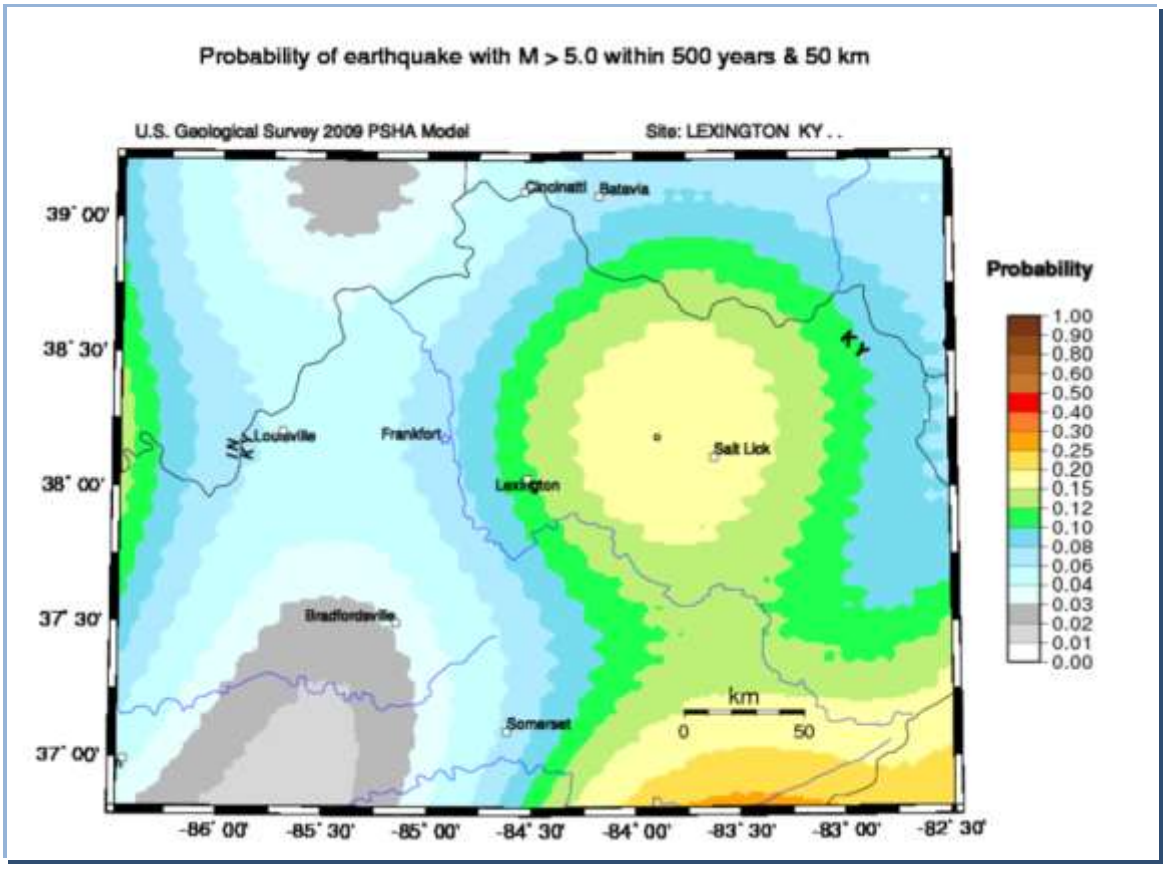
to what they would have been in a hard gust of wind" (Kentucky Gazette, Lexington, Ky.).

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.

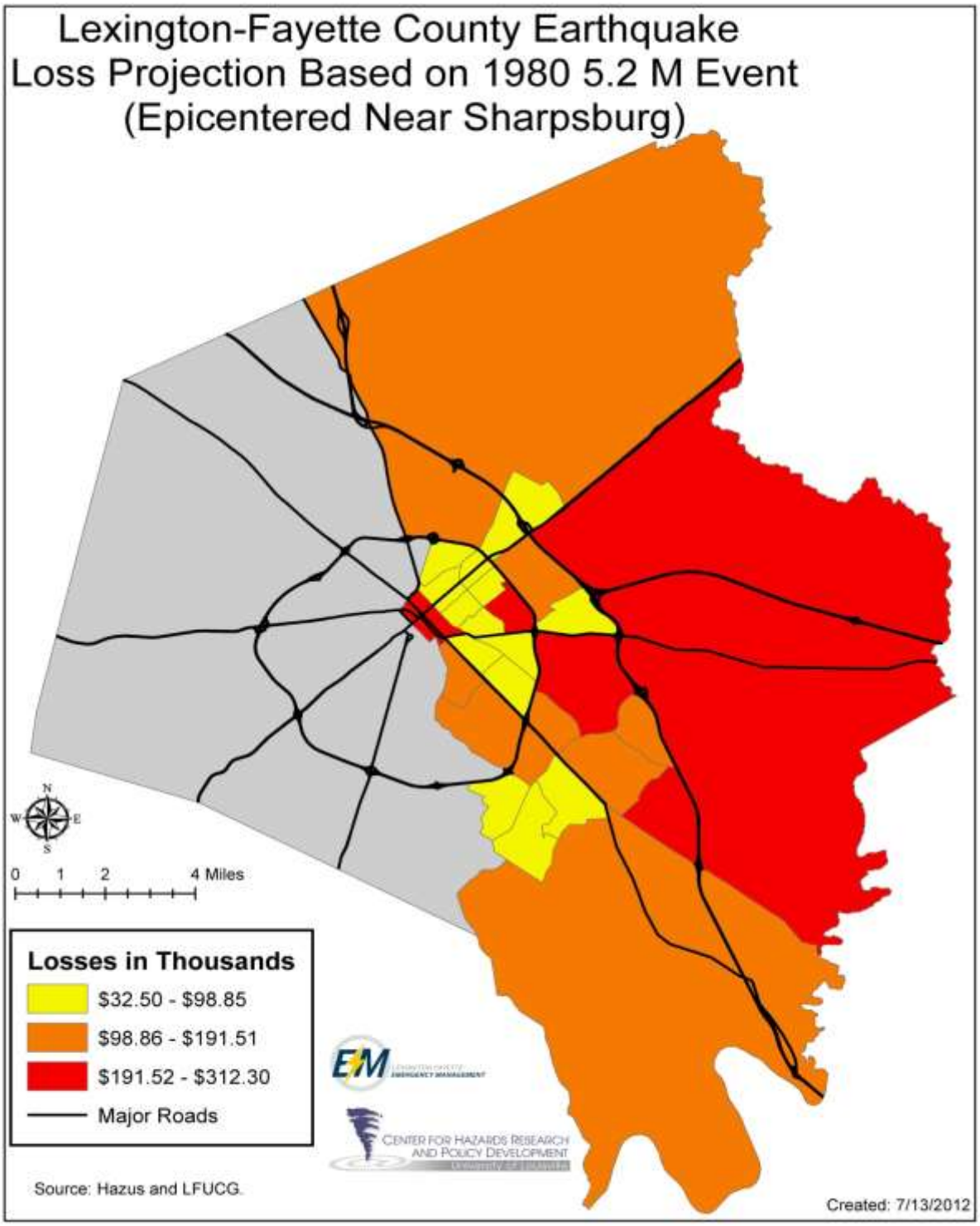
While Lexington Fayette County lies within 300 miles of the New Madrid Seismic Zone there are also many smaller fault lines running throughout the state and the county. An earthquake in this zone or in central Kentucky could damage structures, cause injuries, and impact the economy in the long-term, 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 is 0.1.


Probability of earthquake with M > 5.0 within 500 years & 50 km
U.S. Geological Survey 2009 PSHA Model
Site: LEXINGTON KY . .
Cincinnati
Batavia
Louisville
Frankfort
Salt Lick
Lexington
Bradfordsville
Somerset
km
0
50
Probability
1.00
0.90
0.80
0.60
0.50
0.40
0.30
0.25
0.20
0.15
0.12
0.10
0.08
0.06
0.04
0.03
0.02
0.01
0.00
39° 00'
38° 30'
38° 00'
37° 30'
37° 00'
-86° 00'
-85° 30'
-85° 00'
-84° 30'
-84° 00'
-83° 30'
-83° 00'
-82° 30'

4.6.2 Assessing Vulnerability Overview: Earthquake

In order to understand Lexington Fayette County's vulnerability to the Earthquake hazard the Planning Team decided to use FEMA's HAZUS software to replicate the 1980 Sharpsburg Earthquake. The Sharpsburg Earthquake was chosen due to the fact that it displays the potential for damage to the community. Other Earthquake scenarios (New Madrid) were run using the software but they did not depict any risk/loss for Lexington Fayette County.
The following map displays expected losses data by Census Tracts (which is the smallest unit that the HAZUS Earthquake model produces). The loss data was broken down into three (3) categories similar to the other Hazard Vulnerability Score maps.

The following map displays the areas (Census Tracts) that would be affected by a magnitude 5.2 Sharpsburg Earthquake.



4.6.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Earthquake

As mentioned above the Planning Team used the 1980 Sharpsburg earthquake as the scenario to capture potential losses. The HAZUS software produces a report that describes the potential losses and identifies vulnerable structures. In short, the report predicts fifty five (55) structures to be moderately damaged and estimates a total economic loss of $3,490,000 (See Appendix 4.2).

4.7 Flood Identification

Description

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.

Factors determining the severity of floods include:

- Rainfall intensity and duration
- A large amount of rain over a short time can result in flash flooding
- Small amounts may cause flooding where the soil is saturated
- Small amounts may cause flooding if concentrated in an area of impermeable surfaces
- Topography and ground cover
- Water runoff is greater in areas with steep slopes and little vegetation

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.

Stream flooding is much worse inland during storm surge because of backwater effects.

- *Dam-Failure Flooding* 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.)
- *500-Year Flood Plain*. The area that has a 0.2% chance, on average, of flooding in any given year.
- *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
- *Annual flooding*. Occurs much more frequently than the 100-year flood and, over time, may in fact produce a much greater risk to structure.

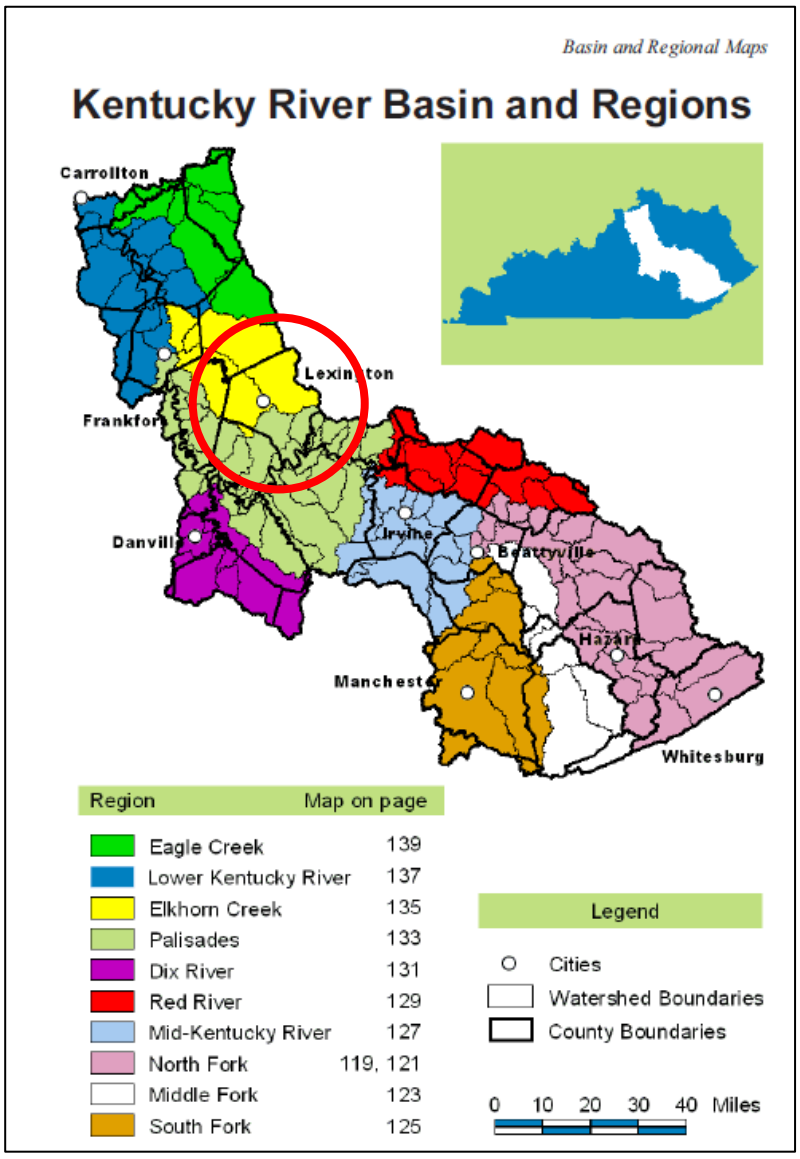
4.7.1 Flood Profile

Profile Risk Table	
Period of occurrence:	**Riverine Flooding: any time but primarily January through May Flash floods: anytime, but primarily during Summer rains**
Number of events: (1967-2011)	**39**
Annualized Probability:	**0.89**
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:	**Total: $7,516,407 Property: 5,725,275 Crop: 1,791,132**
Extent (Date, Damages, Scale/Size):	**3/1/1997, $1,545,946, 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.

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.



Source: Kentucky River Basin Management Plan.
http://www.uky.edu/WaterResources/Watershed/KRBMP/KRB_MPmb.htm

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.

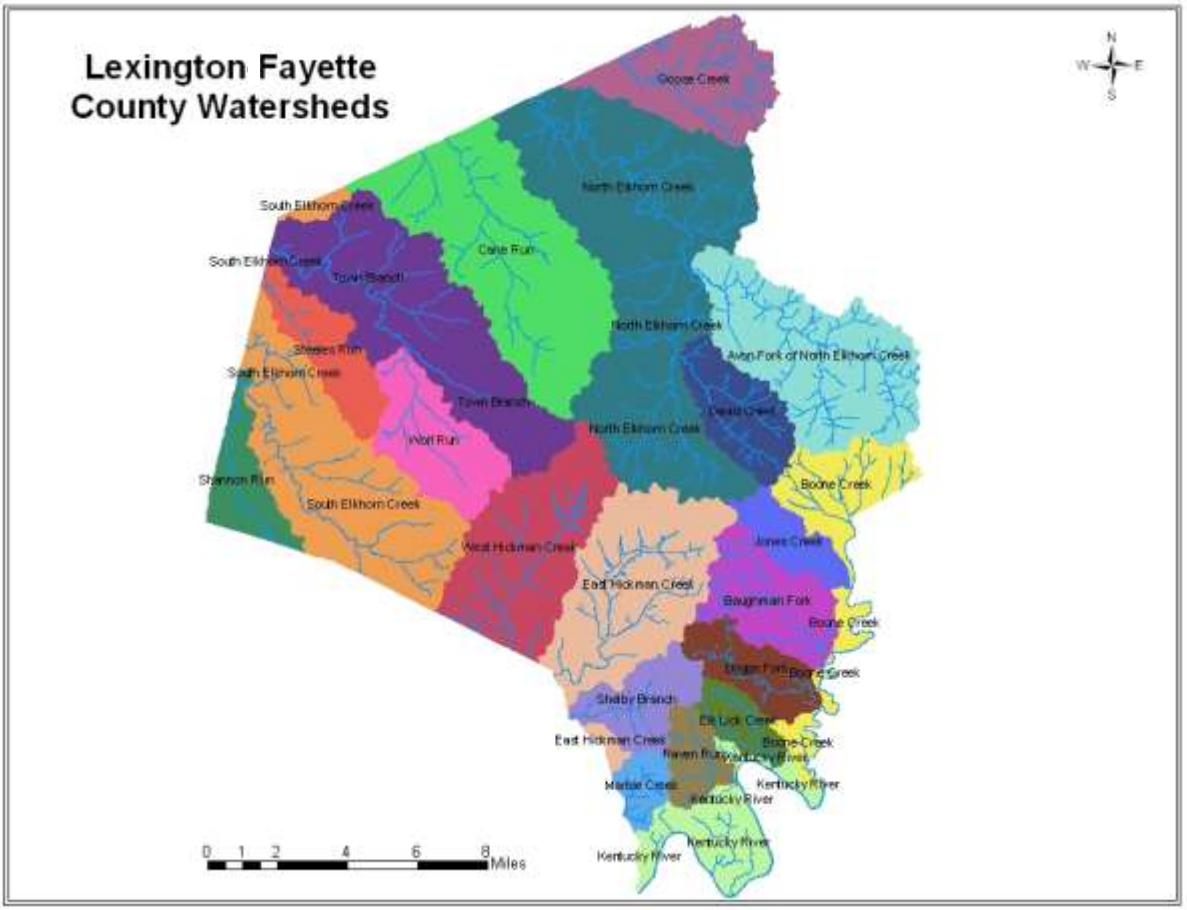
Flooding is exacerbated by urban encroachment into the floodplains, runoff from impervious surfaces and storm sewer problems. These conditions cause Lexington to experience flood damage from frequent storm events of low rainfall amounts, especially in the older parts of the City.

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.

24 Lexington Fayette County Watersheds Map



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.

Lexington Fayette County 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
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.

Other examples of Lexington Fayette County flood events, from State and local sources include:

- **May 1-4, 2010**: 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.
- **February 15, 2003**: A severe winter storm with freezing rain caused basement flooding.
- **March 20, 2002**: Eight to ten homes on Beach Road flooded
- 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 was more than $100,000.
- **March 5, 1964**: The Lexington-Herald Leader reported that a severe storm responsible for tornadic activity also brought 3.54 inches of rain that caused numerous flash floods to Lexington Fayette County.
- **June 23, 1960**: The Lexington-Herald Leader reported Storms and Flash floods affecting the area and damaging homes
- **January 6, 1950**: The Kentucky River approached flood stage and the Lexington-Herald Leader reported six days of rain, phone and power lines down, roads blocked and basements flooded.

The U.S. Weather Bureau of Blue Grass Field reported more than five and one-half inches of rain had fallen since the first of the year.

The potential for floods include the whole range of events, from the bankful conditions that are relatively common to the extremely 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.

Lexington Fayette Urban County (CID 210067)	
Status	**Current**
CRS Entry Date	10/01/1991
Current Effective Date	10/01/2007
Current Class	7
% flood insurance discount for SFHA	15
% discount for non-SFHA	5

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. To aid in the effort of mitigating future flood events, a Floodplain Mitigation Plan has been completed by the LFUCG DOWQ listing prioritized flood/stormwater management projects. In 2010, Lexington Fayette County updated their Floodplain Management Plan which addresses specific flood mitigation programs for the community and is incorporated into this plan.

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4.7.2 Assessing Vulnerability Overview: Flood

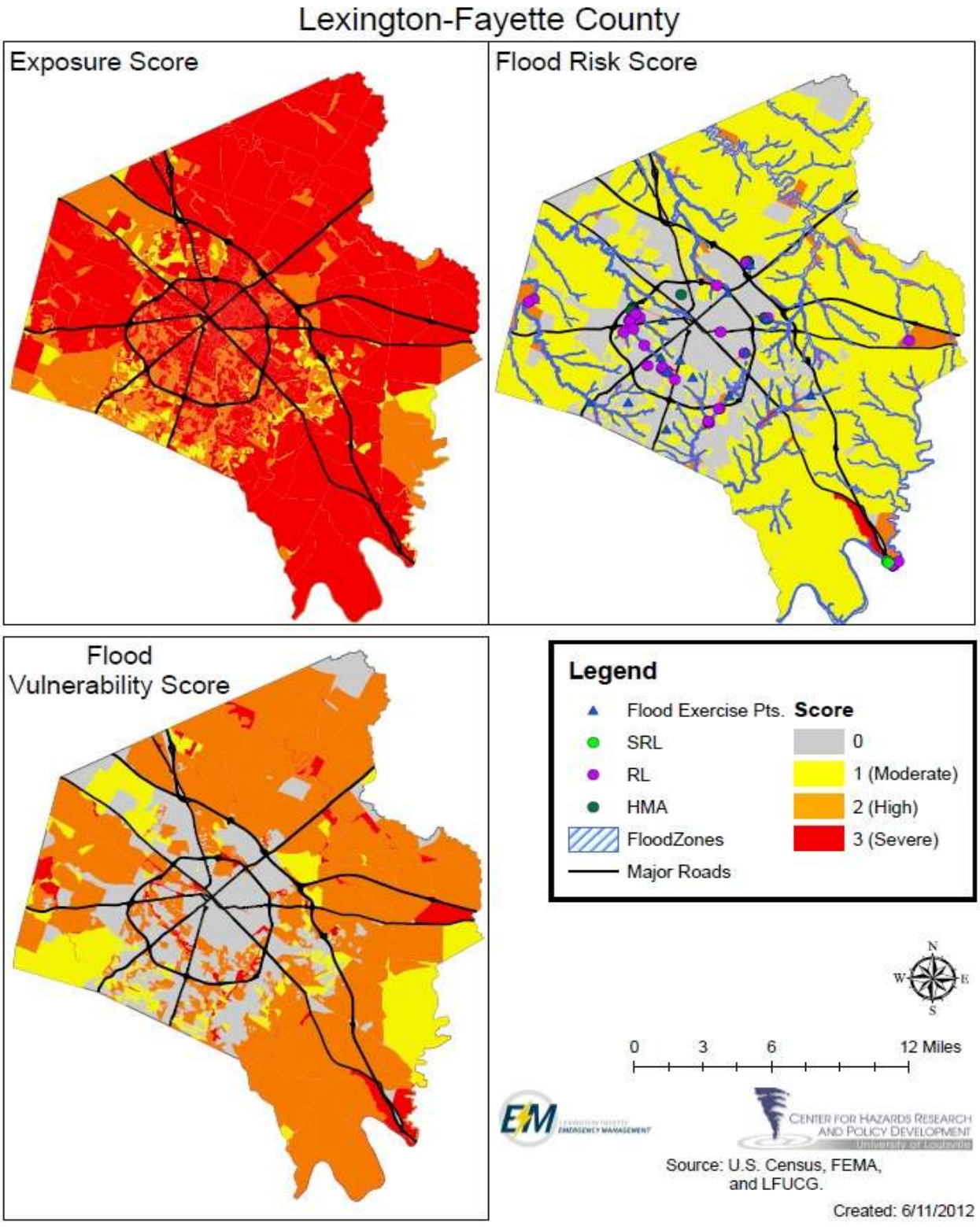
Flood Vulnerability Score = Exposure Score X Risk Score

The Flood Vulnerability Score was determined by creating a Flood Risk Score multiplied by the Exposure Score. The Risk Score for Flood was derived by calculating a Spatial Score. The Spatial Score for Flood was developed by calculating a Hazard Zone Score and Hazard Occurrence Score. In order to calculate the Hazard Zone Score for Lexington Fayette County the Planning Team used the Digital Flood Insurance Rate Map (DFIRM) as the Hazard Zone. Next, the DFIRM was overlaid onto the planning areas (Census Blocks) and weighted based on the percent of the area the Hazard Zone (DFIRM) covers. This percentage of area affected by the mapped Flood potential area (DFIRM) was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Zone Score.

The Hazard Occurrence Score was determined by counting four separate variables within each Census Block. Using data provided from Kentucky Division of Water (KDOW) and Lexington Fayette County the Planning Team identified Repetitive Loss Properties (RL), Severe Repetitive Loss Properties (SRL), Flood Mitigation Project Areas (HMA) and Flood Exercise Points. These four variables were identified and aggregated to individual Census Blocks. The Hazard Occurrence data displayed where high concentrations of flood events have occurred, thus producing areas of risk. Once all the Hazard Occurrence data points were calculated and aggregated to each Census Block, the Census Blocks were scored 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Occurrence Score.

The Flood Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and then ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The Flood Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Flood Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Flood Vulnerability Score equation.



4.7.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Flood

In order to determine structures that are vulnerable and estimated to be damaged during a Flood the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the LFUCG DFIRM. These flood hazard zone maps display areas that would be flooded during a 100 year flood event, thus were used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

Flood Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	222	$251,513,200
Residential	2,339	$636,867,918
Government	26	$20,182,000
Total	**2,587**	**$908,563,118**

There has been data captured to derive an Annualized Loss number for Flood, which states that Lexington Fayette County will average $170,827 of loss per year.

4.7.4 Repetitive Loss

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.

Lexington Fayette County 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) 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/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 39 Repetitive Loss properties and 0 Severe Repetitive Loss Properties, which can be viewed on the Flood Risk Score map.

4.8 Hail Identification

Description

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

4.8.1 Hail Profile

SUMMARY OF HAILSTORM RISK FACTORS	
Period of occurrence:	**Year-round**
Number of events: (1960-1993)/(2006-2011)	**63**
Annualized Probability:	**1.66**
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:	**Total: $5,367,600** **Property: $5,257,822** **Crop: $109,778**
Extent (Date, Damages, Scale/Size):	**05/18/1993, $5,000,000, TORRO: H8**

Historical Impact

The effects of large hailstorms can include minimal to severe property and crop damage and destruction. According to the research, at least 63 reported hailstorms have fallen in Lexington Fayette County from 1960-1993/2006-2011. These storms of varying sized hail have caused an estimated $5,367,600 worth of total damage in adjusted 2011 dollars. 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 provides more detailed information on several recent hail storms that resulted in damage and injury.

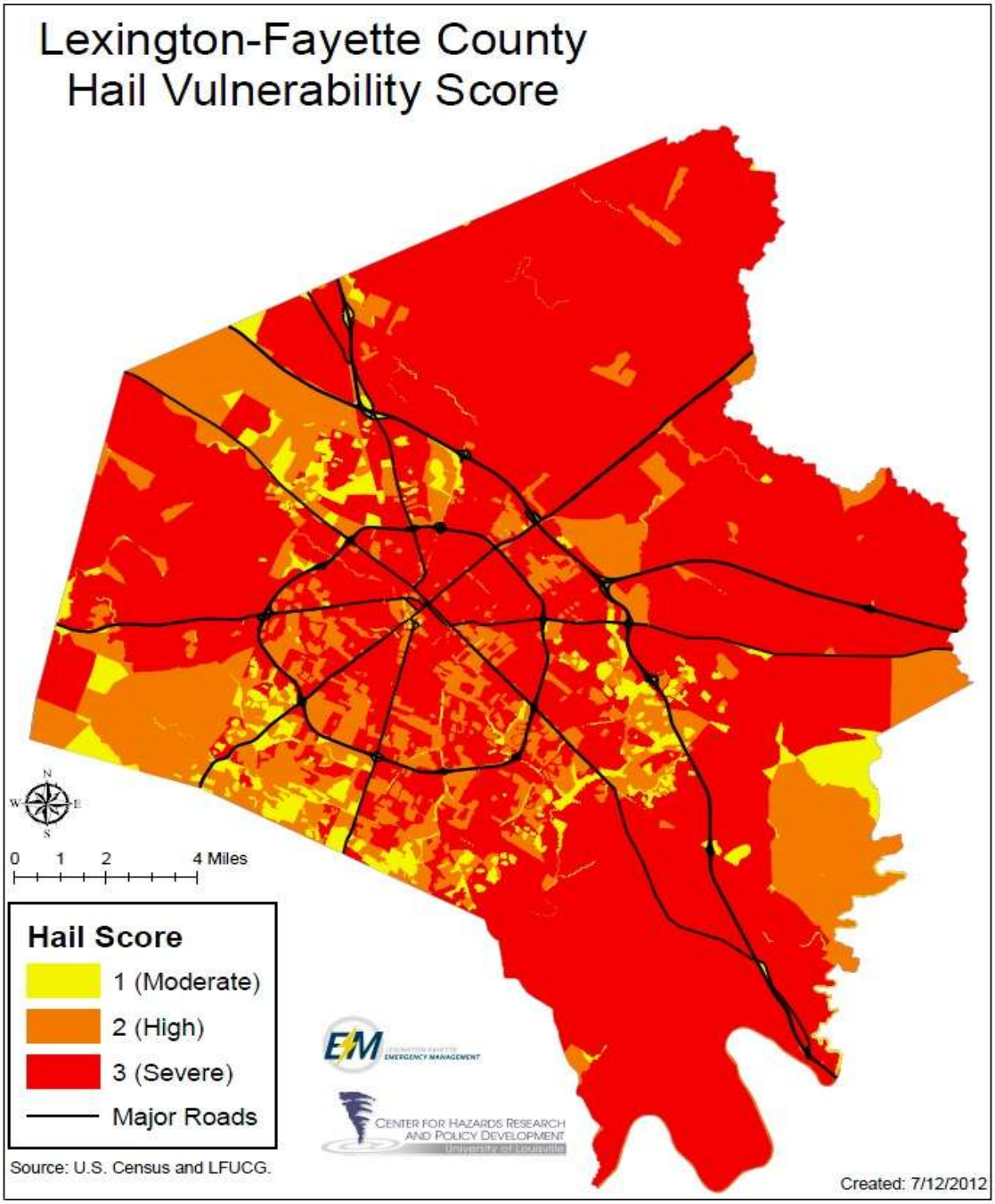
- **March 2012**: Hail in the golf ball- and even tennis ball-size (Approximately 70 mm in diameter) range was seen in most regions of the state accompanying a tornadic event.
- **May 31, 2006**: Roof damage was reported and power lines were downed in the Newtown Pike area. A cluster of thunderstorms 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**: A large Plexiglas window was blown in at the Fayette Mall. No injuries were reported. 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.

4.8.2 Assessing Vulnerability Overview: Hail

Hail Vulnerability Score = Exposure Score X Risk Score

The Hail Vulnerability Score was determined by creating a Hail Risk Score multiplied by the Exposure Score. Lexington Fayette County has no real spatial data that can be calculated to determine vulnerable areas to hail, which would be used to develop a Hail Spatial Score. Hail is the type of hazard that typically affects a county the size of Lexington Fayette equally. With that being said the Annualized Loss Score data is the only component of the Risk Score. Using this type of county wide data does not provide geographically specific areas of Risk. Therefore, when executing the calculation of the Hail Vulnerability Score it is basically dependent on the Exposure Score. The Exposure Score does provide a visual display of areas that could be harder hit by Hail based on the exposure that is within each Census Block.

The following map displays the areas that could more be vulnerable to Hail based on there being more assets (Exposure).



4.8.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Hail

Identifying individual structures and estimating potential losses from Hail is a problematic endeavor. Without any current spatial data that identifies Hail hazard boundaries, it is assumed that the entire county has equal vulnerability and the potential to be damaged from Hail. That being stated it is assumed that each structure within Lexington Fayette County has an equal chance of being affected by Hail. In order to estimate which structures could be damaged from Hail it is assumed that all structures could be damaged which accounts for 140,951 structures valued at $24,769,019,964, although this is unlikely.

There has been data captured to derive an Annualized Loss number for Hail, which states that Lexington Fayette County will average $141,253 of loss per year.

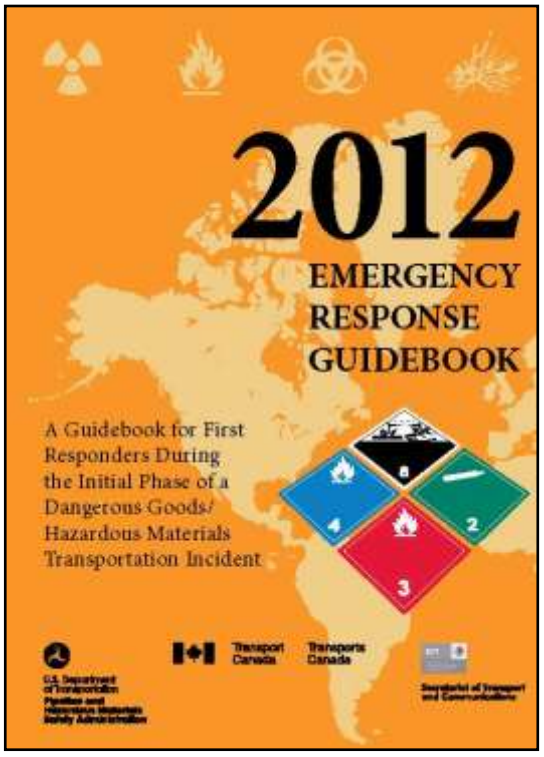
4.9 HAZMAT Identification

Description

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 2012 Emergency response Guidebook. This is "A Guidebook for First Responders during the Initial Phase of a Dangerous Goods/ Hazardous Materials Transportation Incident."

Source: http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Hazmat/ERG2012.pdf

4.9.1 HAZMAT Profile

SUMMARY OF HAZMAT RISK FACTORS	
Period of occurrence:	**Year-Round**
Number of events: (2005-2011)	**41**
Annualized Probability:	**6.83**
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:	**Unknown**
Extent (Date, Damages, Scale/Size):	**Unknown**

Historic 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[6] for a full listing of truck routes most commonly used to transport HAZMAT.

[6] http://fayettelepc.com/PDF/Appendix_Q-7_LEPC_Emergency_Response%20Plan-2011.pdf

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.

- 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 region 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.

A survey completed by the KYTC and the UK College of Engineering made several key observations:[7]

- 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.

The following local data provides information on some recent hazardous material releases that resulted in interruption of human activities.

- **April 25, 2012**: A construction crew nicked a medium-pressure gas line near Cromwell Way causing road closures and delayed public school bus service.
- **April 25, 2012**: Fluid leakage, likely transmission or hydraulic fluid, closed one lane on the outer loop of Man o' War near Armstrong Mill Road.

[7] Kentucky Transportation Center, "A High Level Analysis of Hazardous Material Commodity Flow in Fayette County." UK College of Engineering, 2010.

4.9.2 Assessing Vulnerability Overview: HAZMAT

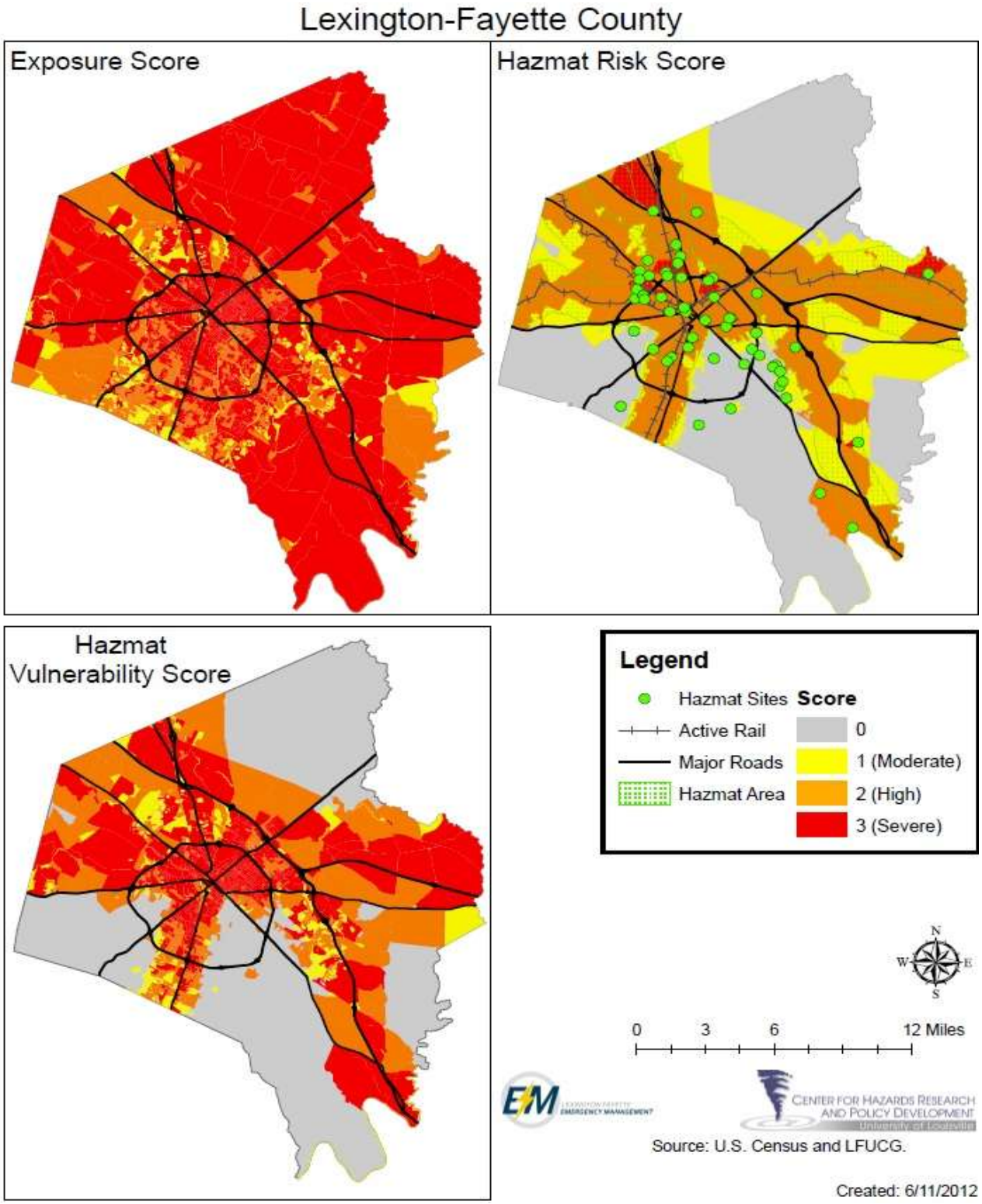
HAZMAT Vulnerability Score = Exposure Score X Risk Score

The HAZMAT Vulnerability Score was determined by creating a HAZMAT Risk Score multiplied by the Exposure Score. The Risk Score for HAZMAT was derived by calculating a Spatial Score. The Spatial Score for HAZMAT was developed by calculating a Hazard Zone Score and Hazard Occurrence Score. In order to calculate the Hazard Zone Score for Lexington Fayette County the Planning Team developed a one (1) mile buffer around HAZMAT traveled routes (road and Rail) as the Hazard Zone. Next, the buffers were overlaid onto the planning areas (Census Blocks) and weighted based on the percent of the area the Hazard Zone (Buffers) covered. This percentage of area affected by the mapped HAZMAT potential area (Buffers) was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Zone Score.

The Hazard Occurrence Score was determined by counting the number of HAZMAT locations, located within Lexington Fayette County. This data was identified and aggregated to individual Census Blocks. The Hazard Occurrence data displayed where high concentrations of HAZMAT events could occur based on location of HAZMAT, thus producing areas of risk. Once all the Hazard Occurrence data points were calculated and aggregated to each Census Block, the Census Blocks were scored 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Occurrence Score.

The HAZMAT Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and then ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The HAZMAT Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its HAZMAT Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the HAZMAT Vulnerability Score equation.



4.9.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: HAZMAT

In order to determine structures that are vulnerable and estimated to be damaged during a HAZMAT incident the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the one (1) mile buffers on the HAZMAT traveled roads and railways. These one (1) mile buffer maps display areas that would be evacuated during a typical HAZMAT event. The one (1) mile buffer was also used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

HAZ-MAT Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	5357	$3,281,164,717
Residential	71,671	$7,545,071,737
Government	283	$581,171,950
Total	**77,311**	**$11,407,408,404**

There has not been any data captured at this point to create an Annualized Loss number for HAZMAT.

4.10 Karst & Sinkhole Identification

Description

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.

Example of flooding in a karst basin within an urban environment
Source: Kentucky Geological Survey - Geologic Image Database

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

Source: Kentucky Geological Survey - Geologic Image Database

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

actually 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

Attempt to fill in a cover-collapse sinkhole.
Source: Kentucky Geological Survey - Geologic Image Database

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.

4.10.1 Karst & Sinkhole Profile

SUMMARY OF KARST/SINKHOLE RISK FACTORS	
Period of occurrence:	**At any time. More common in May and June**
Number of events:	**717 (Sinkholes)**
Annualized Probability:	**Unknown**
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: On average in Kentucky is 7 feet in diameter**

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 cost perhaps $500,000 to $2,000,000 of economic loss annually, and may have devastating effect on individuals.

Sinkhole cover collapse in Boyle County. This phenomenon occurs throughout the Inner Bluegrass karst landscape. Source: Kentucky Geological Survey.

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 and high land value have combined in the Lexington Fayette County Service Area to form one of the more expensive and difficult to resolve drainage problems. Sinkholes receive all of 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 1.5 cases cover collapse per year in Fayette county are reported to KGS. KGS has a cover collapse database of reported sinkholes dating from 1976-2012. Property damage is typically minor and inefficiently tracked though 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.

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.

4.10.2 Assessing Vulnerability Overview: Karst & Sinkhole

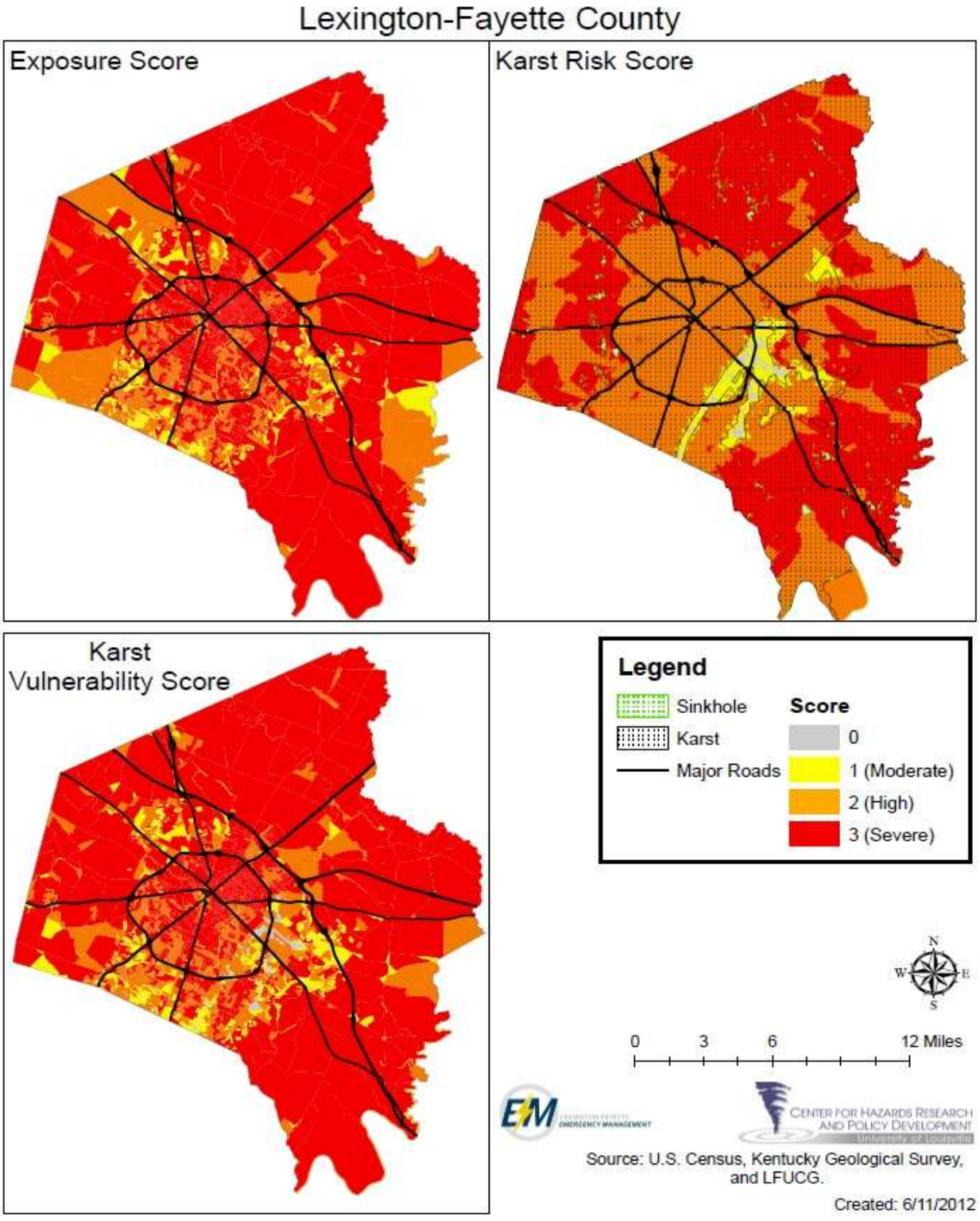
Karst/Sinkhole Vulnerability Score = Exposure Score X Risk Score

The Karst/Sinkhole Vulnerability Score was determined by creating a Karst/Sinkhole Risk Score multiplied by the Exposure Score. The Risk Score for Karst/Sinkhole was derived by calculating a Spatial Score. The Spatial Score for Karst/Sinkhole was developed by calculating a Hazard Zone Score and Hazard Occurrence Score. In order to calculate the Hazard Zone Score for Lexington Fayette County the Planning Team used the KGS Karst Potential GIS layer as the Hazard Zone. Next, the Karst Potential Map was overlaid onto the planning areas (Census Blocks) and weighted based on the percent of the area the Hazard Zone (Karst Potential Map) covers. This percentage of area affected by the mapped Karst/Sinkhole potential area (Karst Potential Map) was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Zone Score.

The Hazard Occurrence Score was determined by counting the number of sinkholes throughout Lexington Fayette County. Using data provided from KGS the Planning Team identified 717 sinkholes. These sinkhole GIS data points were identified and aggregated to individual Census Blocks. The Hazard Occurrence data displayed where high concentrations of Sinkhole events have occurred, thus producing areas of risk. Once all the Hazard Occurrence data points were calculated and aggregated to each Census Block, the Census Blocks were scored 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Occurrence Score.

The Karst/Sinkhole Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and the ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The Karst/Sinkhole Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Karst/Sinkhole Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Karst/Sinkhole Vulnerability Score equation.



4.10.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Karst/Sinkhole

In order to determine structures that are vulnerable and estimated to be damaged during a Karst/Sinkhole the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary's used as the overlay was the KGS Karst Potential GIS layer and the KGS Sinkhole GIS polygon layer. The Karst Potential and the Sinkhole GIS layer display areas that are within Karst/Sinkhole potential areas, thus was used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

Karst Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	6008	$4,057,642,395
Residential	12,1840	$16,546,566,929
Government	367	$622,749,850
Total	**128,215**	**$21,226,959,174**
Sinkhole Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	9	$27,545,800
Residential	335	$100,914,603
Government	0	$0
Total	**344**	**$128,460,403**

4.11 Landslides Identification

Description

Landslides occur when masses of rock, earth, or debris move down a slope. Landslides may be very small or very large, and can move at slow to very high speeds. Many landslides have been occurring over the same terrain since prehistoric times. They are activated by storms and fires and by human modification of the land. New landslides occur as a result of rainstorms, earthquakes, volcanic eruptions, and various human activities.

Mudflows or debris flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." A slurry can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. A slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way.

Most of the landslide damage does not occur in rugged mountain country. Most losses from landslides and soil creep occur in cities developed on gently sloping hillsides. Although a landslide may occur almost anywhere, from man-made slopes to natural, pristine ground, most slides often occur in areas that have experienced sliding in the past. All landslides are triggered by similar causes. These can be weaknesses in the rock and soil, earthquake activity, the occurrence of heavy rainfall or snowmelt, or construction activity changing some critical aspect of the geological environment. Landslides that occur following periods of heavy rain or rapid snow melt worsen the accompanying effects of flooding.

Landslides pose a hazard to nearly every state in the country by causing $2 billion in damages and 25 to 50 deaths a year. There is a concentration of losses in the Appalachian, Rocky Mountain and Pacific Coast regions. It has been estimated that about 40 percent of the U.S. population has been exposed to the direct and indirect effects of landslides.

Public and private economic losses from landslides include not only the direct costs of replacing and repairing damaged facilities, but also the indirect cost associated with lost productivity, disruption of utility and transportation systems, reduced property values, and costs for any litigation. Some indirect costs are difficult to evaluate, thus estimates are usually conservative or simply ignored. If indirect costs were realistically determined, they likely would exceed direct costs.

Much of the economic loss is borne by federal, state, and local agencies responsible for disaster assistance, flood insurance, and highway maintenance and repair. Private costs involve mainly damage to land and structures. A severe landslide can result in financial ruin for the property owners because landslide insurance (except for debris flow coverage) or other means of spreading the costs of damage are unavailable.

Types

- *Slides* of soil or rock involve downward displacement along one of more failure surfaces. The material from the slide may be broken into a number of pieces or remain a single, intact mass. Sliding can be rotational, where movement involves turning about a specific point. Sliding can be translational, where movement is down slope on a path roughly parallel to the failure surface.

The most common example of a rotational slide is a slump, which has a strong, backward rotational component and a curved, upwardly-concave failure surface.

- *Flows* are characterized by shear strains distributed throughout the mass of material. They are distinguished from slides by high water content and distribution of velocities resembling that of viscous fluids. Debris flows are common occurrences in much of North America. These flows are a form of rapid movement in which loose soils, rocks, and organic matter, combined with air and water, form slurry that flows downslope. The term "debris avalanche" describes a variety of very rapid to extremely rapid debris flows associated with volcanic hazards. Mudflows are flows of fine-grained materials, such as sand, silt, or clay, with high water content. A subcategory of debris flows, mudflows contains less than 50 percent gravel.
- *Lateral spreads* are characterized by large elements of distributed, lateral displacement of materials. They occur in rock, but the process is not well-documented and the movement rates are very slow. Lateral spreads can occur in fine-grained, sensitive soils such as quick clays, particularly if remolded or disturbed by construction and grading. Loose, granular soils commonly produce lateral spread through liquefaction. Liquefaction can occur spontaneously, presumably because of changes in pore-water pressures, or in response to vibrations such as those produced by strong earthquakes.
- *Falls and Topples*. Falls occur when masses of rock or other material detach from a steep slope or cliff and descend by free fall, rolling, or bouncing. These movements are rapid to extremely rapid and are commonly triggered by earthquakes. Topples consist of forward rotation of rocks or other materials about a pivot point on a hill slope. Toppling may culminate in abrupt falling, sliding, or bouncing, but the movement is tilting without resulting in collapse. Data on rates of movement and control measures for topples is sparse.

Factors Contributing to Landslides

Vulcan Materials Co. producing aggregate from a mine on the corner of Manchester and S. Forbes.

Source: Kentucky Geological Survey - Geologic Image Database

- Steep slopes are more susceptible to landslides and should be avoided when choosing a building site.
- Slope stability decreases as water moves into the soil. Springs, seeps, roof runoff, gutter down spouts, septic systems, and site grading that cause ponding or runoff are sources of water that often contribute to landslides.
- Changing the natural slope by creating a level area where none previously existed adds weight and increases the chance of a landslide.
- Poor site selection for roads and driveways.
- Improper placement of fill material.
- Removal of trees and other vegetation. Plants, especially trees, help remove water and stabilize the soil with their extensive root systems.

4.11.1 Landslide Profile

SUMMARY OF LANDSLIDE RISK FACTORS	
Period of occurrence:	**At any time. Chance of occurrence increases after heavy rainfall, snowmelt, or construction activity.**
Number of events: (1981-2009)	**9**
Annualized Probability:	**0.32**
Warning time:	**Days to months, depends on inspection for weaknesses in rock and soil.**
Potential impact:	**Economic losses such as decreased land values, infrastructure damage, and agro-business losses. May cause minimal to severe property damage and destruction.**
Potential of injury or death:	**Injury and slight chance of death**
Potential duration of facility shutdown:	**Days to weeks**
Past Damages:	**$3,125.82**
Extent (Date, Damages, Scale/Size):	**2008, $1,543, Scale: Slopes at 15% or higher**

Historical Impact

According to the Kentucky Geological Survey (KGS), hundreds of landslides occur across Kentucky every year. The Kentucky Transportation Cabinet (KYTC) repair costs range from 2 to 6 million dollars annually over the entire state. Wetter years have the potential to produce more landslides, incurring more costs. However there are hundreds of slides that are a result of other activities, many of which are unreported. These slides can also pose significant risk to people and infrastructure.

The KGS completed a project to assess the geologic context of landslide and rockfall maintenance costs along Kentucky roadways. The data was derived from the Kentucky Transportation Cabinet (KYTC) Operations Maintenance System, a database of maintenance activities derived from district work orders. The table shown to the right lists those occurrences within Lexington Fayette county.

According to the KYTC Geotechnical Project Database (http://kgs.uky.edu/kgsweb/KYTC/search_r.asp) accessed through the KGS, there are recorded four category "landslide" projects that have been

KYTC Landslide and Rockfall Maintenance Lexington-Fayette County

Fiscal Year:	Location:	Type:	Total Cost:
04-05	I-75	Landslide	$510.58
07-08	KY-1267	Landslide	$871.11
08-09	US-25	Rockfalls	$121.28
08-09	KY-2328	Rockfalls	$79.87
08-09	KY-4	Rockfalls	$1,542.98
Total Cost of Repairs:			$3,125.82

reported on between the years of 1981 and 1991 in Fayette County. Over the years, approach embankments of existing bridges have settled which were typical of many embankments built on I-75 in the 1960's. The slope failures are also typical to these times due to steep slopes built with weak soils, poor compaction techniques, and improper drainage controls (Source: Memorandum Project ID L-019-1991, http://kgs.uky.edu/kgsweb/KYTC/Reports/L-019-1991.pdf).

Population increase and rapid urbanization along steep slopes can cause an increase in landslides. In Fayette County, continued urban expansion into rural regions of the County where slopes become steeper, >15% near the Kentucky River, will increase the Lexington Fayette County's landslide potential.

LFUCG's 2007 Comprehensive Plan and Subdivision Regulations address the permitting process for building in areas with steep slopes. In the Comprehensive Plan, Objective E under Goal 3 is to "Preserve, protect, and maintain soils, existing trees, tree stands, and other plan life; natural drainage ways, creeks,

and springs; and environmentally sensitive areas such as sinkholes and steep slopes from severe intrusion, alteration, or destruction during urban development". Subdivision Regulations within the Zoning Ordinance Lexington Fayette Urban County, Kentucky require an assessment of these areas for possible geotechnical modifications prior to construction (http://www.lexingtonky.gov/index.aspx?page=339).

4.11.2 Assessing Vulnerability Overview: Landslide

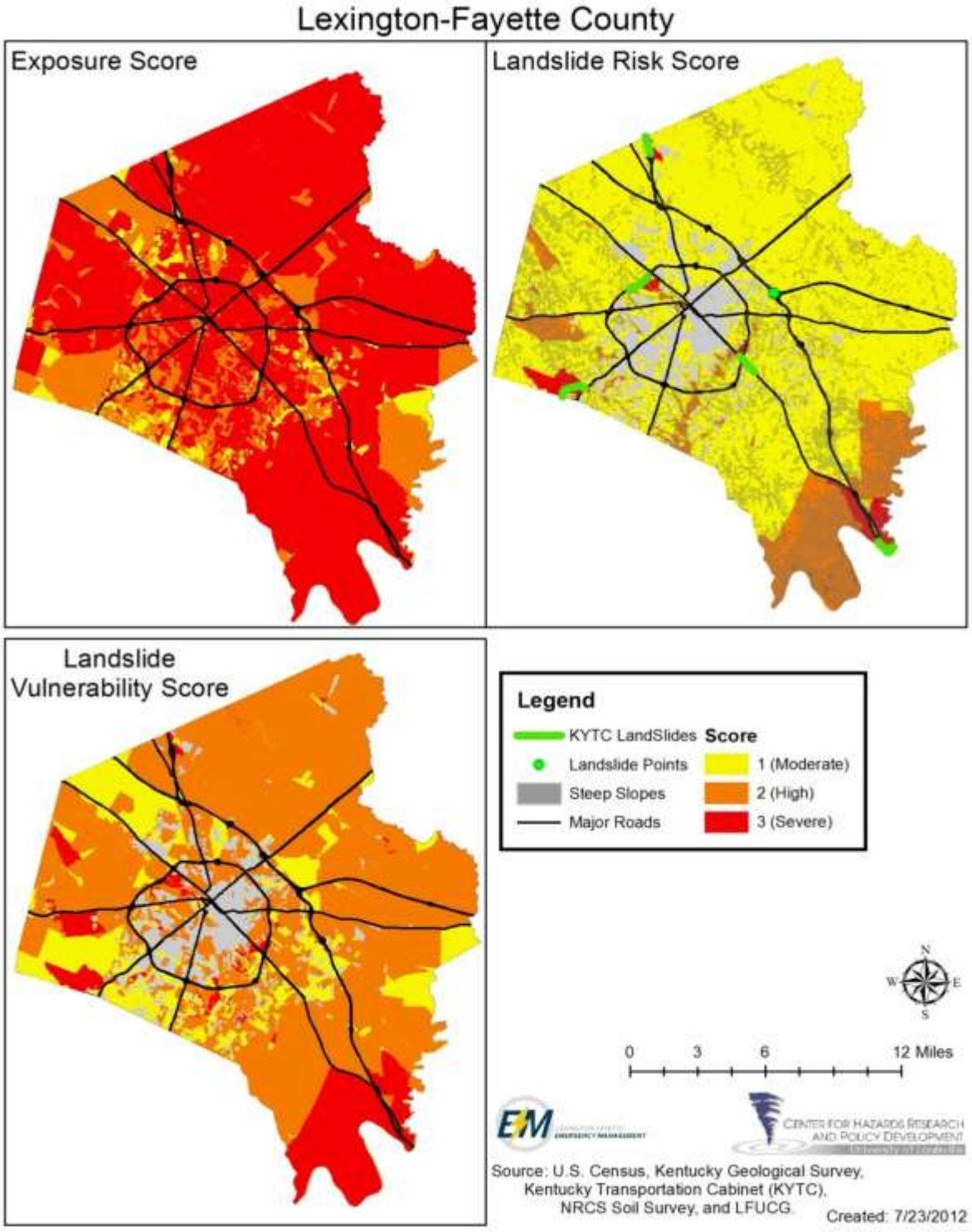
Landslide Vulnerability Score = Exposure Score X Risk Score

The Landslide Vulnerability Score was determined by creating a Landslide Risk Score multiplied by the Exposure Score. The Risk Score for Landslide was derived by calculating a Spatial Score. The Spatial Score for Landslide was developed by calculating a Hazard Zone Score and Hazard Occurrence Score. In order to calculate the Hazard Zone Score for Lexington Fayette County the Planning Team used a GIS polygon layer displaying areas of high slope (15% or higher) as the Hazard Zone. Next, the high slope areas were overlaid onto the planning areas (Census Blocks) and weighted based on the percent of the area the Hazard Zone (slope areas) covers. This percentage of area affected by the mapped high slope areas was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Zone Score.

In order to calculate the Hazard Occurrence Score two separate variables were captured within each Census Block. Using data provided from KYTC Road crews and captured by the KGS the Planning Team identified areas that have had maintenance due to Landslides. These GIS datasets captured individual roadway segments and specific road work points where landslide maintenance has occurred. The Hazard Occurrence data displayed where high concentrations of Landslide events have occurred, thus producing areas of risk. Once all the Hazard Occurrence data segments/points were calculated and aggregated to each Census Block, the Census Blocks were scored 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Occurrence Score.

The Landslide Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and the ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The Landslide Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Landslide Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Landslide Vulnerability Score equation.



4.11.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Landslide

In order to determine structures that are vulnerable and estimated to be damaged during a Landslide the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the 15% or higher slope data developed from a Digital Elevation Model. These 15% slope maps display areas that could be damaged due to a Landslide event, thus were used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

Landslide Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	284	$634,710,200
Residential	4,526	$1,509,455,009
Government	5	$2,573,350
Total	**4,815**	**$2,146,738,559**

4.12 Mine Subsidence Identification

Description

Land subsidence occurs when the ground sinks to a lower than normal level. Mine subsidence is defined as the collapse of underground mines resulting in direct damage to a surface structure.

Land subsidence occurs when large amounts of ground water have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rock falls in on itself. Land subsidence can occur unnoticed because it covers large areas rather than in a small spot, like a sinkhole.

Mine subsidence normally begins when pillars and roof supports that were left in the mine can no longer support the bedrock above the mine. This loss of support is transferred to the ground surface which also drops, creating structural problems for houses, roads, and utilities in the subsidence area as well as public safety concerns on other improved property. The subsidence can occur immediately or many years later after the completion of mining. Mine subsidence is dependent on the type of mining and the geological framework of the area in question.

As mined out areas increase and communities expand over these areas, the incidences of subsidence damage and the amount of financial loss will also increase. Factors influencing the magnitude and extent of surface movements resulting from the subsurface extraction of minerals are extremely complex and include:

- The thickness of the mined seam
- The mining method
- Total length and width of the extraction area
- Depth to the seam
- The nature of the overlying and underlying rocks
- Surface topography
- Geologic discontinuities such as faults
- The elapsed time since mining took place
- The size, shape, design, and construction of the structures built upon the mined out areas

Types

- *Sag mine subsidence* occurs as a gentle depression over a large area. Sags can form when a large area of mineral was mined or where several adjacent pillars have failed simultaneously. The area affected by a collapsing underground mine can be larger on the surface than below ground. This is dependent upon the angle of draw which is dictated by the thickness of the seam of mineral mined and the distance between the surface and the mine. The deeper the mine, the larger the surface area disturbed and more shallow the subsidence depth. However, a mine that is closer to the surface will result in a deeper area of subsidence.
- *Pits* normally form over shallow mines where the mining is less than 100 feet deep. Pits can develop over a few days once the settlement has reached the surface (this represents mostly

vertical movement). The depth of a pit can vary from a few inches up to eight feet and be from two to 40 feet in diameter.

- *Longwall* mining involves total removal of the mineral from a predetermined area. Nothing is left to support the roof and subsidence is almost immediate and complete. Once a longwall mine or panel has subsided, the vertical movement will cease since the void has been filled.

Mine Subsidence Site Development Problems

- Building homes, garages, roads, septic systems, and other such structures and infrastructure above abandoned underground mines can cause structural problems if subsidence occurs.
- Building near or above an abandoned underground mine, such as in many Abandoned Mine Lands (AML) areas, requires a thorough review to determine the subsidence potential and the need for stabilization before construction. AML funding cannot be used to stabilize a structure in the event the owner failed to properly evaluate the site prior to development.

4.12.1 Mine Subsidence Profile

SUMMARY OF MINE SUBSIDENCE FACTORS	
Period of occurrence:	**At any time**
Number of events:	**0**
Annualized Probability:	**0**
Warning time:	**Weeks to months, according to monitoring and maintenance.**
Potential impact:	**Economic losses such as decreased land values, and agro-business losses. May cause geological movement, causing infrastructural damages.**
Potential of injury or death:	**Injury and slight chance of death**
Potential duration of facility shutdown:	**Days to weeks**
Past Damages:	**Unknown**
Extent (Date, Damages, Scale/Size):	**Unknown**

Historical Impact

Limestone, a sedimentary rock mainly composed of calcium carbonate, is an important resource in Kentucky. It is the principal source of crushed stone used in construction, agriculture, and a variety of industries. Kentucky supplies millions of tons of limestone and lime to out-of-state markets in the Ohio River Valley and the Gulf Coast region.

Construction, the largest market for crushed stone produced in Kentucky, includes aggregate for road construction and maintenance, and for residential, commercial, and government construction, riprap and jetty stone, and railroad ballast. Industrial and miscellaneous applications include chemically pure stone for the manufacture of lime and cement; filter stone, sorbent stone for removing sulfur dioxide emissions from coal-burning plants, rock dust for explosion abatement in underground coal mines; chemical stone, and acid-water treatment. Agricultural uses include limestone applied to soils to adjust their pH, poultry grit, and mineral feed.

Limestone is the chief geologic resource in Lexington Fayette County. The Central Quarry, near downtown Lexington at 1280 Manchester Street, mines limestone for use in construction materials (concrete, asphalt). The mines originating from the Central Quarry extend under parts of Lexington.

Several mineral veins have been encountered during limestone quarrying. Barite veins were heavily mined in the early 1900s. Mineral such as fluorite, calcite, sphalerite, and galena were encountered in these veins but were not found in economic quantities. Clays have been used locally as lining for stocked ponds. Residual clay in the vicinity of New Circle and Nicholasville Roads in Lexington was used in the manufacture of bricks. A few holes have been drilled for oil, but there has never been any oil production in Lexington Fayette County.

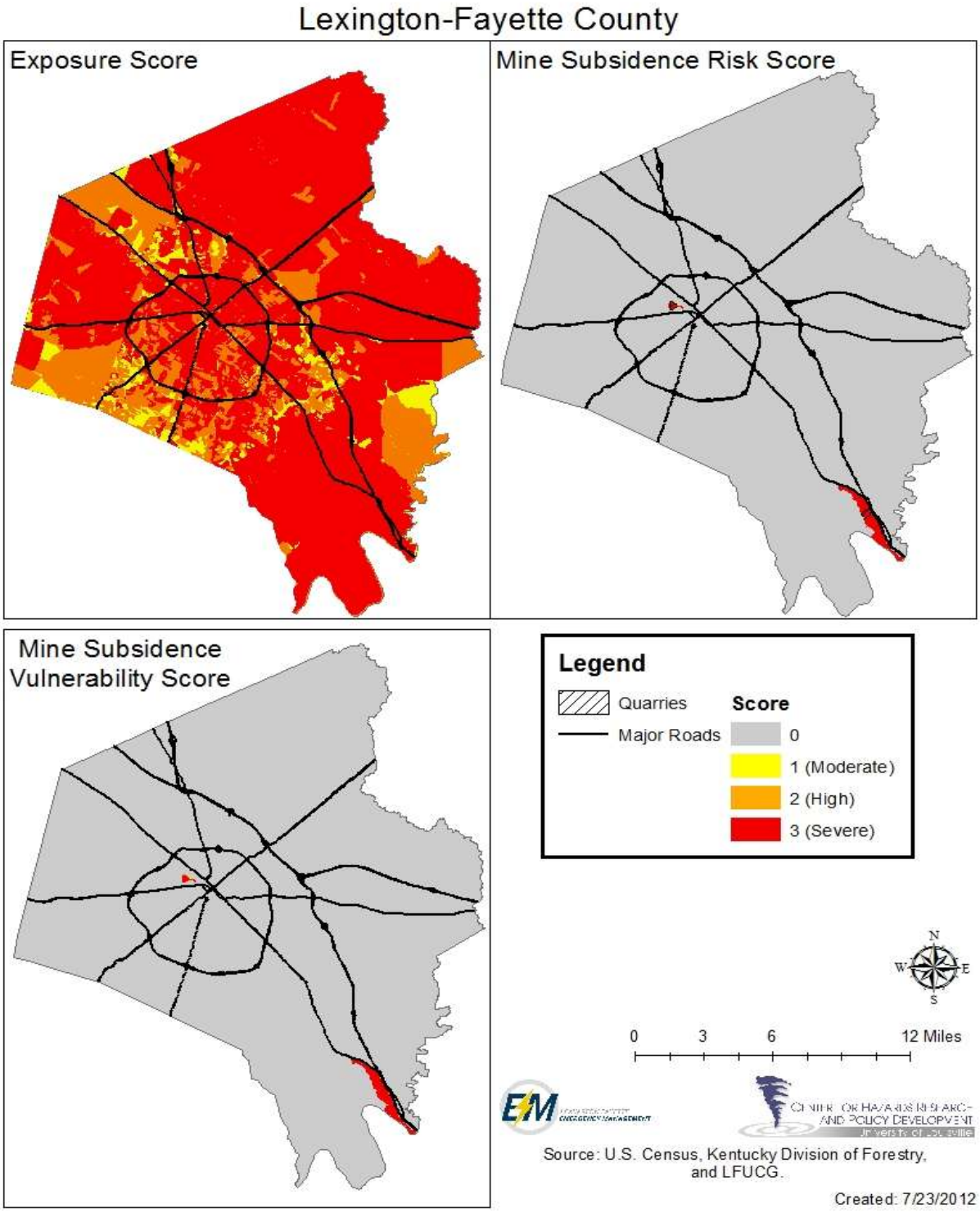
Abandoned mines are one indication of possible mine subsidence as unmaintained mines deteriorate overtime causing cave-ins and possibly causing the land above to subside. Although there has been no reported incidence of mine subsidence, the continued limestone quarrying within Lexington Fayette County and the continued growth of the built environment create an ever increasing vulnerability to mine subsidence. Thus, mine subsidence will continue to be researched and evaluated as a potential natural hazard risk.

4.12.2 Assessing Vulnerability Overview: Mine Subsidence

Mine Subsidence Vulnerability Score = Exposure Score X Risk Score

The Mine Subsidence Vulnerability Score was determined by creating a Mine Subsidence Risk Score multiplied by the Exposure Score. The Risk Score for Mine Subsidence was derived from a Spatial Score. The Spatial Score was developed by using mined out quarry data to develop a Hazard Zone Score. The mine quarry data was derived from LFUCG GIS data and displayed two areas of mine quarry operations. The percentage of the area affected by the mined out areas was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Mine Subsidence Risk Score. The Mine Subsidence Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Mine Subsidence Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Mine Subsidence Vulnerability Score equation.



4.12.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Mine Subsidence

In order to determine structures that are vulnerable and estimated to be damaged from Mine Subsidence the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the mined out quarry data. These mined out quarry areas display areas that could be damaged from a Mine Subsidence incident, thus was used to showcase risk and potential loss in this model.

Due to the small size of these mined out quarry areas Lexington Fayette County currently displays no structures within a Mine Subsidence hazard area. It is important to maintain this data and control development around these areas for future development.

There has not been any data captured at this point to create an Annualized Loss number for Mine Subsidence.

4.13 Severe Storm Identification

Description

A thunderstorm is formed from a combination of moisture, rapidly rising warm air and a force capable of lifting air such as a warm and cold front, a sea breeze or a mountain. 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 100,000 thunderstorms worldwide each year.
- 1,800 to 2,000 thunderstorms occur worldwide in a given second.
- In the last 25 years, severe storms have been involved in over 300 federal disasters.

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 is the second most frequent killer in the U.S. with nearly 100 deaths and 500 injuries each year.
- Lightning is a component of all thunderstorms.
- In the continental U.S. there are more than 40 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, 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:
  - Tall object transferred to person
  - Tall object to ground to person.
  - 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.
- 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.

4.13.1 Severe Storm Profile

SUMMARY OF SEVERE STORM RISK FACTORS	
Period of occurrence:	**Spring, Summer, and Fall**
Number of events: (1960-2011)	**94**
Annualized Probability:	**1.84**
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.**
Potential duration of facility shutdown:	**Days to weeks**
Past Damages:	**Total: $12,047,737 Property: $11,940,817 Crop: $106,920**
Extent (Date, Damages, Scale/Size):	**5/18/1993, $7,878,788, 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 type 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 provides more detailed information on several recent severe storms that resulted in damage, injury, or death.

- **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.

Lexington Fayette County Presidential Declarations for Severe Storm
May 11, 2010, DR1912, severe storms, flooding, mudslides, and tornadoes
June 10, 2004, DR1523, Severe storm, Flooding, and Landslides
February 24, 1989, DR821, Severe storm, Flooding
December 12, 1978, DR568, Severe storm, Flooding.

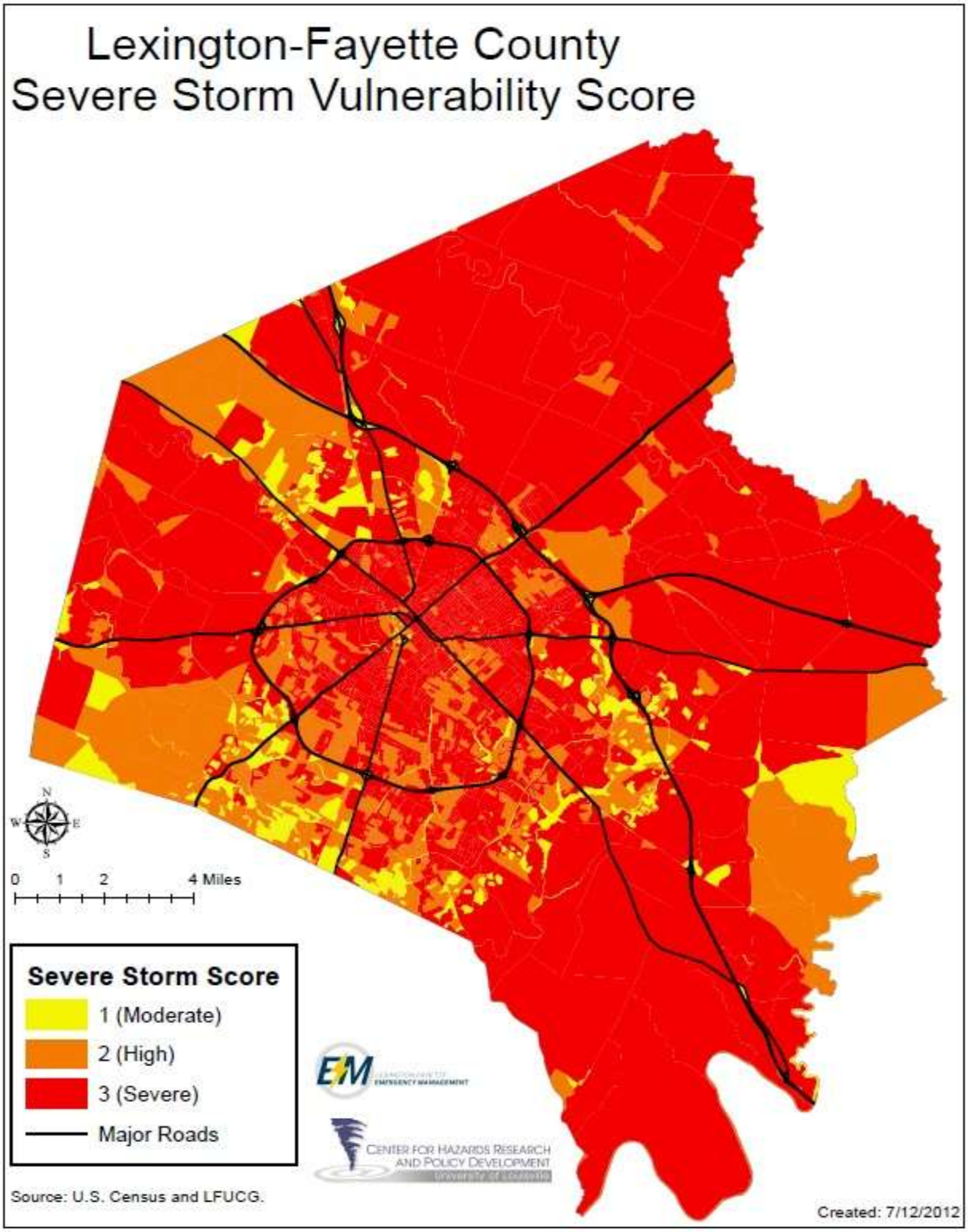
- **September 2008**: The worst power outage in Kentucky history, a result of high winds left over from Hurricane Ike, knocked out power to 600,000.
- **May 27, 2004**: Numerous trees and power lines were downed. Two truck loading stations were damaged on Jaggie Fox Way near Georgetown Road. Several 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 all 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.
- **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 was 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.

4.13.2 Assessing Vulnerability Overview: Severe Storm

Severe Storm Vulnerability Score = Exposure Score X Risk Score

The Severe Storm Vulnerability Score was determined by creating a Severe Storm Risk Score multiplied by the Exposure Score. Lexington Fayette County has no real spatial data that can be calculated to determine vulnerable areas to Severe Storm, which would be used to develop a Severe Storm Spatial Score. Severe Storm is the type of hazard that typically affects a county the size of Lexington Fayette equally. With that being said the Annualized Loss Score data is the only component of the Risk Score. Using this type of county wide data does not provide geographically specific areas of Risk. Therefore, when executing the calculation of the Severe Storm Vulnerability Score it is basically dependent on the Exposure Score. The Exposure Score does provide a visual display of areas that could be harder hit by Severe Storm based on the exposure that is within each Census Block.

The following map displays the areas that could more be vulnerable to Severe Storm based on there being more assets (Exposure).



4.13.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Severe Storm

Identifying individual structures and estimating potential losses from Severe Storm is a problematic endeavor. Without any current spatial data that identifies Severe Storm hazard boundaries, it is assumed that the entire county has equal vulnerability and the potential to be damaged from Severe Storm. That being stated it is assumed that each structure within Lexington Fayette County has an equal chance of being affected by Severe Storm. In order to estimate which structures could be damaged from a Severe Storm it is assumed that all structures could be damaged which accounts for 140,951 structures valued at $24,769,019,964.

There has been data captured to derive an Annualized Loss number for Severe Storm, which states that Lexington Fayette County will average $236,230 of loss per year.

4.14 Severe Winter Storms Identification

Description

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.

4.14.1 Severe Winter Storm Profile

SUMMARY OF SEVERE WINTER STORM RISK FACTORS	
Period of occurrence:	**Winter**
Number of events: (1960-2011)	**27**
Annualized Probability:	**0.53**
Warning time:	**Days for Snow Minutes to hours for ice**
Potential impact: Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, and damaged or destroyed critical facilities Can cause severe transportation problems and make travel extremely dangerous.	**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**
Potential duration of facility shutdown:	**Days**
Past Damages:	**Total: $4,682,219 Property: $3,089,203 Crop: $1,593,016**
Extent (Date, Damages, Scale/Size):	**02/19/2003, $2,035,119, Size: 1.25 inches of ice and 30 inches of snow**

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 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

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

- **January 20, 2011**: Four inches of snow was measured just outside of Lexington
- **February 15, 2010**: Snowfall varied from 4 to 8 inches from south to north across the county.
- **January 30, 2009**: Four inches of snow was measured at the Lexington Airport.
- **January 28, 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 23, 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 19, 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.
- **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.

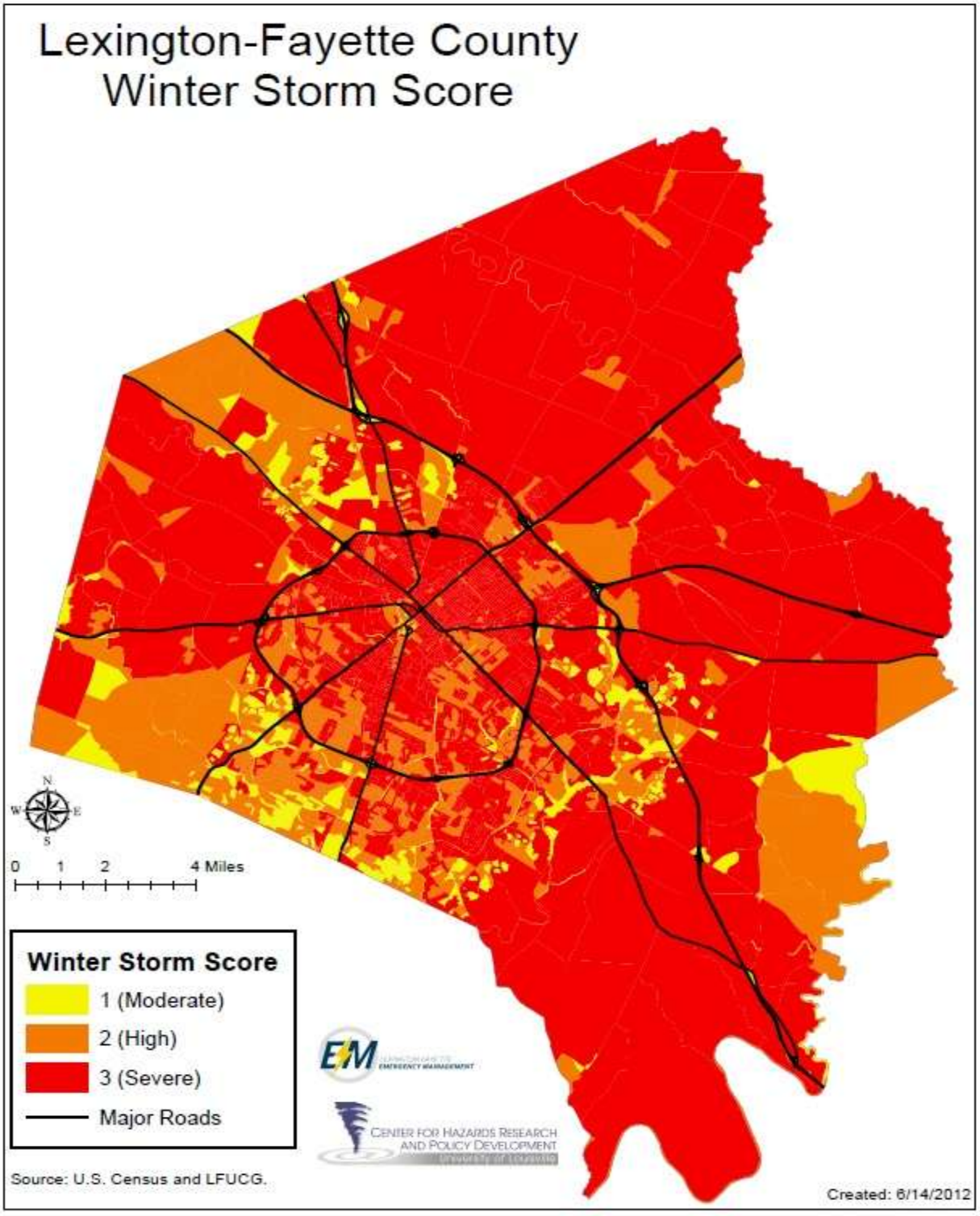
- **January 8, 1996**: The notorious "Blizzard of 96'" brought a significant amount of snowfall to the Lexington/Fayette County region. It was reported that 7 to 15 inches of snow (with drifts up to three feet) accumulated as a result of the storm. Road conditions remained hazardous in some locations 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.

4.14.2 Assessing Vulnerability Overview: Severe Winter Storm

Severe Winter Storm Vulnerability Score = Exposure Score X Risk Score

The Severe Winter Storm Vulnerability Score was determined by creating a Severe Winter Storm Risk Score multiplied by the Exposure Score. Lexington Fayette County has no real spatial data that can be calculated to determine vulnerable areas to Severe Winter Storm, which would be used to develop a Severe Winter Storm Spatial Score. Severe Winter Storm is the type of hazard that typically affects a county the size of Lexington Fayette equally. With that being said the Annualized Loss Score data is the only component of the Risk Score. Using this type of county wide data does not provide geographically specific areas of Risk. Therefore, when executing the calculation of the Severe Winter Storm Vulnerability Score it is basically dependent on the Exposure Score. The Exposure Score does provide a visual display of areas that could be harder hit by Severe Winter Storm based on the exposure that is within each Census Block.

The following map displays the areas that could more be vulnerable to Severe Winter Storm based on there being more assets (Exposure).



4.14.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Severe Winter Storm

Identifying individual structures and estimating potential losses from Severe Winter Storm is a problematic endeavor. Without any current spatial data that identifies Severe Winter Storm hazard boundaries, it is assumed that the entire county has equal vulnerability and the potential to be damaged from Severe Winter Storm. That being stated it is assumed that each structure within Lexington Fayette County has an equal chance of being affected by Severe Winter Storm. In order to estimate which structures could be damaged from a Severe Winter Storm it is assumed that all structures could be damaged which accounts for 140,951 structures valued at $24,769,019,964.

There has been data captured to derive an Annualized Loss number for Severe Winter Storm, which states that Lexington Fayette County will average $91,808 of loss per year.

4.15 Tornados Identification

Description

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 completely 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

- World-wide, about 1,000 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.

4.15.1 Tornado Profile

SUMMARY OF TORNADO RISK FACTORS	
Period of occurrence:	**Spring, Summer, and Fall**
Number of events: (1963-2011)	**13**
Annualized Probability:	**0.27**
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: (Adjusted for inflation to 2011 $)	**Total: $19,874,303 Property: $19,687,788 Crop: $186,515**
Extent (Date, Damages, Scale/Size):	**03/10/1986, $10,400,000, F3**

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 1963 to 2011, 13 tornadoes have touched down causing nearly $20 million in damages and 26 injuries in Lexington Fayette County. Of these eight tornadoes two were categorized as F0, four as F1 class, and one in both the F2 and F3 categories.

The following State and local data provides more detailed information on several recent tornadoes thru 2011 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. 6 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.
- **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.

Source: http://www.crh.noaa.gov/lmk/?n=tornado_climatology_fayette

4.15.2 Assessing Vulnerability Overview: Tornado

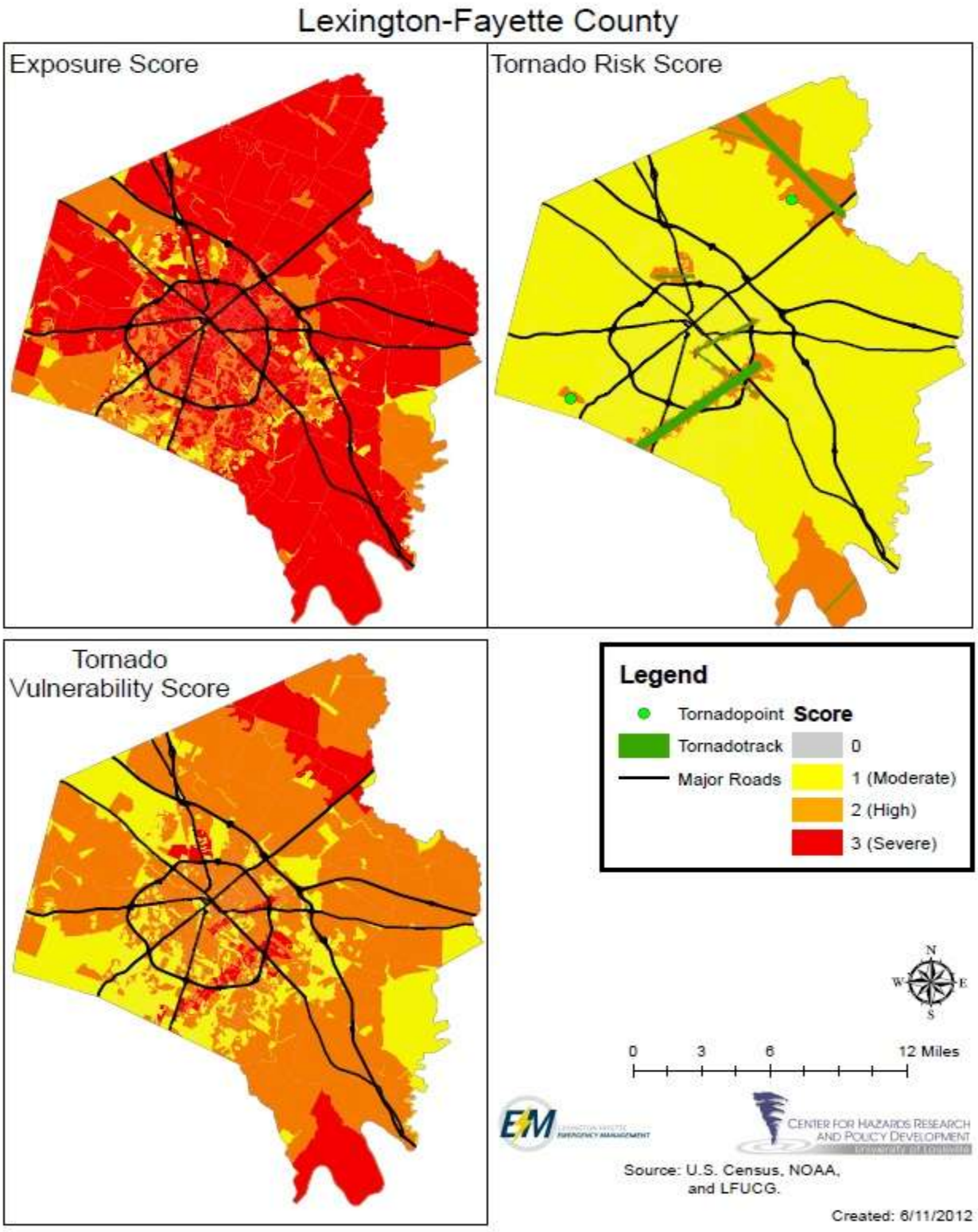
Tornado Vulnerability Score = Exposure Score X Risk Score

The Tornado Vulnerability Score was determined by creating a Tornado Risk Score multiplied by the Exposure Score. The Risk Score for Tornado was derived by calculating a Spatial Score. The Spatial Score for Tornado was developed by calculating a Hazard Zone Score and Hazard Occurrence Score. In order to calculate the Hazard Zone Score for Lexington Fayette County the Planning Team used NOAA provided Tornado path GIS data. Included in the path data was the width of the Tornado path which was used as the Hazard Zone layer. Next, the Tornado path data was overlaid onto the planning areas (Census Blocks) and weighted based on the percent of the area the Hazard Zone (Tornado Path) covers. This percentage of area affected by the mapped Tornado path data was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Zone Score.

The Hazard Occurrence Score was determined by counting the number of Tornado touchdowns Lexington Fayette County has experienced according to NOAA. These individual touchdown points were aggregated to individual Census Blocks. The Hazard Occurrence data displayed where high concentrations of Tornado events have occurred, thus producing areas of risk. Once all the Hazard Occurrence data points were calculated and aggregated to each Census Block, the Census Blocks were scored 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Occurrence Score.

The Tornado Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and the ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The Tornado Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Tornado Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Tornado Vulnerability Score equation.



4.15.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Tornado

In order to determine structures that are vulnerable and estimated to be damaged during a Tornado event the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the NOAA Tornado path GIS data. These Tornado path maps display areas that were within the path of past Tornados, thus were used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

Tornado Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	253	$215,858,700
Residential	3,604	$711,894,824
Government	6	$4,391,000
Total	**3,863**	**$932,144,524**

There has been data captured to derive an Annualized Loss number for Tornado, which states that Lexington Fayette County will average $420,448 of loss per year.

4.16 Wildfires Identification

Description

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

1. *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.
2. *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.
3. *Timber litter*. This type of fuel is most dominant in mountainous topography, especially in the Northwest.
4. *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 actually 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.

4.16.1 Wildfire Profile

SUMMARY OF WILDFIRE RISK FACTORS	
Period of occurrence:	**Year-Round, primarily Summer**
Number of events: (2005-2011)	**2**
Annualized Probability:	**0.33**
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:	**Unknown**
Extent (Date, Damages, Scale/Size):	**Size: 3,197 acres of contiguous tree canopy area located in the southern tip of the County**

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.

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.

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.

Private individuals own 78 percent of the timberland 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 over 1,800 wildland fires annually. These fires burn more than 50,000 acres per year. The leading cause of forest fires in Kentucky is arson. Arson is the act of intentionally and/or maliciously setting a fire. Wildland arson is a serious crime that hurts all Kentuckians.

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 two identified wildland fires in Fayette County between 2005 and 2011. The most recent wildfire to effect Lexington-Fayette was on September 15, 2010. These specific incidents can be seen on the Wildfire Risk Map in the Assessing Vulnerability Overview section.

4.16.2 Assessing Vulnerability Overview: Wildfire

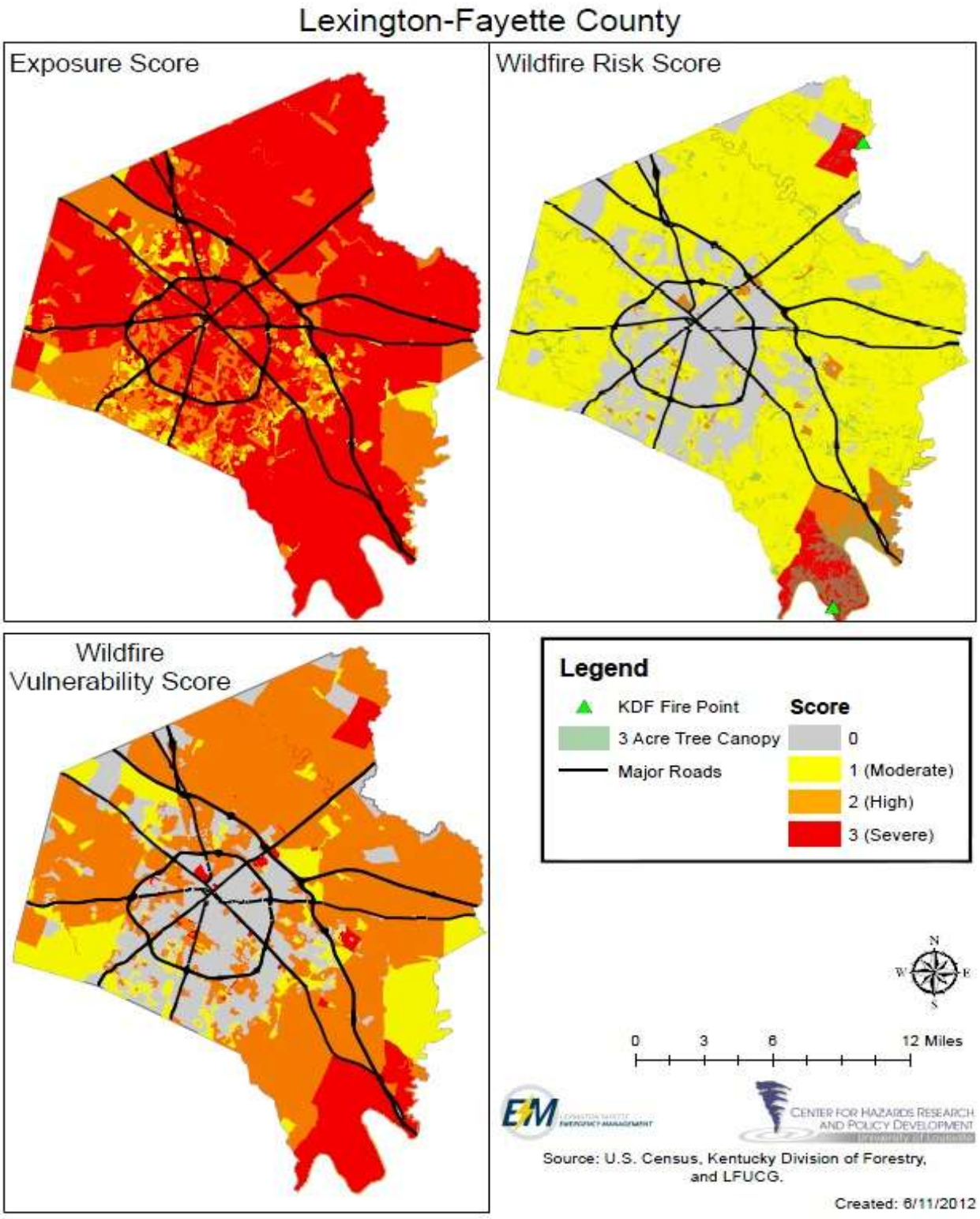
Wildfire Vulnerability Score = Exposure Score X Risk Score

The Wildfire Vulnerability Score was determined by creating a Wildfire Risk Score multiplied by the Exposure Score. The Risk Score for Wildfire was derived by calculating a Spatial Score. The Spatial Score for Wildfire was developed by calculating a Hazard Zone Score and Hazard Occurrence Score. In order to calculate the Hazard Zone Score for Lexington Fayette County the Planning Team used a tree canopy layer comprised of three (3) acres or higher to display Wildfire potential. Next, the tree canopy data was overlaid onto the planning areas (Census Blocks) and weighted based on the percent of the area the Hazard Zone (Tree Canopy) covers. This percentage of area affected by the mapped tree canopy data was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Zone Score.

The Hazard Occurrence Score was determined by counting the number of Wildfires Lexington Fayette County has experienced according to the Kentucky Department Forestry. These individual Wildfire points were aggregated to individual Census Blocks. The Hazard Occurrence data displayed where high concentrations of Wildfire events have occurred, thus producing areas of risk. Once all the Hazard Occurrence data points were calculated and aggregated to each Census Block, the Census Blocks were scored 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe) to develop the Hazard Occurrence Score.

The Wildfire Risk Score was then calculated by adding the Hazard Zone Score and Hazard Occurrence Score and the ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe). The Wildfire Vulnerability Score was calculated for each Census Block by multiplying the Census Block's Exposure Score by its Wildfire Risk Score and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe).

The following map displays the maps and components of the Wildfire Vulnerability Score equation.



4.16.3 Assessing Vulnerability: Identifying Structures and Estimating Losses: Wildfire

In order to determine structures that are vulnerable and estimated to be damaged during a Wildfire the Planning Team used the Hazard Boundary Overlay Loss Estimation methodology. The Hazard Boundary used as the overlay was the three (3) tree canopy GIS layer. These tree canopy maps display areas that could be damaged based on the fact that they are within the canopy layer, thus was used to showcase risk and potential loss in this model.

The following table describes the total number of structures identified within the hazard boundary and the replacement cost of those structures. This model estimates complete damage of each structure located within the Hazard Boundary.

Wildfire Hazard Boundary		
Type	**# of Structures**	**Replacement Cost**
Commercial	74	$161,947,100
Residential	2,756	$947,628,439
Government	10	$1,925,000
Total	**2,840**	**$1,111,500,539**

There has not been any data captured at this point to create an Annualized Loss number for Wildfire.

4.17 Analyzing Development 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 Lexington Fayette 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.

In the seven-county (Fayette, Jessamine, Woodford, Scott, Bourbon, Clark and Madison) MSA, the population has increased from 479,198 in 2000 to 555,015 in 2010, a 15.8% increase for the area. Fayette County, as a percentage of the MSA population, has declined from 56.3% in 1970 to 54.4% in 2000. 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 2010 data showing Fayette County population comprising 53.3% of the MSA population.

Population Growth in Fayette County & the Fayette Metro Area

	1980	1990	2000	2010
Fayette County	204,165	225,336	260,512	295,803
7 county metro area total	370,981	405,936	479,198	555,015*
Fayette Co. as % of metro	55.0%	55.5%	54.4%	53.3%
State	3,660,777	3,685,296	4,041,769	4,339,367

Source: US Census Bureau, Census of Population, 1980-2010
**The MSA was redefined to 6 counties sans-Madison. Madison county's Total Population has been added for continuity.*

At 44.9% and 49.6%, both Fayette County and the entire metro area have grown more rapidly than the percentage growth of the state as a whole (18.5%) over this time period. Based on the 2000 Census data, projections used in Lexington Fayette County's 2007 Comprehensive Plan Update[1] estimates the future

population of the urban county to continue growing at the current 15% decennial rate, for an increase to 327,341 in 2020 and 358,122 in 2030[8].

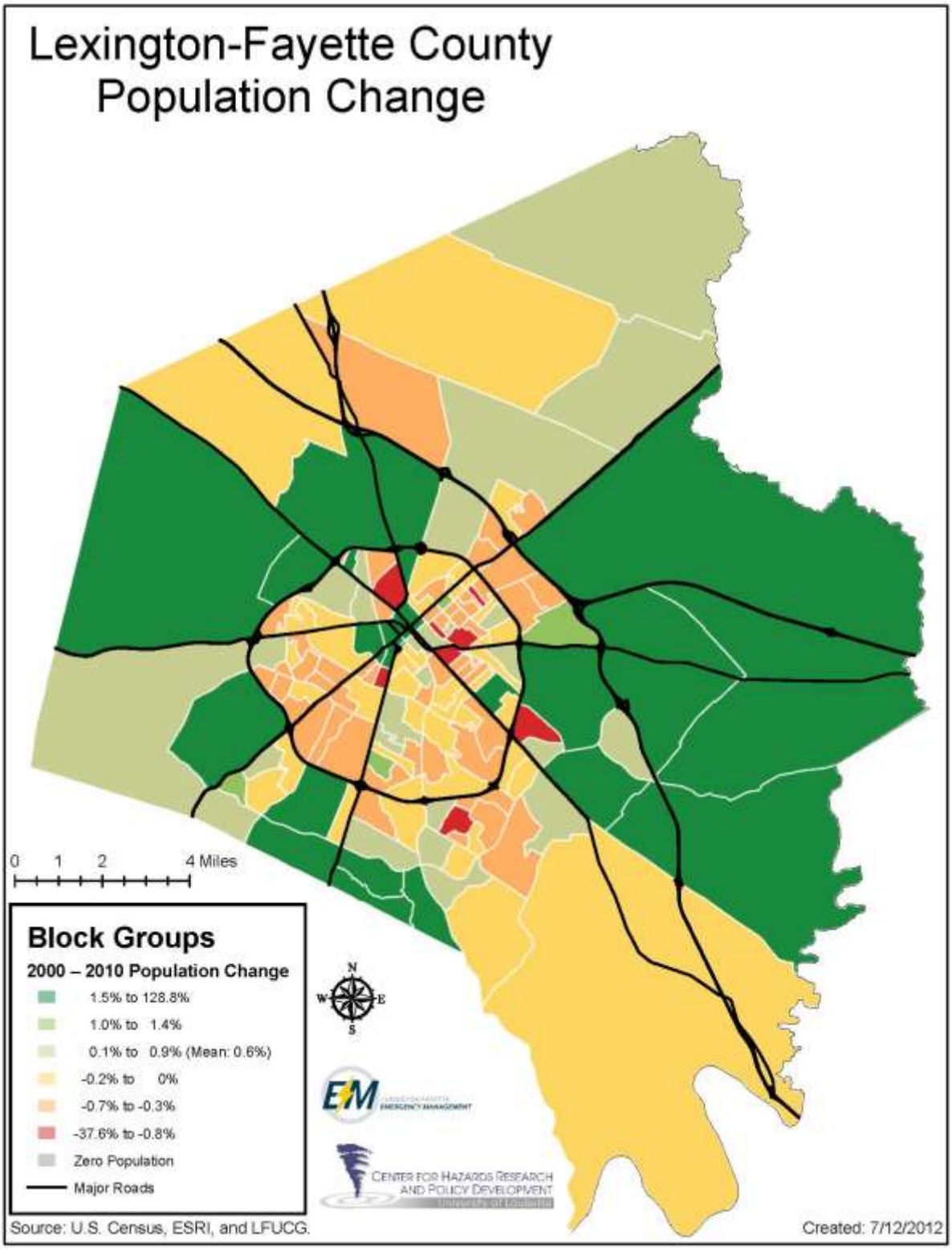
In order to display population change data using similar modeling techniques as the Hazard Vulnerability Scores, the Planning Team developed a map that can be overlaid onto the each Hazard Vulnerability Score. This depiction of the data provides the end user the ability to depict areas of high risk and high growth based on population trend data. The following map displays population change predicted over the timeframe of 2000-2010 for Lexington Fayette County.

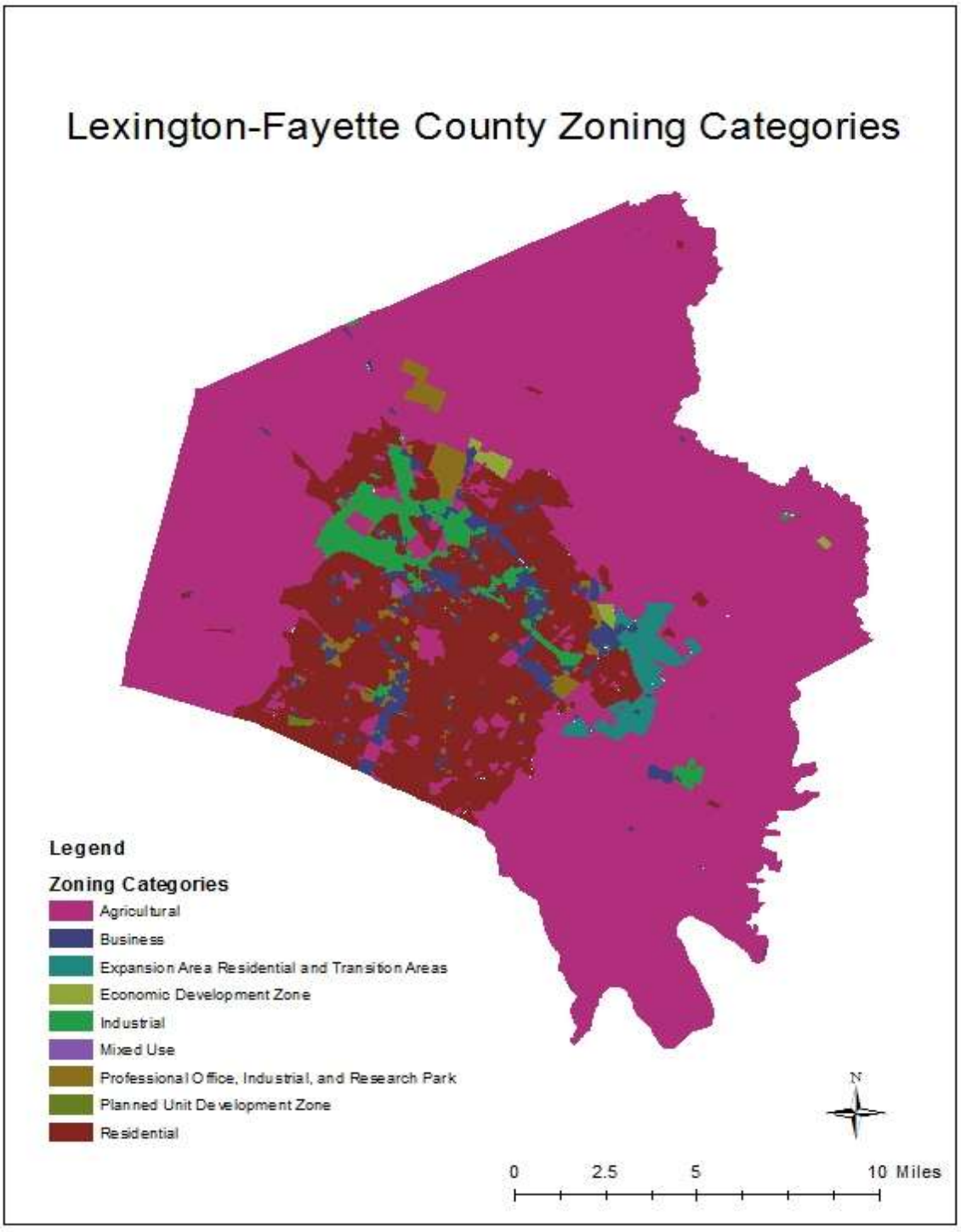
4.17.2 Landuse

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. As part of the mitigation strategy Lexington Fayette County will overlay the Hazard Vulnerability Score maps and or the Risk Score maps onto the landuse map when considering future landuse changes.

[8] The 2007 Comprehensive Plan for Lexington Fayette County, Kentucky, 250

The following map reflects Lexington Fayette's current zoning categories.




Lexington-Fayette County Zoning Categories
Legend
Zoning Categories
Agricultural
Business
Expansion Area Residential and Transition Areas
Economic Development Zone
Industrial
Mixed Use
Professional Office, Industrial, and Research Park
Planned Unit Development Zone
Residential
N
0
2.5
5
10 Miles

4.17.3 Development Trends Methodology

In order to understand actual Development Trends throughout the Lexington Fayette County planning area the Planning Team developed a new methodology. The model that was developed incorporated specific data variables that directly related to development in our community.

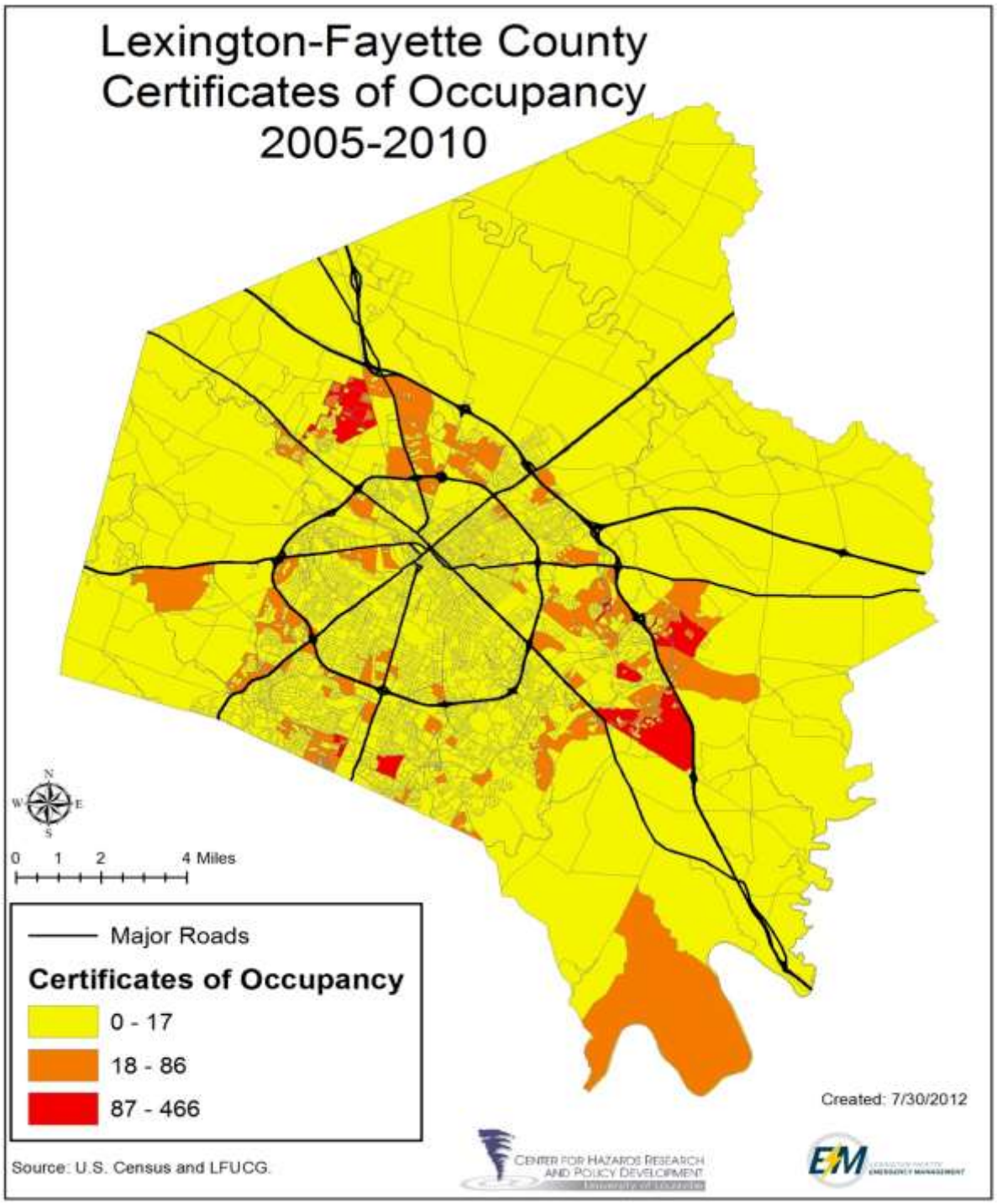
During the update of LFUCG's comprehensive plan the LFUCG Planning staff has been capturing data on the identification of Certificate of Occupancy Permits (Residential, Commercial and Industrial) granted from 2006-2010.

This data was geo-located using GIS analysis and incorporated into the Census Block planning areas. The model created was developed to mimic the models used in the Hazard Vulnerability Score methodology. The data was aggregated to the Census Block it was located within.

Comparable to the Hazard Occurrence Score developed as part of the Risk Scores for each hazard the number of Certificates for Occupancy were calculated by total number per Census Block (Hazard Occurrence Score). This data was then calculated and ranked 0 to 3 (0 = No data, 1 = Moderate, 2 = High, and 3 = Severe), again to mimic the Hazard Vulnerability Score model.

This model provides a development trend model based on actual development data that has been assimilated over the last four years. The areas in red depict trends of high growth over the last five years. The design of the model was developed to match the Hazard Vulnerability Score model in order for users to overlay the two models and understand where areas of high growth and high risks are located in correlation with each other.

The following map depicts areas of development based on the number of Certificate of Occupancy Permits that have been identified.



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 all three models 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.

5.0 Mitigation Strategy

5.1 Overview for Developing a Mitigation Strategy

FEMA's Local Mitigation Plan requirements encourage agencies at all levels, local residents, businesses, and the nonprofit sector to participate in the mitigation planning and implementation process. This broad public participation enables the development of mitigation actions that are supported by these various stakeholders and reflect the needs of the community.

The Lexington Fayette County's Mitigation Strategy responds to the Risk Assessment with projects and activities to mitigate natural and man-made hazards. The Mitigation Strategy outlines projects in a Five-Year Plan that allows Lexington Fayette County to make informed future land use and zoning decisions, design better infrastructure, and keep the public out of harm's way.

Moreover, the updated plan and Mitigation Strategy provides a proactive, community mitigation program of activities, projects, and programs that will help local agencies, residents, and businesses to be better prepared to prevent and/or reduce losses from an identified hazard. Lexington Fayette County has been successful to-date with mitigation activities, including regulatory and legislative actions.

The Mitigation Strategy is specific to exposure and impacts by each hazard and lists prioritized hazard mitigation projects that best meet Lexington Fayette County's needs for multiple hazard damage reduction. Section 5 outlines the design of the Mitigation Strategy developed through a tier of Steering Committee and Planning Team meetings. The mitigation strategy is based upon the best available data and provides a blueprint for reducing the potential losses identified in the risk assessments which are the factual basis for the mitigation strategy.

The section reviews the problems and common issues in Lexington Fayette County and details how the Steering Committee and Planning Team revised the community's goals and objectives by utilizing an all-hazards approach. Ongoing mitigation programs, as described in this section, assisted the Steering Committee with developing a Five-Year Action Plan. To start, the following capability assessment

outlines Lexington Fayette County's standing in Federal, State and Local ordinances, statutes and regulations, and reviews funding mechanisms.

5.2 Federal and State Capability Assessment

To set the stage for a mitigation strategy it is imperative to know the capability of the community to perform mitigation, regulate, and design outreach. Reducing hazards is a priority for Lexington Fayette County and the Commonwealth of Kentucky. Federal and State regulations affect all of Kentucky and each local community is subject to them. However, a community may adopt laws that are even more restrictive.

The following subsections outline hazard mitigation activities listed in the 2010 State Hazard Mitigation Plan that evaluates state regulations, policies, and state-funded or administered programs. Following this description of State capabilities there is a similar section/description of Lexington Fayette County's capabilities. The intent in listing both State and Local capabilities is to develop a better understanding of state government activities related to hazard mitigation and their impact on local communities. In addition, an analysis of the regulatory functions with respect to mitigation and hazards planning is imperative to good planning.

Among the best examples of hazard mitigation in State government are the floodplain management program, the dam safety program, and the FEMA-funded State administered hazard mitigation programs. However, a number of other programs, funding sources, executive orders, and interagency agreements have elements that can support or facilitate hazard mitigation. The state's capability is the foundation of similar capabilities by local government.

State Regulatory Analysis and Funding Summary

Kentucky Pre- and Post- Disaster Legislation

The Kentucky General Assembly realizes that the Commonwealth is subject to disasters or emergency occurrences at all times. These instances can range from events affecting limited areas to widespread catastrophic events. Immediate and effective response to these occurrences is a fundamental responsibility of elected government. Therefore, the General Assembly established a statewide comprehensive emergency management system to provide assessment and mitigation of threats to public safety and the negative externalities resulting from all major hazards.

The KRS were enacted in 1942 to eliminate provisions no longer in force or effect and to compile the remaining laws into a comprehensible form. In July of 1998, Kentucky Revised Statutes (KRS) 39A.010 established the Kentucky Division of Emergency Management (KyEM) and local emergency management agencies, replacing Kentucky Disaster and Emergency Services. In addition, the emergency powers provided in KRS Chapter 39A through 39F were conferred upon the Governor, the county judges/executives, the mayors of cities and urban-county governments, and the chief executives of local governments. Provisions were also established for mutual aid among the cities, counties, and urban-county governments of the Commonwealth.

There are a number of sections in KRS which address the issues of emergency systems, hazard safety, and hazard mitigation. There are several statutes which specifically pertain to pre-disaster mitigation:

- **KRS 39** - The KyEM shall coordinate for the Governor all matters pertaining to the comprehensive emergency management program and disaster and emergency response of the Commonwealth. The division shall be the executive branch agency of state government having primary jurisdiction, responsibility, and authority for the planning and execution of disaster and emergency assessment, mitigation, preparedness, response, and recovery for the Commonwealth (KRS 39A.050).
- **KRS 147** - Any general fund appropriations made for the Local Match Participation Program may be used for flood control planning and mitigation activities and straight sewage pipe removal and mitigation activities (KRS 147A.029).
- **KRS 149** - There are two official fire hazard seasons as established by the state legislature (KRS. 149.400). The fire seasons run from February 15 - April 30 and October 1- December 15. During the official fire seasons, "it shall be unlawful for any person to set fire to, or procure another to set fire to any flammable material capable of spreading fire, located in or within one hundred fifty (150') of any woodland or brushland, except between the hours of 6:00 p.m. and 6:00 a.m., prevailing local time, or when the ground is covered with snow". Open burning requirements are outlined in 401 KAR 63:005.
- **KRS 151** - The Energy and Environment Cabinet shall administer KRS 151 and establish the requirements for obtaining a floodplain development permit (KRS 151.250). The water resources authority shall develop a public information program for use by local units of government which will assist them in the development of floodplain management and flood hazard mitigation programs (KRS 151.600).
- **KRS 158** - The board of each local school district, and the governing body of each private and parochial school or school district, shall establish an earthquake and tornado emergency procedure system in every public or private school building in its jurisdiction having a capacity of 50 or more students, or having more than one classroom (KRS 158.163). The earthquake and tornado emergency procedure system shall include, but not be limited to:
    - A school building disaster plan, ready for implementation at any time, for maintaining the safety and care of students and staffs;
    - A drop procedure - an activity by which each student and staff member takes cover under a table or desk, dropping to his or her knees, with the head protected by the arms, and the back to the windows;
    - A safe area - a designated space including an enclosed area with no windows, a basement or the lowest floor using the interior hallway or rooms, or taking shelter under sturdy furniture;
    - Protective measures to be taken before, during, and following an earthquake or tornado;
    - A program to ensure the students and the certificated and classified staff are aware of and properly trained in, the earthquake and tornado emergency procedure system.
- **KRS 198B** - The Uniform State Building Code (KRS 198B.050) addresses issues concerning seismic and severe wind construction in response to the Commonwealth's potential earthquake and wind threats.
- **KRS 211** - The Cabinet for Health Services shall develop and conduct programs for evaluation and control of activities related to radon including laboratory analyses, mitigation, and measurements (KRS 211.855).

In addition to KRS legislation, the following are other initiatives which address state hazard mitigation:

- Jurisdictions which participate in the **National Flood Insurance Program (NFIP)** have established ordinances related to floodplain development. In addition, as a NFIP community, when purchasing a home located within the boundary of a special flood hazard area (SFHA), the buyer is required to purchase flood insurance.
- **Kentucky Drought Mitigation and Response Plan**: Prepared by the Energy and Environment Cabinet in partnership with the Kentucky Drought Mitigation and Response Advisory Council in fulfillment of the directive of Senate Joint Resolution 109, December 31, 2008. This plan provides statewide guidance to assess and minimize the impacts of a drought in Kentucky. This plan serves as a foundation to a proactive drought planning process intended to reduce drought risk in Kentucky. The plan describes a simple collaborative approach to accelerate the decision-making processes of state and federal agencies that are necessary to assist local government efforts in drought response. It establishes a mechanism for these agencies to work together during non-drought years with various agencies and individuals outside of state government to identify mitigation actions that can be taken to reduce the impacts of future droughts.
- **Flood Map Modernization in Kentucky**: Map Modernization is a cornerstone for helping communities to be better prepared for flood disasters. The NFIP currently serves 4.5 million policyholders and provides $650 billion in coverage nationwide. Kentucky is in the process of updating flood maps statewide with the goal of identifying flood hazards for areas that drain more than 1 square mile (640 acres). It is important to remember that every stream, large or small, has a floodplain and that any downstream structure may be damaged during flooding. The new aerial-photo-base maps will show areas that are likely to be flooded during a 1-percent-annual-chance flood. To accomplish map modernization, KDOW has formed partnerships with the KYTC, KGS, Kentucky KyEM, USGS, Kentucky Council of Area Development Districts (ADDs), and U.S. Army Corps of Engineers (USACE).

The end product of these partnerships will be not only digital floodplain maps, but also information that can be used for homeland security, natural resource conservation, emergency management and transportation purposes in order to promote economic development and maximize mitigation efforts.

The following table analyzes the tools available at this time in the Commonwealth. The table depicts the existing authorities, policies, programs and resources, and how they affect the hazard mitigation process.

Federal Funding and Technical Assistance Sources

Various federal government agencies offer a wide range of funding and technical assistance programs to help with mitigation efforts throughout the State. The table below is a list of Federal Funding and Technical Assistance programs available to states and local communities. The table outlines the funding source, purpose, the hazard mitigation application and contact info.

STATE AND LOCAL CAPABILITIES ASSESSMENT	
Existing Authorities	Floodplain Management Ordinance
	Building Codes
	Zoning Regulations
	Subdivision Regulations
	Fire Prevention Codes (State)
	Stormwater Management Plan
	Hazardous Materials Ordinance
Programs	NWS Storm Ready Program
	Emergency Support Functions
	Community Rating System
	Flood Map Modernization
Resources	Local Economic Development
	Regional Development Agency
	Local Emergency Management Agency
	State Emergency Management Agency
	Local Emergency Planning Committee
	Floodplain Management Plan
	Kentucky Drought Mitigation and Response Plan

FEDERAL FUNDING AND TECHNICAL ASSISTANCE PROGRAMS				
Grant Name	**Agency**	**Purpose**	**Hazard Mitigation Application**	**Contact Info**
Emergency Management Performance Grants (EMPG)	Homeland Security	To assist the development, maintenance, and improvement of State and local emergency management capabilities, which are key components of a comprehensive national emergency management system for disasters and emergencies that may result from natural disasters or accidental or man-caused events.	EMPG provides the support that State and local governments need to achieve measurable results in key functional areas of emergency management: 1) Laws and Authorities; 2) Hazard Identification and Risk Assessment; 3) Hazard Management; 4) Resource Management; 5) Planning; 6) Direction, Control, and Coordination; 7) Communications and Warning; 8) Operations and Procedures; 9) Logistics and Facilities; 10) Training; 11) Exercises; 12) Public Education and Information; and 13) Finance and Administration.	Department of Homeland Security, FEMA, c/o 245 Murray Lane - Bldg. #410, Washington, DC 20523. Telephone 800-621-FEMA-(3363). http://www.fema.gov/government/grant/government.shtm#4
Economic Adjustment Assistance	Dept. of Commerce, Economic Development Administration	To address the needs of distressed communities experiencing adverse economic changes that may occur suddenly or over time, and generally result from industrial or corporate restructuring, new Federal laws or requirements, reduction in defense expenditures, depletion of natural resources, or natural disaster.	Project grants can be in response to natural disasters including improvements and reconstruction of public facilities.	Office of Economic Adjustment, Dept. of Defense, 400 Army Navy Drive, Suite 200, Arlington, VA 22202-4704. Telephone: (703) 604-6020. https://www.cfda.gov/index?s=program&mode=form&tab=step1&id=b6288a16987f7dcbbff7a5a23d12d99f
National Earthquakes Hazards Reduction Program (NEHRP)	FEMA	The NEHRP's premise is that while earthquakes may be inevitable, earthquake-related damages are not. Activities of the program include basic and applied research; technology development & transfer; and training, education, & advocacy for seismic risk reduction measures.	FEMA administers a program of grants and technical assistance to States to increase awareness of earthquake hazards, foster plans, and implement mitigation actions to reduce seismic vulnerability.	Mitigation Division FEMA Region IV 3003 Chamblee-Tucker Rd. Atlanta, GA 30341 Telephone: (770) 220-5200 http://www.fema.gov/plan/prevent/earthquake/nehrp.shtm

FEDERAL FUNDING AND TECHNICAL ASSISTANCE PROGRAMS				
Grant Name	**Agency**	**Purpose**	**Hazard Mitigation Application**	**Contact Info**
Community Assistance Program State Support Services Element (CAP-SSSE)	FEMA	To ensure that the flood loss reduction goals of the NFIP are met, build state and community floodplain management expertise and capability, and leverage state knowledge and expertise in working with their communities.	Provides funding to States to provide technical assistance to communities in the NFIP and to evaluate community performance in implementing NFIP floodplain management activities.	FEMA, U.S. Dept. of Homeland Security 500 C Street SW, Washington, D.C. 20472 Telephone: (800-621-FEMA (3363). http://www.fema.gov/plan/prevent/floodplain/fema_cap-ssse.shtm http://www.fema.gov/government/grant/government.shtm#4
National Flood Insurance Program (NFIP)	FEMA	To enable persons to purchase insurance against physical damage to or loss of buildings and/or contents therein caused by floods, mudslide or flood-related erosion, thereby reducing Federal disaster assistance payments, and to promote wise floodplain management practices in the Nation's flood-prone and mudflow- prone areas.	Enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. (States, localities, and individuals)	FEMA, U.S. Dept. of Homeland Security 500 C Street SW, Washington, D.C. 20472 Telephone: (800) 621-FEMA (3362) http://www.fema.gov/government/grant/government.shtm#4 http://www.fema.gov/business/nfip/
Cooperating Technical Partners (CTP) Program Management	FEMA	The purpose of CTP Program Management is to provide, through a Cooperative Agreement with CTPs, a means to support global program management, state Business Plan updates, outreach, and training to state and local officials for Map Modernization and Risk MAP efforts. The Program Management activities do not directly result in production of a new or revised flood hazard map.	Provides funding to CTPs to supplement, not supplant, ongoing flood hazard mapping management efforts by the local, regional, or State agencies.	FEMA, U.S. Dept. of Homeland Security 500 C Street SW, Washington, D.C. 20472 Telephone: (800) 621-FEMA (3362) http://www.fema.gov/plan/prevent/fhm/ctp_main.shtm http://www.fema.gov/government/grant/government.shtm#4

FEDERAL FUNDING AND TECHNICAL ASSISTANCE PROGRAMS				
Grant Name	**Agency**	**Purpose**	**Hazard Mitigation Application**	**Contact Info**
National Dam Safety Program	FEMA	To provide vital support for the improvement of the state dam safety programs that regulates most of the 79,500 dams in the U.S. Dam safety training for state personnel, increase the number of dam inspections, increase the submittal and testing of Emergency Action Plans, more timely review and issuance of permits, improved coordination with state emergency preparedness officials, identification of dams to be repaired or removed, conduct dam safety awareness workshops and creation of dam safety videos and other outreach materials.	Provides financial assistance to the states for strengthening their dam safety programs through grant assistance	FEMA, U.S. Dept. of Homeland Security 500 C Street SW, Washington, D.C. 20472 Telephone: (800) 621-FEMA (3362) http://www.fema.gov/plan/prevent/damfailure/ndsp.shtm http://www.fema.gov/plan/prevent/damfailure/stategrant.shtm http://www.fema.gov/government/grant/government.shtm#4

Five FEMA-Funded Grant Programs

KyEM implements five grant programs that provide funding for the following types of actions and projects.

- Voluntary acquisitions and demolition or elevation of flood-prone structures for conversion to permanent open space
- Voluntary acquisitions and demolition of landslide-prone structures for conversion to open space in perpetuity
- Infrastructure protection measures against windstorms or earthquakes
- Dry flood proofing of commercial property
- Minor structural flood control projects
- Tornado safe rooms and community shelters
- Utility protection measures

Following is a summary of the grant programs.

1. Flood Mitigation Assistance (FMA) Grant Program
The FMA grant program provides funding for cost-effective measures which reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA program is funded on an annual cycle. Each year the state receives a target allocation of funding for which local communities can apply. The FMA program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

2. Hazard Mitigation Grant Program (HMGP)
Following a Presidential disaster declaration, the HMGP provides funding to the State for projects to reduce damages, losses and suffering in future disasters. The intent of HMGP is to provide a federal, state and local partnership in developing and funding mitigation projects. Funding is available from the FEMA (up to 75% of the project) and State (up to 12% of the project).

3. Pre-Disaster Mitigation (PDM) Grant Program
The PDM provides funds to the State for pre-disaster mitigation planning and the implementation of cost-effective mitigation projects prior to a disaster event. The PDM program is a nationally competitive program. There is no state allocation and no national priority for projects. The PDM program is funded on an annual cycle. The PDM program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

4. Repetitive Flood Claims (RFC) Grant Program
The RFC grant program provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claim payment(s) for flood damages. The long-term goal of the RFC grant program is to reduce or eliminate the number of recurring flood insurance claims, through mitigation activities which are in the best interest of the National Flood Insurance Fund. All RFC grants are eligible for up to 100 percent Federal cost assistance. RFC grants are awarded to Applicants on a nationwide basis without reference to State allocations, quotas, or other formula-based allocations.

5. Severe Repetitive Loss (SRL) Grant Program
The SRL grant program provides funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the NFIP. SRL Properties are residential properties that have at least four NFIP claim payments over $5,000 each, when at least two such claims have occurred within any ten-year

period, and the cumulative amount of such claims payments exceeds $20,000; or for which at least two separate claims payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two such claims have occurred within any ten-year period.

FEMA-FUNDED HAZARD MITIGATION ASSISTANCE GRANT PROGRAMS		
FEMA Grant Name	**Purpose**	**Hazard Mitigation Application**
1. FMA Program	To help States and communities plan and carry out activities designed to reduce the risk of flood damage to structures insurable under the NFIP.	The program provides planning, project and technical assistance grants for mitigation activities that are technically feasible and cost effective.
2. HMGP	To prevent future losses of lives and property due to disasters; to implement State or local hazard mitigation plans; to enable mitigation measures to be implemented during immediate recovery from a disaster; and to provide funding for previously identified mitigation measures to benefit the disaster area.	Project grants can be funded for such activities as acquisition, relocation, elevation, and improvements to facilities and properties to withstand future disasters.
3. PDM Program	The PDM program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations.	Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.
4. RFC Program	Provides funding to States and communities to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claims for flood damages, and that cannot meet the requirements of the FMA program for either cost share or capacity to manage the activities.	Up to $10 million is available annually for FEMA to provide RFC funds to assist States and communities reduce flood damages to insured properties that have had one or more claims to the NFIP.
5. SRL Program	Provides funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the NFIP.	Eligible flood mitigation project activities include Floodproofing (historical properties only); Relocation; Elevation; Acquisition; Mitigation reconstruction (demolition rebuild); and Minor

Eligible projects must meet a FEMA-approved benefit-cost analysis, in which the applicant must demonstrate for every dollar spent on a project at least a dollar's worth of future damage protection will be realized. Projects must also meet other criteria. The Kentucky State Clearinghouse, comprised of a group of state regulatory agencies, must review projects to identify any adverse impact on environmental, archeological, and historic resources. These agencies also may provide guidance on permits which must be obtained before the project may proceed or actions the applicant's community must take to reduce the effects on such resources.

5.3 Lexington Fayette County's Capability Assessment

Because of the Lexington Fayette County area's history with natural disasters, it is expected that there is generalized support for advancing hazard mitigation strategies. The plan's Steering Committee – made up by representatives of the stakeholder groups and general public – contributed to the mitigation planning process by submitting recommendations for building strategies that reflect the present and desired state of preparedness in Lexington Fayette County.

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.

The following action items that are provided in this section recommend projects that could be implemented through existing programs and integrated into job descriptions, comprehensive plans, capital improvement plans, zoning and building codes, permitting, and other planning tools, where appropriate. Fortunately, many of the agencies who are responsible for implementing identified action items are members of the Steering Committee. The 2012 Plan follows suit with incorporating existing planning mechanisms.

Essential to building the updated plan was to review existing plans, studies, reports, and technical information for incorporation. The recently approved Floodplain Management Plan was an important resource in identifying ongoing programs and flood mitigation accomplishments. Other information that was incorporated into the plan includes:

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

This review and incorporation is outlined in the following sections that describe mitigation activities that served as basis for determining the five-year mitigation action items.

5.3.1 Ongoing Mitigation Activities

The Lexington Fayette County mitigation program activities listed below demonstrate the ongoing efforts to mitigate the effects of natural and man-made hazards. To ensure the utilization of best practices and efficient resource management, the mitigation strategy will be monitored, updated and evaluated as ongoing programs are implemented.

In order to better organize Lexington Fayette County's ongoing mitigation activities, the stakeholder committee reviewed current activities according to six general mitigation categories:

1. Preventive actions
2. Property protection
3. Structural projects
4. Natural resource protection

5. Emergency services
6. Public information and awareness

Preventive Actions

Preventive activities keep problems from getting worse. Land use and development of hazard areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices. Preventive measures are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not be substantial.

Below are descriptions of ongoing preventive activities in Lexington Fayette County:

Detention Basin Inspection Team: The DOWQ has established a protocol for the maintenance of detention basins 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 stormwater devices to ensure their proper maintenance and functionality. In cases where the government does not own the detention basin, the DOWQ staff has been given the authority to enforce detention basin maintenance requirements. Each detention basin is inspected twice a year.

LFUCG Floodplain Ordinance: In January 2001, an amended Floodplain Conservation and Protection Ordinance went into effect regulating development in the floodplain. Under the ordinance, no construction is allowed in the floodplain (unless granted a Local Special Use Permit). 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.

Greenways: The Greenways Program began in 1984 with the creation of the community's first greenway along West Hickman Creek. Since the adoption of the 1988 Comprehensive Plan, greenways have been identified as a goal for inclusion in development of all types. There are currently 856 acres of greenways that have been dedicated to or purchased by LFUCG, with an additional 145 acres to be acquired. In addition to the extensive acreage controlled by the government, different Homeowner Associations own 120 acres of greenway/floodplains that will remain as open space. Greenways are an appropriate passive use of floodplain land that provide open space and, with proper vegetative treatment, improvement in water quality.

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.

Stormwater Funding Study: In 2006, the Stormwater Funding Advisory Task Force was formed to discuss alternate methods of funding stormwater activities. In January of 2010 the stormwater management fee was implemented. There are generally three grant types: 1) Neighborhood Grants, 2) Education Grants, and 3) Infrastructure Grants. Each have differing funding amounts and cost shares.

Stormwater Quality Projects Incentive Grant Program: The Stormwater Quality Projects Incentive Grant Program provides financial assistance for projects in the community that improve water quality, address stormwater runoff and educate the public about these issues.

Urban Service Area Boundary: 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. Furthermore, Article 19 of the Zoning Ordinance restricts the development of new agricultural structures in the floodplain.

Property Protection

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis. Property protection measures protect existing structures by modifying the building to withstand hazardous events, or removing structures from hazardous areas.

Below are descriptions of ongoing preventive activities in Lexington Fayette County:

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 September of 2010. 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.

NFIP Compliance
Requirement §201.6(c)(3)(ii)

[The mitigation strategy] must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

The Divisions of Planning and Water Quality provide assistance to 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.

Home Flood-Proofing Program: Between 1992 and 2007 – the program was discontinued in 2007 – the Division of Engineering administered this program to assist home owners in making their residence resistant to surface water flooding. Through the program, home owners received 50% of eligible costs for structural modifications to their home to keep out surface water. The home owner also received advice on flood-proofing techniques and locating a contractor. More than 350 homes participated in the program, with LFUCG expenditures totaling over $1,000,000.

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 stormwater 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.

Sinkhole Regulation: Lexington Fayette County is located 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. Ideally, sinkholes should be areas of open space. Since the early 1980s, the LFUCG has included special standards for sinkholes in the Subdivision Regulations. These standards require sinkholes may not be used as a part of the storm drainage system without a complete geotechnical evaluation.

The LFUCG has strong standards relating to a specific sinkhole within a development. In an area where there is a cluster of sinkholes, the Subdivision Regulations address it as a geologic hazard area and require that it be left in a natural state similar to the floodplain requirements. As Lexington Fayette County develops more of the vacant land inside the Urban Service Area, there are areas of geologic hazard that will require special attention to address any conflicts that may arise.

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.

Natural Resource Protection

Natural Resource Protection activities preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are usually implemented by parks, recreation, or conservation agencies or organizations.

Below are descriptions of ongoing natural resource protection activities Lexington Fayette County:

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.

Greenways Master Plan: The Greenways Master Plan was adopted as an element of the 2001 Comprehensive Plan in 2002. Nine Conservation Greenways are identified for protection in order 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.

Greenway Manual: The LFUCG has written a proposed Greenway Manual to define principles, procedures, standards and guidelines applicable to the facility development and management of all greenways in the Urban County. Best Management Practices for Conservation Greenways include control of vegetation, removal, planting, disturbance and riparian zones. The Manual addresses trail construction, stream crossings, access and development practices in and adjacent to greenways. The manual is currently being reviewed as part of the Division of Water Quality's efforts to address the requirements of the Consent Decree. It is anticipated that implementation and adoption of the manual will occur in 2013.

Reforest the Bluegrass: The LFUCG's Divisions of Engineering, Streets, Roads, and Forestry, and Parks and Recreation, organized this project which is designed to recreate pre-settlement, streamline forests that were once native to the inner Bluegrass Region of Kentucky. Through the efforts of thousands of volunteers, Lexington is progressively restoring the long-lost benefits of streamside forests for generations to come. Some accomplishments of the program include more than 175 acres of floodplains restored, more than 10,500 volunteers involved, and more than 100,000 tree seedlings planted.

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. This will help to reduce flash flood runoff and to improve water quality. This is administered by the Urban Forester.

Variance to the Weed Ordinance: In 1999, the Urban County Council revised the Weed Ordinance to allow property owners to use native plants next to streams, drainage swales, and in karst areas. This variance in the ordinance allows a 26-foot wide, non-woody, vegetative buffer zone to be established. The plants provide a root zone that can reduce stream bank erosion and stream siltation. This ordinance has been coupled with a public education program to encourage appropriate streamside plantings.

Structural Projects

2011 Sanitary Sewer Capital Improvement Plan: Although not directly related to floodplain management, rehabilitation of the sanitary sewers system will also mitigate flood-related threats to public health and property by reducing sewer overflows during heavy rainfall events.

2011 Stormwater Projects Priority List: The Division of Engineering has ongoing programs to reduce flooding in neighborhoods and has completed numerous stormwater projects. Since 1996, a priority list has been used to address community needs in a more efficient manner. These projects have been compiled into a Stormwater Projects Priority List. Each project was assigned a priority, based on factors

that included the number of homes flooded, the level of structural damage, and the cost effectiveness of the project. As these are completed, stormwater problems in Fayette County should be substantially reduced.

Watershed Gauges: Since 1997 the LFUCG has had a cooperative agreement with the U.S. Geological Survey to collect data on watersheds in Fayette County. Stream gauges and rain gauges have been installed at various locations throughout the county, with at least one gauge in each watershed. These gauges continuously transmit data via satellite to the U.S.G.S. The data is used for watershed and floodplain modeling, which is critical to floodplain management. More gauges would be valuable, but funding for this is limited. Funding for new gauges should be sought in the future.

FEMA Hazard Mitigation Grant Program: Through this program, the LFUCG completed projects to acquire and demolish flood prone properties, and the construction of detention basins, culverts, and channel improvements.

Emergency Services

Emergency Services measures are taken during an emergency to minimize its impact. These measures often are the responsibility of emergency management responders and staff and the owners or operators of major or critical facilities.

Below are descriptions of ongoing emergency service activities in Lexington Fayette County:

Chemical Stockpile Emergency Preparedness (CSEPP): CSSEP is a cooperative effort by local, state, and federal agencies to prepare for the slight, but very real, threat of accidents at the chemical munitions storage site in Madison County, one of eight nationally. Through CSEPP, Fayette County coordinates planning, training, and exercises with the depot, surrounding counties, and the state of Kentucky. Lexington also receives funds for equipment and supplies necessary to respond to such emergencies. If a release at the depot were to occur, Fayette County, along with Jessamine and Laurel Counties, can serve as a host center for people evacuating Madison County. However, LFUCG is also an at-risk community due to the variability in weather patterns that could move agents.

CSEPP Funding since (2006-2012)	
Grantor: Department of Homeland Security	
Year	**Total**
FY 2006	$182,382
FY 2007	$161,098
FY 2008	$125,320
FY 2009	$372,300
FY 2009	$100,000
FY 2010	$595,600
FY 2011	$388,400
FY 2012	$580,700
TOTAL:	**$2,505,800**
Source: LFUCG DEM	

Community Emergency Response Team (CERT):

The DEM, in partnership with the Division of Fire and Emergency Services, have a training program to help citizens become a first responder in their own neighborhoods. The FEMA program consists of 24 hours minimum of training that is broken into 8 separate 3 hour classes. Session topics include disaster preparedness, disaster medical operations, light search and rescue, terrorism, disaster fire suppression, and disaster psychology and team organization. The training ends with a disaster simulation where team members get to practice skills they've learned in the course.

The first CERT team in Lexington, consisting of nine members, went through training in February 2004. Currently, 194 people have been trained in sixteen different training sessions since the program began. Two trainings are held per year in the spring and fall with periodic refresher training courses.

Comprehensive outreach is conducted through CERT by "Preparedness Ambassadors" or volunteers who assist with presentations, booth staffing, and serve as neighborhood leaders. CERT staff also assisted individual residents, including those of Sayre Christian Village, with the completion of their own personal preparedness plans.

DEM Alert Notification System:

- The LFUCG/DEM/E911 has purchased and is utilizing a web-based system that is capable of reverse 911 phone/fax/pager notification for the community and is capable of being used for notification to the community regarding emergency information.
- The LFUCG/DEM implemented a system called AlertUS. Broadcasts/activations originate from DEM and are carried either thru the web or the University of Kentucky's FM 91.3 radio station to special beacons that are placed in critical facilities throughout Lexington Fayette County. Beacons are in place at Lexington Center, Transylvania University, the Opera House, and to the local YMCAs. Other critical facilities will receive these beacons in the future.
- An AlertAM Public Safety radio system has been purchased and is now installed. It broadcasts on 1620 AM radio. The system currently has three nodes providing service across most of Fayette County, including Interstates 64/75 and the Kentucky Horse Park.
- LFUCG/DEM purchased flood marker signs that include both a "Road May Flood" sign, as well as signs that indicate water depth. DEM is working with the Kentucky Dept. of Highways to install these signs in critical areas of known flooding in Fayette County.
- The Lexington Fayette Urban County Government's Emergency Alerts and Notifications (LEAN) system is an automated community notification tool designed to enhance preparedness and facilitate urgent and necessary outbound communications to citizens during emergency events.

Emergency Operations Center (EOC): When a state of emergency has been declared by the Mayor, the EOC opens to provide resources and coordinate the community's needs such as: transportation, medical, food, shelter, heat, etc. In the summer of 2012, the EOC was relocated to the new DEM headquarters. Represented organizations at the EOC include Emergency Management, Police, Fire, Public Information, LexTran, Fayette County Public Schools, Public Works, Red Cross, Social Services, et cetera.

Emergency Operation Plan (EOP): The EOP is the backbone of operations during a disaster. The EOP provides a standard operations plan for the entire county and details services, along with CSEPP. DEM is in the process of revising the current Fayette County EOP. The new EOP will reflect a format that includes the Emergency Support Functions (ESFs) and is scheduled for completion by the end of 2012.

Facility Shelter Surveys/Disaster In-Services-Training: This program, administered by DEM, coordinates several community activities that assist facilities in planning for disasters. This process usually starts with a facility visit to conduct a survey which will identify and designate potential shelter safe areas. After the initial survey, several documents that will assist the facility in building their own emergency plan are presented. Annual in-service training for all potential hazard events is practiced. Tornado and Shelter-in-Place training are the most widely requested topics for in-services. This program also conducts training to local schools and universities.

Fayette Local Emergency Planning Committee (LEPC): The Fayette LEPC is made up of government, health officials, media, and Lexington businesses that use, store, or transport extremely hazardous chemicals. The goal of the LEPC is to educate the community about the potential for chemical emergencies. DEM is responsible for keeping records, completing hazard analysis for facilities, assisting facilities with production of their Tab Q-7s, performing annual tabletop and full scale exercises with facilities that have extremely hazardous substances, ensuring compliance, and protecting the public by providing information about these local facilities. DEM is also responsible for providing reports on the activities of the LEPC, as well as all funds generated through Title III activities to the State Emergency Response Commission.

Hazardous Material Emergency Response: DEM supports that Hazardous Materials Program by participating in the on-call rotation, attending training, and responding, (when called), to chemical emergencies and other related events.

Healthcare Emergency Planning Committee (HCEPC): The HCEPC is a partnership among hospitals, healthcare providers, and public safety agencies to enhance emergency preparedness. The HCEPC has helped facilitate mutual aid agreements between hospitals to assist each other during disasters. HCEPC serves as the steering committee of the Metropolitan Medical Response System (MMRS) and partners with CSEPP. The HCEPC is also involved with emergency planning, training, exercises, and coordinating with emergency management, police, and fire.

Metropolitan Medical Response System (MMRS): The MMRS is an ongoing effort by the public health and safety community in Lexington Fayette County to plan for serious health and medical catastrophes that threaten public health (terrorism, epidemics, etc.), to develop systems for coordinating and providing critical care where it is needed, and to purchase medicine and equipment.

MMRS Funding since (2006-2012)	
Grantor: Department of Homeland Security	
Year	**Total**
FY 2006	$220,764
FY 2007	$245,238
FY 2008	$232,962
FY 2009	$311,585
FY 2010	$311,585
FY 2011	$307,896
FY 2012	$267,609
TOTAL:	**$1,897,639**
Source: LFUCG DEM	

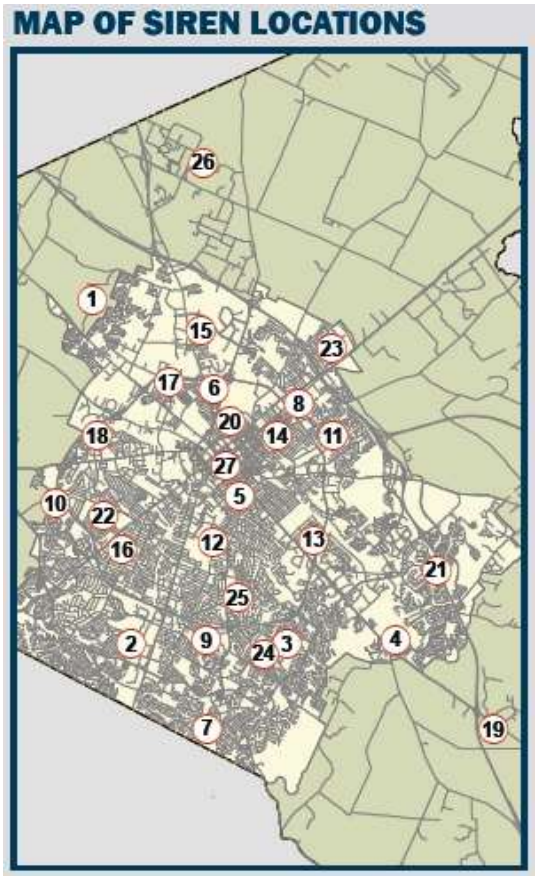
National Disaster Medical System (NDMS): The NDMS is designed to care for the victims of an incident, like 9-11, that exceeds the medical care capability of an affected state, region or federal medical care system. NDMS plans for treating large numbers of casualties in a major peacetime disaster or national security emergency involving a conventional military conflict. DEM is responsible for coordinating efforts with local hospitals, the Department of Defense, FEMA, the Veterans Administration, and Health and Human Services in the event of the activation of this system.

Neighborhood Emergency Network (NEN): The NEN is a volunteer program sponsored by the Lexington Fayette County Neighborhood Council and DEM. The purpose is to enhance community preparedness and emergency response by developing a unique partnership between neighborhoods and public safety agencies. The program is sponsored by the LFUCG and those neighborhoods and residents that wish to participate. In addition to enhancing ties between neighborhoods and public safety, the program seeks to provide residents with opportunities for training and education on emergency preparedness.

Severe Storms and Earthquake Preparedness Program: Each year the state of Kentucky has two months set aside for local communities to participate in Severe Storms and Earthquake Preparedness activities. In Lexington Fayette County, DEM compiles a month-long calendar of events for both preparedness programs. Local activities include a comprehensive outreach program, which includes a mass mailing of informative literature

Severe Weather Warning Systems: DEM manages and coordinates the outdoor warning system which consists of 27 outdoor warning sirens with voice in various parks around Lexington Fayette County. These devices are activated from the 24 hour warning point at Police Headquarters on Main Street. The system is tested monthly with weekly diagnostic tests performed silently. Standard operating procedures for siren operation are developed and reviewed annually.

Other warning systems located at the 24 hour warning point include Emergency Alert System (EAS), and the Cable Interrupt system. Other warning systems that are monitored include the NOAA weather radio and several computer generated weather programs to keep a watchful eye on possible weather conditions that would affect Lexington Fayette County.



Source: DEM, Website Location: http://www.lexingtonky.gov/index.aspx?page=2807

SKYWARN Program: To obtain critical weather information, the National Oceanic and Atmospheric Administration's (NOAAs) NWS established SKYWARN with partner organizations. Volunteers of this program help keep local communities safe by providing timely and accurate reports of severe weather to the NWS. Metro police officers, all new recruits from the Fire Department, as well as the Kentucky Utilities field personnel are also trained.

StormReady Campus – University of Kentucky: Since 2003, the University of Kentucky (UK) is officially recognized as a StormReady Campus by the NWS. The certification means that UK has successfully met the criteria outlined by the NWS in its nationwide program to enhance community preparedness for severe storms and weather emergencies. With assistance from DEM, severe weather safe areas have been identified in every building on campus and floor plans with designated safe rooms are made available for every building on campus. Special weather radios have been installed in the most populated buildings and in residence halls.

StormReady County – Fayette County: Fayette County is official recognized as a StormReady County by the NWS.

Terrorism and Weapons of Mass Destruction: Lexington and DEM staff have received training for any event that might disrupt normal daily activities, such as terrorism or the use of a weapon of mass destruction. DEM attends regularly scheduled training sessions and response is incorporated into the EOP.

Public Information and Awareness

Public information and awareness activities advise residents, and visitors about the hazards, ways to protect people and property from the hazards, and mitigation techniques they can use to protect themselves and their property.

Best Management Practices (BMP) for Yards: The Division of Engineering/Water Quality has a public information program to encourage property owners to discontinue the practice of mowing the stream bank. Instead, natural plantings and a 25-foot stream buffer strip is encouraged. In new areas, the Subdivision Regulations require a 25-foot vegetative buffer strip along streams.

Building Your Home Booklet: This booklet, prepared by the Department of Public Works, contains information on rights, restrictions and other important information often overlooked in the purchase of a home. Included in the booklet is information on storm drainage and floodplain areas, flood insurance and drainage issues.

Channel 3: As a part of the franchise agreement with the local cable television, company, Channel 3 was made available to the LFUCG. Through this channel, information on community issues, meetings and emergencies has been broadcast to over 120,000 homes and businesses in Lexington Fayette County.

Cooperative Technical Partnership (CTP) Agreement: In order to make its flood insurance rate maps more accurate, LFUCG is participating as a FEMA Cooperating Technical Partner (CTP) with the Kentucky Division of Water. Information will be used to correct errors that have been found on the maps. FEMA will provide technical assistance, funding as available, and will accept the data as official.

DEM Outreach Initiatives: DEM has a variety of preparedness initiatives and outreach programs that target all segments of the population, most notably schools, civic groups, neighborhood associations, faith-based organizations, and businesses. DEM operates and maintains a website, social media profiles, distributes an e-newsletter, press releases, newspaper articles, and makes television and radio appearances. Additionally, DEM educates in-person for small and large group presentations, safety fairs, and trade shows to name a few activities. DEM also engages in advertising by the use of transit bus boards, outdoor banners and billboards, radio, television, newspaper (daily, weekly, and monthly), the internet, and other non-traditional methods. Some notable stand-alone projects have included a targeted media campaign, suburban mobile home park preparedness fair, and AM radio live web streaming.

Floodplain Mailings: Every year, the LFUCG mails information related to flood insurance to owners of properties that are considered repetitive loss properties, and to other owners of properties that are considered to be in repetitive loss areas. The LFUCG has significantly increased the number of properties that have been mailed this information. Using the GIS system, all property owners within 1,000 feet upstream and downstream of repetitive loss properties receive a letter and other information notifying them of some of the benefits of the NFIP.

GIS Data: Accurate GIS data is essential to the proper display of floodplain water surface elevations and their horizontal extents. The LFUCG uses vector contour information extracted from aerial photography flown in April 2000 to accurately depict floodplain base flood elevations. In addition to accurate elevation data, LFUCG's GIS section maintains an extensive vector data library of structures, hazards, and environmental factors to aid in effective floodplain management. In flooding emergencies, this data is provided to Public Safety officials and elected decision makers. GIS also makes this data available to the public via the Internet, as well as through publication of paper maps.

Lexington Herald-Leader Newspaper Community Page & Other Community Papers: This page of the newspaper has been used to reach readers throughout the Bluegrass Region and to provide information on community issues. It has been used to highlight the need for and the availability of flood insurance in addition to emergency service messages.

Web Page: The LFUCG has a web page that provides public information and builds awareness of hazard mitigation through the Division of Planning, DEM, and Fire & Emergency Services pages. For example, information is provided on floodplains, flood-proofing, water quality, engineering services, and planning updates. Work on upgrading and adding pertinent information is ongoing.

5.3.2 Stand-Alone Mitigation Projects

LFUCG has been successful in completing numerous mitigation activities to date. Below is a snap shot of the projects that are identified as successes within the jurisdiction of Lexington Fayette County.

Flood Hazard

COMPLETED

- **Derby Drive Stormwater Improvement Project:** Buy-Out/Demolition – $360,000
  - Acquire and demolish four flood prone properties on Derby Drive (276, 280, 284, and 288). By removing these residences, property damage and potential safety issues are mitigated.
- **Vaughns Branch Hazard Mitigation Project:** Stormwater Mitigation – $2,162,000
  - This project replaced four concrete box culverts with open span structures, constructed a detention basin and made minor sanitary sewer and stream bank repairs.
- **Whitemark Ct/ Lilydale Dr. Stormwater Improvement Project:** Buy-Out/Demolition – $325,000
  - Acquire and demolish one floodprone property at 4024 Lilydale Drive. By removing this structure, property damage and potential safety issues are mitigated and
- **Viley:** Buy-Out/Demolition – Over $7 million
  - Includes Sugar Mill detention, 4 culverts, and 36 acquisitions. These improvements will prevent future flooding that, in the past, has damaged property.
- **Kilrush:** Buy-Out/Demolition – $293,000
  - Demolition of three homes. By removing these residences, property damage and potential safety issues are mitigated.
- **NPS (Non-Point Source) 319 Grant**
  - The Urban County Government completed both McConnell Springs and Gainesway 319 grant-funded projects. Both projects re-established permanent wetland areas to improve water quality and create habitat for wildlife.
- **Mill Creek Stream and Wetland Restoration Project**
  - LFUCG partnered with Fayette County School System, the EPA, US Fish & Wildlife, University of Kentucky, Kentucky Department of Fish and Wildlife Resources and others to restore 700 feet of an urban stream, located on an elementary school site, into a naturally functioning stream and wetland. As a result, students can investigate the area for science and mathematics education.

- **Crimson King/ Coldstream Ct. Stormwater Project (June 2012):** Buy-Out/Demolition – $1,500,000
    - This project is to acquire and demolish six – three on each – flood prone properties. By removing these residences, property damage and potential safety issues are mitigated.
- **Cabot/Shandon/ Parkside and Ft. Sumter/Gayle Hazard Mitigation Project (March 11, 2012):** Buy-Out/Demolition – $2,374,000
    - This project is to acquire and demolish 15 flood prone properties. By removing these residences, property damage and potential safety issues are mitigated.

ONGOING

- **Updated Digital Flood Insurance Rate Maps**
    - As a Cooperating Technical Partner (CTP), LFUCG and FEMA partnered to produce new DFIRMS. The approval of Letters of Map Revisions (LOMRs) benefits the citizens of Fayette County because they are more reliable, easier to interpret, and have been fully integrated into the LFUCG's GIS system.
- **Address legacy issue of LOMRs**
    - Address legacy issues of LOMRs for sixteen affected areas where residents are currently required to carry flood insurance. By developing and submitting the appropriate information to FEMA, LOMRs for these areas can be obtained, which may result in eliminating the requirement by lending institutions of flood insurance for some residents; the reduction of flood insurance premiums for other residents; more accurate maps; and will improve LFUCG's compliance with the NFIP. The new maps being developed by the KDOW will facilitate this process and assist in revising the floodplain, as necessary, in these areas.

UNDERWAY

- **Anniston/Wickland Stormwater Improvement Project (2013):** Stormwater Mitigation – $2,180,000
    - This project is to construct additional detention and new storm sewer infrastructure. By mitigating flooding of this area, property damage and potential safety issues are mitigated and LFUCG no longer has to respond to assistance calls from the residents.
- **University of Kentucky Nicholasville Road Alumni Drive Intersection Project (Summer 2013):** Stormwater Mitigation – $8 million
    - The improvement of an existing culvert located at the intersection of Nicholasville Road and Alumni Drive; the creation of retention/ detention basins and permeable pavement for University parking lots near Commonwealth Stadium. These improvements will prevent future flooding that, in the past, has damaged property and caused loss of life. A project engineer has been selected and utility relocation is projected to take place in the fall of 2012 with water retention/detention basin work scheduled for the summer of 2013.
- **Lafayette / Southbend Area:** Buy-Out/Demolition – $2,380,000
    - This project is to acquire and demolish nine flood prone properties. By removing these residences, property damage and potential safety issues are mitigated.

FUTURE

- **Green Acres Neighborhood Stormwater Project:** Buy-Out/Demolition – 2.8 million
  - This project is to acquire and demolish four floodprone properties. By removing these residences, property damage and potential safety issues are.
  - Future work may include sanitary sewer improvements and stream bank stabilization.
- **Ft. Sumter Drive:** Buy-Out/Demolition – $1,067,000
  - This project is to acquire and demolish floodprone properties. By removing these residences, property damage and potential safety issues are mitigated.
- **CR-4, Parkside @ Shandon:** Buy-Out/Demolition – $2,434,000
  - This project is to acquire and demolish 11 flood prone properties. By removing these residences, property damage and potential safety issues are mitigated.
- **Risk Mapping, Assessment and Planning (Risk MAP)**
  - Produce non-regulatory informational maps for the North Elkhorn Creek Watershed to assist in determining flood hazards, potential property loss or damage, and mitigation projects.

Tornado Hazard

FUTURE

- **Tornado Safe Room:** Severe Storm Mitigation – **$**15,275
  - Construct two tornado safe rooms.
  - These pending projects will be located at the Versailles road campus and the other at the recycling center on Manchester Street.

All Hazards

COMPLETED

- **Alternative Water Supplies:** Infrastructure/Capacity Improvements – $164 million
  - Built 30.5 miles of 42” diameter pipeline to connect 20 million gallon treatment plant to ensure adequate potable drinking water to all citizens of the county.

ONGOING

- **EOC Generator:** Emergency Management Improvements – $52,000
  - Install an EOC Generator to ensure back-up energy source to the EOC in the event of a power outage.
- **Outreach and Education**
  - Developed through the DEM, brochures are available that include tips, techniques, and technology to assist with building a new home or evaluating a home’s safety. Community outreach will educate the public about shelter-in-place procedures.
- **Preparedness Fair at Every Mobile Home Park:**

  - Annual outreach fairs to educate and distribute materials on evacuation, shelter, and storm-proofing tips.
- **Critical Customer Identification and Updating:**
  - Continue to update critical customer information to ensure critical infrastructure and customer information is prioritized.
- **Critical Infrastructure Identification:**
  - Continue to identify critical infrastructure.
- **Public Works Coordination**
  - Coordinate agencies with respect to clearing roads after an event to streamline and expedite the return to normal operations within Lexington Fayette.
  - Public Works coordination insures crew movement as well as public safety.
- **Damage Assessment Teams:**
  - Assess damaged infrastructure after weather or manmade events. Assessment teams responsible depend on the size of the event. With smaller outages the assessment is completed by the first responders.

UNDERWAY

- **University of Kentucky Emergency Generator and Warning Alert System (2013):** Infrastructure/Capacity Improvements and Warning/Notification – $260,000
  - Purchasing and installing an emergency generator and transfer switch at WUKY's main transmission site, in addition to constructing an ice bridge to protect equipment from heavy ice that could debilitate critical and essential emergency communications via WUKY radio to the Central Kentucky and UK Campus Community.
  - Purchasing and installing an early warning alert system with eight Emergency Phone Towers with Wide Area Emergency Broadcast System. The emergency notification broadcast towers would be strategically placed across UK's Main Campus to provide the highest visibility and reach the most recipients through the public announcement speakers used for natural disaster warnings.

5.4 Local Hazard Mitigation Goals & Objectives

Information needed to establish revise the 2006 Plan goals, objectives and actions was collected by two public meetings, DEM, the CHR staff and the Steering Committee analysis of the risk assessment sections.

Local Hazard Mitigation Goals Requirements

§201.6(c)(3)(i): [The hazard mitigation strategy **shall** include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The revised goals were determined by the Steering Committee to have the greatest benefit in hazard mitigation for Lexington Fayette. The Mitigation Goals were designed to be general guidelines of what is to be achieved by Lexington Fayette County. These goals are for the long-term and represent the overall vision of the mitigation plan. The objectives define the strategies and implementation steps to attain the identified goals.

LFUCG Multi-Hazard Mitigation Goals

- **Goal 1**— Attempt to minimize the loss of life and injuries that could be caused by natural 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 natural 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.

Following is a list of all goals and the associated objectives.

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

Objective 1.1 Facilitate the strengthening of public emergency and support agencies, including infrastructure, facilities, equipment, and personnel to natural and man-made hazards.

Objective 1.2 To build awareness of and inform citizens about areas or circumstances susceptible to hazards and having a great potential for loss of human life during a natural and man-made hazard event.

Objective 1.3 Control factors or prevent losses to critical facilities and infrastructure from 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.

Objective 2.1 Support efforts that will assist with the continuity of critical business operations.

Objective 2.2 Identify problems and potential remedies regarding significant livestock and/or crop losses caused by natural and man-made hazards.

Objective 2.3 Promote property protection by removing, hazard-proofing, or retrofitting structures and property in areas vulnerable to natural and man-made hazards.

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

Objective 3.1 Integrate the local pre- and post-disaster mitigation functions with the response and recovery functions of the region and state.

Objective 3.2 Form local partnerships that leverage support and share resources for response to, and recovery from, natural and man-made hazards.

Objective 3.3 Review existing local agency programs, plans, and policies to determine their effectiveness and efficiency in reducing risk and vulnerabilities to natural and man-made hazards.

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

Objective 4.1 Promote the use of early-warning systems to alert the public in advance of natural hazards.

Objective 4.2 Disseminate useful information about local hazards to the general public, development professionals and elected officials in order to assist in safe, appropriate development, particularly in hazard areas.

Objective 4.3 As resources allow, develop and promote outreach strategies designed to educate residents, including LEP, about local hazards, their associated risk and vulnerabilities, and the applicable mitigation actions.

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

Objective 5.1 Reduce vulnerability from future hazards by collecting better hazard information and updating local databases to better identify areas at-risk, including LEP, and calculate a comprehensive estimate of the county's loss potentials.

Objective 5.2 Increase the community's involvement in the Community Rating System (CRS) and floodplain management programs.

Objective 5.3 Support the development, and use of, mitigation related laws, building codes and standards designed to reduce vulnerability and risk to all.

5.5 Identification & Analysis of Mitigation Actions

During the plan development process, the Planning Team harnessed the expertise and local knowledge of the steering committee to review and update the action items from the previous plan. Opportunities for input and participation in the update process included facilitated discussions during the second and third steering committee meetings, as well as follow-up correspondence.

With the help of the Steering Committee, 22 new action items were introduced to the updated mitigation strategy introduced for Lexington Fayette County to strive for over the next five years.

Identification and Analysis of Mitigation Measures

Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In the updated plan, special emphasis was placed on the limited English speaking (LEP) population, and expanding on each of the goals and objectives. New consideration was given to hazardous materials and the inclusion of man-made hazard terminology in the goals, objectives, and action items. Additionally, important emphasis was placed on the need for human capital (i.e. personnel) and more thorough training for non-traditional municipal employees and public officials.

The following section identifies, evaluates, and analyzes a comprehensive range of specific mitigation actions considered to reduce the effects of each hazard identified in the Risk Assessment, with emphasis on new and/or existing buildings and infrastructure. These actions are based on the evaluation of the risk assessment by the Steering Committee and from public comment.

5.6 Implementation of Mitigation Actions

The final Five-Year Action Plan includes how actions will be implemented and administered, including the department or agency responsible for carrying out the actions, the potential funding sources, and the implementation timeline.

The Planning Team was mindful of identifying and evaluating mitigation actions, using the following considerations:

- 2010 State Hazard Mitigation Plan
- Compatibility with revised goals and objectives
- Cost/benefit reviews of potential actions
- Identified funding priorities
- Compatibility with other local or regional plans and programs

Implementation of Mitigation Actions Requirement

§201.6(c)(3)(iii): The mitigation strategy section shall include an action plan describing how the actions identified will be prioritized, implemented, and administered by the local jurisdiction.

Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

5.6.1 Prioritization and Cost / Benefit of Mitigation Actions

Mitigation action prioritization emphasizes the extent to which benefits are maximized, according to a cost benefit review of the proposed projects and their associated costs. Through the Cost-Benefit Prioritization Matrix, the cost-benefit analysis was completed whereby 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 community.

The Steering Committees utilized a benefit scoring system of:

- Very High, permanently eliminate
- High, reduce the probability
- Medium, warn the public
- Low, educate the public

Mitigation Benefit Scale	
Ranking	**Description**
A Very High	Projects or activities which **permanently eliminate** damages or deaths and injuries across Lexington Fayette County from any hazard.
B High	Projects or activities which **reduce the probability** of damages, deaths, and injuries across Lexington Fayette County from any hazard.
C Medium	Projects or activities which **warn** the public to the approach of a natural hazard threat across Lexington Fayette County.
D Low	Public outreach projects or activities meant to **educate** the public on the subject of hazard mitigation including studies and research on best practices for disaster preparedness, or improve data acquisition and compilation for analysis.

Once the benefit of the project was determined, the Planning Team convened to determine the priority of each action item based on a cost-benefit ranking. The Cost-Benefit Prioritization Matrix below uses rough cost estimations and the mitigation benefit scale to assign a prioritization ranking for each action item. Those action items that receive a higher cost-benefit ranking signal projects that have a higher benefit and lower cost. Inversely, projects that are estimated to be higher in cost with a lower benefit receive a lower cost-benefit ranking.

Cost – Benefit (C-B) Prioritization Matrix					
		Benefit			
		D (Low)	C (Medium)	B (High)	A (Very High)
Cost	Very High	Low	Low	Medium	Medium
	High	Low	Medium	High	High
	Medium	Medium	High	High	Very High
	Low	Medium	High	Very High	Very High

5.6.2 Five-Year Action Plan

The final Five-Year Action Plan addresses all of the identified hazards. In addition, an all-hazards category was added to include projects with multiple benefits for more than one hazard. This category was created to encompass numerous projects that cover all-hazards. Below is the total number of actions/projects for five hazard categories:

All Hazards Category	31 action items
Severe Storm	3 action items
Tornado	3 action items
Hazardous Materials	1 action item
Flood	6 action items
TOTAL	**44 PROJECTS/ACTIONS**

For each goal and objective a table of actions and projects items is provided. The final Five-Year Action Plan includes how actions will be implemented and administered, including the department or agency responsible for carrying out the actions, the potential funding sources, and the implementation timeline. Projects and activities have detail that will ensure their success.

For program funding/budget, the mitigation measures in the Action Plan are cost effective, environmentally sound, and technically feasible and the Action Plan prioritizes the measures based on these criteria. Many of the projects are grant dependent and as a result will rely on the grant process, approvals and resulting timeline. Many of the projects can be integrated into job descriptions or standard operating procedures.

Below is an example of one action item that can be found in the tables totaling 44 action items:

Action	Cost-Benefit	Timeframe (Years)	Hazards Addressed	Description	Offices Responsible	Funding/Budget Considerations
4.2.1 *Outreach*	Low	1-2 yrs.	All-hazards	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.	DEM Division of Planning	Internal

When a row appears with its cells in light tan, it signifies one of the 22 newly introduced action items.

1.1.4 *Train*	High	Annually	All-hazards	Ensure Police, Fire, Health (first responders) have access to are trained on how to use both telephone and in-person interpreters.	Multicultural Affairs Fire & Police Other First Responders UK interpreter services	Grant Departmental

Following is an explanation of each column within the Five-Year Action Plan tables.

Action: Each action item is numbered based on the corresponding goal and objective. For ease in navigating the tables each action item includes a short title such as, research, inventory, train, upgrade, fund, outreach, etc.

Cost/Benefit: Color coded cells demonstrate the priority based on the cost-benefit results for each action item.

Low
Medium
High
Very High

Timeframe (years): Goals for completion are broken down as follows:

Annually – To be conducted each year

Immediate to X years – To be started as soon as possible

X years to X years – Reads as is.

Hazards Addressed: Describes the hazard type

Description: Briefly describes the action or mitigation project

Offices Responsible: Identifies which LFUCG departments and other outside organizations will be responsible for leading, participating, and working to complete this action item?

CAO Office **= Chief Administrative Officer Office**

Chamber of Commerce **= Greater Lexington Chamber of Commerce**

Code Enforcement/Building Inspection

Communications **= Government Communications -** LexCall 3-1-1, Government Television 3 (GTV3), Public Information Office.

Council **= Urban County Council**

DEM **= Division of Emergency Management**

DOWQ **= Division of Water Quality**

Engineering **= Division of Engineering**

FC Public Schools **= Fayette County Public Schools**

First Responders = (Division of Fire and Emergency Services, Division of Police, Emergency Medical Services)

G.I.S. & I.T. **= LFUCG Geographic Information System and Information Technology Staff**

Home Builders Association **= Home Builders Association of Lexington, KY**

Hospitals **= Hospitals and other Medical Facilities located in Fayette County**

KDOH **= Kentucky Department of Highways**

KY Utilities **= Kentucky Utilities** (LG&E-KU, KY American Water Company, Columbia Gas, Windstream, Clark Energy, Insight, AT&T, Sprint)

LEP (Limited English-Speaking Population) Experts and Support Groups = Refugee Resettlement Services (Catholic Charities of Louisville, KY Refugee Ministries, Americana International Center), FRYSC (Family Resource and Youth Service Center), Academic and Community Expert Groups, and multi-lingual volunteer groups

LEPC = Local Emergency Planning Committee

LFUCG Agencies = All municipal departments including Council Clerk's Office, Environmental Quality & Public Works, Finance, General Services, Internal Audit, Law, Mayor's Office, Division of Planning

Mayor **= *LFUCG* Office of the Mayor**

MCA **= Multi-Cultural Affairs**

Parks & Recreation

Planning **= Division of Planning**

PDR **= Purchase of Development Rights Program**

Public Works **= Public Works & Development**

Railroad Carriers **=** Railroad Carriers operating in Fayette County.

Risk Management

TV Station Providers **=** Time Warner, DirectTV, Government Television

UK Ag **= University of Kentucky College of Agriculture and Cooperative Extension Office**

Funding/Budget Considerations:

Grant = Stand-alone project potentially funding through various grant sources listed in the Federal Funding and Technical Assistance Programs table earlier in this section.

Internal = General normal operating budget funding from DEM

Departmental = General normal operating budget funding through other LFUCG departments

Lexington Fayette County Five-Year Plan

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

Objective 1.1 Facilitate the strengthening of public emergency and support agencies, including infrastructure, facilities, equipment, and personnel to natural and man-made hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.1.1 *Research*	D	Medium	Annually	All-hazards	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.	Division of Fire and Emergency Services Division of Police LFUCG Agencies	Grant Internal
1.1.2 *Inventory*	D	Medium	Annually	All-hazards	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.	Division of Fire and Emergency Services Division of Police LFUCG Agencies	Grant Internal
1.1.3 *Acquire and Train*	B	High	1-5 yrs.	All-hazards	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.	Division of Fire and Emergency Services Division of Police	Grant
1.1.4 *Train*	B	High	Annually	All-hazards	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.	FC Public Schools First Responders Communications Multicultural Affairs	Grants Department
1.1.5 *Educate*	D	Medium	Annually	All-hazards	Provide cross-cultural communication training to first responders to educate and assist with effectively communicating with the LEP population.	First Responders LEP Experts and Support Groups Multicultural Affairs	Internal
1.1.6 *Upgrade*	B	Medium	3-5 yrs.	All-hazards	Upgrade existing DEM facilities for a stand-alone Emergency Operations Center.	DEM	Grant

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.1.7 *Fund*	B	Medium	Annually	Severe Storm Tornado	Explore funding opportunities for community tornado shelter construction in accordance with FEMA guidelines.	DEM	Grant Internal
1.1.8 *Fund*	B	High	Immediate to 3 yrs.	Severe Storm Tornado	Obtain funding to maintain and upgrade existing outdoor warning systems.	DEM	Grant Internal
1.1.9 *Fund*	B	High	Annually	HAZMAT	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.	DEM DOWQ First Responders	Grant

Objective 1.2 To build awareness of and inform citizens about areas or circumstances susceptible to hazards and having a great potential for loss of human life during a natural and man-made hazard event.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.2.1 *Educate*	D	Medium	Annually	All-hazards	Conduct outreach to educate citizens on how to receive up-to-date evacuation instructions, shelter-in-place procedures, and information pertaining to hazardous material exposure.	DEM LEPC	Internal
1.2.2 *Install*	C	High	1-3 years	Flooding	Install flood marker signs that include both a “Road May Flood” sign, as well as signage indicating water depth.	DEM DOWQ KDOH	Internal

Objective 1.3 Control factors or prevent losses to critical facilities and infrastructure from natural and man-made hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.3.1 *Assess*	B	High	Annually	All-hazards	Request that natural hazard mitigation assessments be conducted on the current utility and communication infrastructure and the conclusions to be provided to DEM.	DEM KY Utilities	Internal

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.3.2 *Assess*	B	High	3-5 yrs.	All-hazards	As resources permit, conduct mitigation assessments on LFUCG owned and operated buildings to ensure that they are resistant to natural and man-made hazard events.	Building Inspection Code Enforcement DEM DOWQ First Responders Risk Management	Grant
1.3.3 *Update, Maintain, and Train*	B	High	Annually	All-hazards	As resources permit, conduct updates, maintenance and training on Emergency Plans of LFUCG owned and operated buildings.	Building Inspection Code Enforcement DEM DOWQ First Responders Risk Management	Internal

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

Objective 2.1 Support efforts that will assist with the continuity of critical business operations.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
2.1.1 *Develop*	D	Medium	1-5 yrs.	All-hazards	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.	DEM DOWQ G.I.S. & I.T. Hospitals	Internal
2.1.2 *Collect Data*	D	Medium	2-3 yrs.	All-hazards	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.	DEM LEP Experts and Support Groups Multicultural Affairs	Departmental

Objective 2.2 Identify problems and potential remedies regarding significant livestock and/or crop losses caused by natural and man-made hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
2.2.1 *Inventory*	B	High	2-5 yrs.	All-hazards	Develop inventory of farmland in order to build a business plan.	DEM UK Ag	Departmental Internal

Objective 2.3 Promote property protection by removing, hazard-proofing, or retrofitting structures and property in areas vulnerable to natural and man-made hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
2.3.1 *Provide Info*	D	Medium	Every 2 yrs.	Flooding	Provide information to the housing industry through publications and electronic resources about residential floodproofing, tornado safe rooms and community tornado shelters, as well as guidelines and criteria for construction.	DEM Engineering Code Enforcement Building Inspection Communications	Departmental
2.3.2 *Acquisition*	B	Medium	Annually	Flooding	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.	CAO Office DOWQ Parks & Recreation PDR Planning	Internal
2.3.3 *Acquisition*	A	Medium	Annually	Flooding	When resources permit, work to purchase and demolish floodprone structures that meet NFIP/CRS guidelines for repetitive loss or for having repeated or extensive flood damage.	Engineering	Grant
2.3.4 *Fund*	A	Medium	Annually	Flooding	To seek and request consistent funding sources for the completion of prioritized stormwater projects in accordance with identified priority storm water projects.	DOWQ	Grant Departmental
2.3.5 *Implement*	B	Very High	2 yrs.	Flooding	Review and implement proposed Greenway Manual in alignment with revisions to the Stormwater Manuals and related regulations	DOWQ Planning	Departmental

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

Objective 3.1 Integrate the local pre- and post-disaster mitigation functions with the response and recovery functions of the region and state.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
3.1.1 *Fund*	B	High	Immediate to 3 yrs.	All-hazards	Obtain funding to hire a planner for the DEM	Council DEM Mayor	Internal
3.1.2 *Integrate Info*	B	High	Every 2 yrs.	All-hazards	Better integrate ESF-5 and 14 into the planning process for the Emergency Operations Plan	DEM	Internal
3.1.3 *Exercise*	B	High	3-5 yrs.	All-hazards	Conduct an exercise with a priority of focusing on mitigation and recovery.	DEM	Grant Internal
3.1.4 *Integrate Info*	B	High	3-5 yrs.	All-hazards	Better incorporate regional and state assets/resources into pre-disaster planning programs	DEM	Departmental
3.1.5 *Integrate Info*	D	Medium	1-3 yrs.	All-hazards	Once available, explore the opportunity to participate in the Commonwealth Hazard Assessment Mitigation Planning System (CHAMPS) as advised by KyEM.	DEM	Internal

Objective 3.2 Form local partnerships that leverage support and share resources for response to, and recovery from, natural and man-made hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
3.2.1 *Community Outreach*	B	High	Annually	All-hazards	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.	DEM	Internal
3.2.2 *Fund*	D	Medium	Annually	All-hazards	When available, obtain funding and support for CERT supplies and equipment, volunteer coordination, and recognition/appreciation events for volunteers.	DEM	Grant Internal

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
3.2.3 *Partner*	D	Medium	2-5 yrs.	All-hazards	Develop LEP partnerships; invite LEP reps to the table in planning and education efforts.	DEM LEP Experts and Support Groups Multicultural Affairs	Departmental
3.2.4 *Community Outreach*	D	Medium	1-3 yrs.	All-hazards	Increase business and private sector (i.e. the Lexington Chamber of Commerce) involvement in the emergency management system.	Chamber of Commerce DEM	Internal

Objective 3.3 Review existing local agency programs, plans, and policies to determine their effectiveness and efficiency in reducing risk and vulnerabilities to natural and man-made hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
3.3.1 *Guide Policy*	B	High	Every 2 years	All-hazards	Review, assess, and make recommendations on hazard related laws, regulations, codes, policies, and other guidelines. Ensure LEP populations are included in said policies and guidelines.	DEM Code Enforcement/ Building Inspection Multicultural Affairs	Internal Departmental
3.3.2 *Partner*	D	Medium	Annually	All-hazards	Combine and submit annual request for mitigation project updates and annual reporting for the FMP and HMP.	DEM Planning	Internal Departmental

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

Objective 4.1 Promote the use of early-warning systems to alert the public in advance of natural hazards.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
4.1.1 *Provide Info*	D	Medium	Annually	All-hazards	Provide multi-lingual information to LFUCG agencies, media, and other LEP organizations, CERT, and the public at-large through publications and electronic resources about emergency procedures.	Code Enforcement DEM LEPC LEP Experts and Support Groups Multicultural Affairs	Internal

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
4.1.2 *Provide Info*	D	Medium	3 yrs.	All-hazards	Identify source (such as FEMA) and disseminate educational information in top foreign (macro) languages like Spanish, French, Swahili, and Arabic as funds allow.	DEM FC Public Schools LEP Experts and Support Groups Multicultural Affairs	Internal Departmental

Objective 4.2 Disseminate useful information about local hazards to the general public, development professionals and elected officials in order to assist in safe, appropriate development, particularly in hazard areas.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
4.2.1 *Outreach*	D	Medium	1-2 yrs.	All-hazards	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.	DEM Planning	Internal
4.2.2 *Training*	D	Medium	3-5 yrs.	All-hazards	When funding permits, conduct hazard mitigation related training seminars and workshops for local building code enforcement officials.	Code Enforcement/ Building Inspection DEM	Grant

Objective 4.3 As resources allow, develop and promote outreach strategies designed to educate residents, including LEP, about local hazards, their associated risk and vulnerabilities, and the applicable mitigation actions.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
4.3.1 *Assess Cost*	D	Medium	2-4 yrs.	All-hazards	Assess feasibility and cost of providing Lexington Fayette's Local Channel 3 to Direct TV and satellite subscribers.	DEM TV Station Providers	Internal
4.3.2 *Educate*	D	Medium	2-4 yrs.	All-hazards	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.	DEM FC Public Schools Multicultural Affairs Private Schools	Internal Grant

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
4.3.3 *Integrate Info*	D	Medium	1-3 yrs.	All-hazards	Encourage and leverage national, state, or local resources already available in other languages to be made available to general public and LEP communities.	Communications FC Public Schools Multicultural Affairs Private Schools	Internal

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

Objective 5.1 Reduce vulnerability from future hazards by collecting better hazard information and updating local databases to better identify areas at-risk, including LEP, and calculate a comprehensive estimate of the county's loss potentials.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
5.1.1 *Methodology*	B	High	1-3 yrs.	All-hazards	**a.** Establish stakeholder taskforce quarterly meetings. **b.** Design a methodology and system to better archive and manage local data types after a natural and/or man-made hazard event, including at-risk LEP populations.	Code Enforcement/ Building Inspection DEM DOWQ Engineering Multicultural Affairs Public Works Risk Management	Internal Departmental
5.1.2 *Collect Data*	D	Medium	Annually	HAZMAT	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.	DEM DOWQ Hospitals KY Utilities Railroad Carriers	Internal Departmental

Objective 5.2 Increase the community's involvement in the Community Rating System (CRS) and floodplain management programs.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
5.2.1 *Distribute Info*	D	Medium	Annually	Flooding	Share and distribute HMP and FMP CRS and annual reports to LFUCG agencies and other steering committee members for review as outlined in the plan maintenance timeline of this plan.	DOWQ Engineering Planning	Internal
5.2.2 *Integrate Info*	D	Medium	5 yrs.	Flooding	Merge future HMP annual progress reporting process with CRS FMP annual reporting process as outlined in the plan maintenance section of this plan.	DEM DOWQ Planning	Internal Departmental

Objective 5.3 Support the development, and use of, mitigation related laws, building codes and standards designed to reduce vulnerability and risk to all.

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
5.3.1 *Community Outreach*	D	Medium	Annually	All-hazards	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.	DEM Code Enforcement/ Building Inspection Planning Home Builders Association	Internal
5.3.2 *Map and Enhance*	B	High	3-5 yrs.	Severe Storm Tornado	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.	DEM Division of Fire and Emergency Services Division of Police	Grant

See Appendix 5.2 for the final Five-Year Action Plan categorized by priority ranking. The Lexington Fayette County Mitigation Five-Year Action Plan is being kept in a "Mitigation Five-Year Planning Workbook" so that updating the actions will be easier and more efficient during the annual and Five-Year Plan Maintenance Procedures. The Actions will be reviewed and updated annually during the Advisory Committee review process and for the annual progress report as described in the plan maintenance section of this plan.

6.0 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. Taking future updates into consideration, adjustments to the method and schedule for maintaining the plan is necessary to ensure continued value for comprehensive risk reduction. Additionally, as the mitigation plan evolves, the plan maintenance process serves as the basis for the next five-year plan update.

The process of monitoring the plan will provide LFUCG the opportunity to document progress in achieving mitigation goals. The Planning Team agreed that it is imperative to have stakeholder involvement for continuing the plan maintenance process and to ensure the mitigation strategy is implemented through local programs and regulations.

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.

6.1 Monitoring, Evaluating, and Updating the Plan

6.1.1 Partnership

The evaluation of the 2005 Plan Maintenance section led the Planning Team to rethink how maintenance could occur for the Plan. The revised plan maintenance focuses on cross-divisional planning efforts within LFUCG departments and staff. The advantage to Lexington Fayette County includes aligning the CRS program annual progress reporting requirements and a maintenance schedule and process to monitor the Hazard Mitigation Plan (HMP). This method will assist with the local Floodplain Management Plan (FMP) and other land use planning mechanisms.

Recognizing the overlap in plan action items and those responsible agencies that will provide project updates on an annual basis, DEM and DP has committed to releasing a mutual request for updates. With the project and action item updates received, DEM and DP will develop annual progress reports for their responsible plans. The two agencies will also collaborate in facilitating an annual Steering Committee meeting to present the updates of the Action Plans for the FMP and HMP.

One additional partnering consideration was for the five-year update cycles of the FMP and HMP. Although it would be advantageous to align the five-year update cycles with one another, the FMP plan will expire in October of 2016, whereas the timeframe of the HMP update will fall in the range of 2018. With that understand, it was decided that the five-year update cycles could not be merged at this time.

This following section further describes the process of how DEM will partner with the Division of Planning, and how the partners agreed to develop a strategy to keep the public and Steering Committee involved during the plan maintenance process, on an annual and as-needed basis, over the next five years. As a result, DEM has committed to collaborating on the development of FMP and HMP annual progress reports by October 1 of every year to maintain compliance with the CRS program requirements and the FMP.

6.1.2 Monitoring

DEM and DP will be the primary point of contacts for County, State, and Federal Officials and they will coordinate all local efforts to monitor and evaluate the plan. LFUCG proposes an attainable and standardized process for maintaining a live plan document through the annual monitoring of the Five-Year Action Plan, and annual progress reporting with public and Steering Committee involvement. The annual progress monitoring will also assist with the incorporation of plan maintenance procedures into other planning mechanisms at the State and Local level, especially the FMP. Annually tracking the implementation of the plan will be the lead responsibility of DEM in partnership with DP.

In order to allow DEM to track and monitor the Five-Year Action Plan and associated project on an ongoing basis, the Planning Team developed a system of "Mitigation Project Checklists", as incorporated into a "Mitigation Five-Year Planning Workbook". For the purpose of offering a user-friendly and interactive plan implementation tool, this excel workbook brings the Five-Year Action Plan and Plan Maintenance tasks to life by allowing DEM and DP to continually monitor and update action item statuses within one tabular workbook. As described in the below "Updating" sub-section of this chapter, this workbook includes worksheets that include reference materials such as the "Annual Reporting Schedule", the plan "Goals & Objectives", and the "Steering Committee Contacts". For the continual monitoring and updating of the mitigation projects and action items, DEM will reference and enter in updates into the "Action Item Checklist", "Project Checklist", and insert needed changes to the plan document in the "Amendment Record" worksheet.

By use of the Mitigation Project Checklists and through LFUCG Partnership both will monitor the status and progress of the plan elements on an ongoing basis. To capture additional activities that are occurring beyond the scope of the HMP and the FMP, the Steering Committee will meet annually to review, and update the Five-Year Action Plan.

To inform the annual progress report and "Mitigation Project Checklists" the Planning Team has developed an individual project progress report form that will be completed by the Steering Committee and appropriate agencies and submitted to DEM/DP on an annual basis (See Appendix 6.2 for sample forms). 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. The continuous monitoring and formalized annual review will serve as the basis for the annual report by October 1 beginning next year (2013).

6.1.3 Evaluating

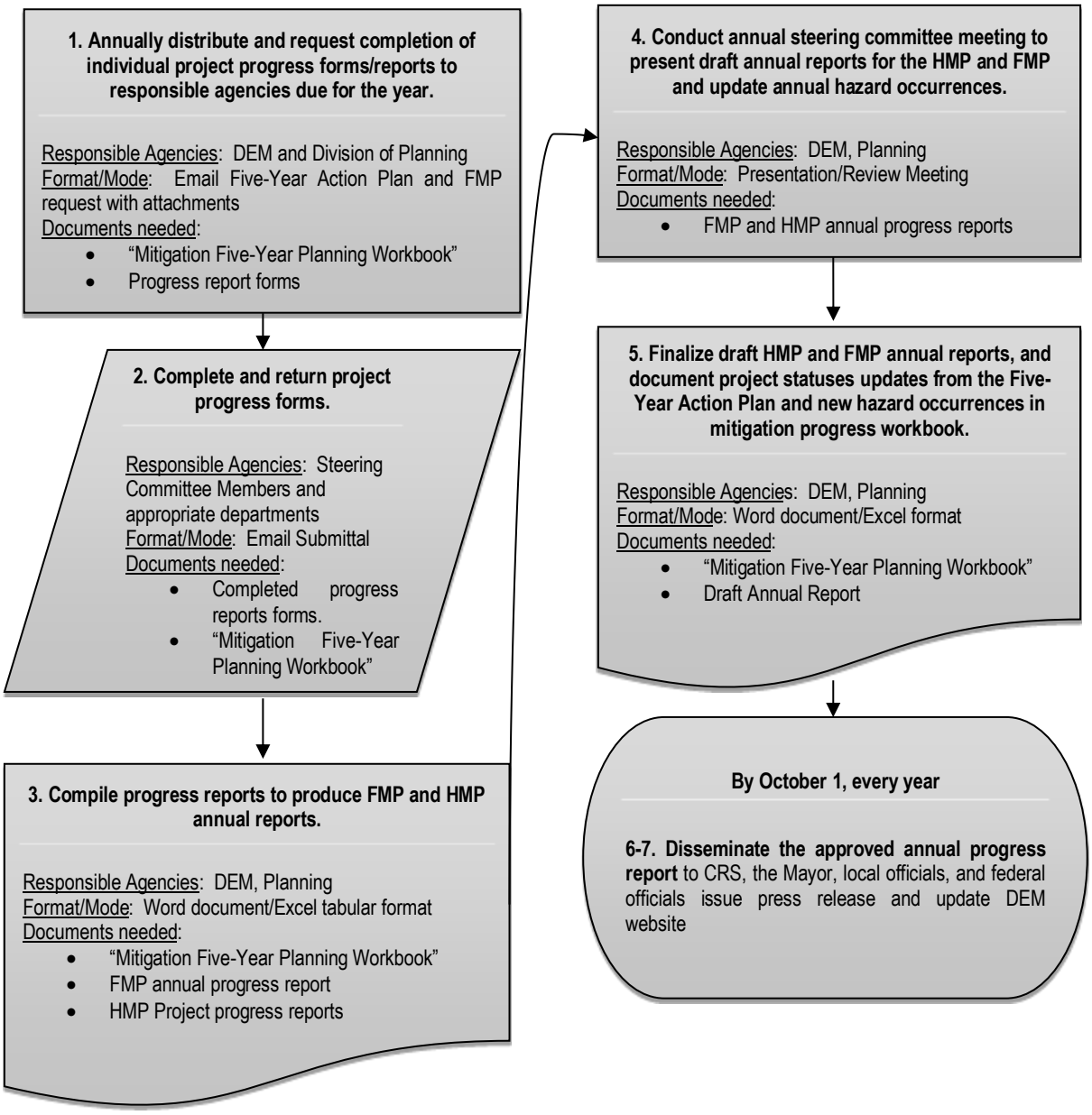
Evaluating means assessing the effectiveness of the plan at achieving its stated purpose and goals. In combination with the strategy for monitoring, the LFUCG, DEM, and members of the Steering Committee will evaluate the status and progress of the plan elements on an annual basis by meeting and reporting. DEM, in coordination with DP, will partner in facilitating the annual update process for the HMP and the FMP. By incorporating the CRS requirements for reporting updates from the FMP, the annual report for the Hazard Mitigation Plan will provide the status of mitigation actions, objectives and goals, beginning in 2013.

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 Steering Committee also will be kept apprised of changes 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 objectives 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 for the Five-Year Action Plan will be approved by the Steering Committee, then Mayor annually. For public notification, a press release will provide the web-link to the annual progress report, which will be located on DEM's website.

The Planning Team developed and the Steering Committee approved the following Annual Reporting Process flowchart for the HMP and FMP Plans:



6.1.4 Updating

During the five-year plan update process, DEM and DP considered merging the cycles of the FMP and HMP. Although it would be advantageous to align the five-year update cycles with one another, the FMP plan will expire in October of 2016, whereas the timeframe of the HMP update will fall in the range of 2018. With that understanding, it was decided that the five-year update cycles could not be merged at this time.

DEM will be responsible for the Lexington Fayette County five-year update required by DMA 2000. As part of a more comprehensive effort to improve data quality and update data as it becomes available (i.e. infrastructure data, property valuation data, hazard data, and a wide variety of GIS-related efforts that will improve the accuracy and soundness of the plan), the Steering Committee will meet annually to review, revise and update the Five-Year Action Plan.

Post-disaster meeting or Emergency meetings will be called into session if needed when Lexington Fayette County receives a Presidentially Declared Disaster Declaration. Priority for mitigation will be given to the post-hazard event timeframe immediately following a natural disaster when current listed mitigation goals, objectives and actions do not fully mitigate the new event. A Steering Committee post-disaster meeting will be called to ensure opportunities are advanced. In addition, the Steering Committee's ability to update the mitigation process by adding new data into the mitigation plan will allow for the efficient use of available resources, staff, and programs.

Because hazard, building and project data is ever-changing the Planning Team developed a standard form and for tracking project progress from the Five-Year Action Plan (See Appendix 6.2 for a sample form). These forms may be used in conjunction with the "Mitigation Project Checklists" which include a worksheet titled "Amendment Record" that allows DEM/PD to record needed and anticipated changes to the plan document in an organized and condensed fashion, which will occur at the next five-year plan update (see Appendix 6.2 for sample Amendment Record worksheet and snapshot of the "Amendment Record" worksheet from the "Mitigation Five-Year Planning Workbook"). Changes that will be revised in the plan document itself will be listed in the annual review of the Five-Year Action Plan (Appendix 5.2) where revisions and updates to schedules, budgets and partnerships may be required and reported in the annual progress report.

The "Mitigation Five-Year Planning Workbook" is developed in excel format with worksheets for the following (See Appendix 6.1 for preview of each worksheet):

- **Workbook Summary:** This summary page provides the user with brief descriptions of each worksheet included in the "Mitigation Five-Year Planning Workbook".
- **Annual Progress Reporting Timeline:** This timeline outlines the steps of the plan maintenance strategy that DEM and DP will complete on an annual basis. The steps of the strategy are categorized as ongoing, annual, and five-year and will occur to report progress on the plan. By marking the status of each step on an annual and ongoing basis, DEM and DP can keep track of what has been completed and if projects are on-track.
- **Mitigation Goals & Objectives:** The mitigation goals and objectives are provided as reference material as DEM and DP works to complete the project and action item checklists, and to match new mitigation project additions with the appropriate goal and objective.
- **Mitigation Action Item Checklist:** The action item checklist contains a listing of the identified action items showing a timeframe for completion, description, responsible agencies, funding and budget considerations, and the hazards addressed. The checklist is provided to keep the status of

each action item on an annual basis and accompanies an "Individual Project Progress Report Form" for responsible agencies to complete when requested on an annual basis.

- **Project Checklist:** The project checklist is more specific than the action item checklist, in that it lists projects that are ongoing or stand-alone, planned in-process, or completed that can be categorized as accomplishing the associated action item. An accompanying "Individual Progress Report Form" may be utilized when requesting updates of responsible agencies on an annual basis.
- **Steering Committee Contacts:** As DEM/DP leads the annual progress reporting process for the mitigation plan, there will be outreach to the Steering Committee members to provide progress on action items and projects they are responsible for. The Steering Committee is listed first by agency/organization; the contact person list should be updated continuously as staff turnover occurs.
- **Amendment Record:** The amendment record form is provided for DEM to keep track of anticipated or needed changes to the hazard mitigation plan document for the next five-year plan update.

This Plan Maintenance process includes, but is not limited to, the proposal and passage (by majority vote) of updates to the Five-Year Action Plan by the Steering Committee during a regular annual or post-disaster meeting. DEM will document changes to the Five-Year Action Plan, including the responsible agency and timeframe for action item completion. Any needed changes to the Hazard Mitigation Plan will be documented in the "Amendment Record" worksheet within the Mitigation Project Checklists Excel workbook.

6.2 Incorporation into Existing Planning Mechanisms

Incorporate the Planning Mechanisms of the Mitigation Plan

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.

As outlined in the Mitigation Strategy, the Five-Year Action Plan utilizes planning mechanisms to outline how projects will be addressed to incorporate mitigation activities. The Steering Committee is composed of staff from those community departments that are implementing the majority of the Plan's recommendations and ensures projects will be implemented through existing or ongoing programs. As a result, activities in the Five-Year Action Plan show how mitigation projects can be integrated into normal operating budgets, job descriptions, comprehensive plans, capital improvement plans, zoning and building codes, site plans, permitting, and other planning tools, where appropriate. The Five-Year Action Plan projects and activities also address reducing the effects of hazards on new buildings and infrastructure as well as existing buildings and infrastructure.

During the review, updating, and standard enforcement of the existing authorities and programs, mitigation actions listed in this plan will be incorporated, implemented, and enforced. Local government functions provide a myriad of methods in which to implement actions identified in the mitigation strategy.

6.2.1 Local Capabilities

The *Local Capabilities Assessment Matrix* below demonstrates the state and local planning mechanisms available for incorporating the requirements of the HMP. See Appendix 5.1 for the *State Capability*

Assessment Matrix. See also Section 5.2 *Federal and State Capability Assessment* for more information on the LFUCG's capability to perform mitigation, regulate, and design outreach. Mitigation Strategy Mitigation success stories located in Section 5.0 under the heading "COMPLETED," outline how LFUCG has demonstrated this in the past five-years.

Below is a summary of the State and Local Capabilities Assessment Matrix which lists state-enforced and LFUCG planning mechanisms and the hazards addressed by each:

LFUCG Local Capabilities Assessment Matrix	Dam Failure	Drought	Earthquake	HAZMAT	Severe Heat	Flood	Karst / Sinkhole	Hail	Landslide	Severe Storm	Severe Winter Storm	Tornado	Wildfire	Subsidence
Comprehensive Plan		●	●	●	●	●	●		●		●		●	●
Building Code			●1a			●1b				●1c	●1d			
Subdivision Code						●2a	●2b		●2c	●2d	●2e			
Floodplain Management Plan						P								
Expansion Area Master Plan				●3a		●3b	●3c		●3d					
Greenway Management Plan				●4a		●4b								
Rural Service Area Land Management Plan						●5								
Zoning Ordinance						●6a	●6b		●6c					
Mining and Quarrying Ordinance														P
Geotechnical Manual						●7a	●7b		●7c					
Structures Manual						●8								
Infrastructure Development Manual						●9a	●9b							
Sanitary Sewer and Pump Station Manual						P								
HazMat Ordinance				P9.5										
Underground Tank Regulation				●11a			●11b							
Stormwater Manual	●12a			●12b		●12c								
Sinkhole Ordinance							P							
Kentucky Drought Mitigation and Response Plan		P												

P = Primarily Addressed Hazard; Red Cell = Hazard Not addressed; ● = Hazard Addressed
See matrix references in Appendix 1.2.

Lastly, LFUCG will keep apprised of the development of Kentucky Emergency Management's (KyEM) Commonwealth Hazard Assessment Mitigation Planning System (CHAMPS); a proposed shared online database for local municipalities to track and document mitigation grant opportunities, mitigation action items, and capability assessments. KyEM anticipates that CHAMPS will completely change how plan maintenance is achieved in the future and will be formally adopted in the next State Hazard Mitigation Plan due in 2013. CHAMPS is being designed to provide KyEM and its local partners a comprehensive planning system and the ability to easily access their local plan and planning components. Monitoring,

evaluating, and updating functions are major components of CHAMPS and are intended to improve efficiency of the mitigation plan strategy and maintenance.

6.3 Continued Public Involvement

The LFUCG, DEM, and the Steering Committee are dedicated to continuing public involvement in the plan and the mitigation actions that will be implemented. This plan has been created with significant input from local citizens and the main goal is to provide opportunities on a regular basis to facilitate continued public involvement.

Continued Public Involvement

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

During the annual reporting process, DEM will engage the public and give the chance to provide feedback. The annual Steering Committee meeting will be advertised through public notification and open to the public for participation. Additionally, following the review of the Steering Committee and approval by the Mayor, the draft annual progress report will be made accessible for download on DEM's website for public review.

In addition to public involvement in the annual progress report process, DEM will continually inform and reach out to the public through social media and by participating in community events to share the message of mitigation. Public outreach strategies implemented during the current plan update process will continue to be utilized, with DEM as the lead responsible agency.

Appendices

Appendix 1.1 Acronyms

AML	Abandoned Mine Lands
BGADD	Bluegrass Area Development District
BMP	Best Management Practices
CAPSSSE	Community Assistance Program State Support Services Element
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
CHR	The Center for Hazards Research and Policy Development
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
DOWQ	Division of Water Quality (LFUCG)
ELL	English Language Learner
EMPG	Emergency Management Performance Grants
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
HCEPC	Healthcare Emergency Planning Committee
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
KySHMP	Kentucky State Hazard Mitigation Plan
KYTC	Kentucky Transportation Cabinet
LEPC	Fayette Local Emergency Planning Committee
LexTran	Lexington Transit Authority
LFUCG	Lexington Fayette Urban County Government
MMRS	Metropolitan Medical Response System
MPG	Mitigation Planning Grant
MRCC	Midwestern Regional Climate Center
MSA	Metropolitan Statistical Area
MSHA	Mining Safety and Health Administration
NCDC	National Climatic Data Center
NDMS	National Disaster Medical System
NEHRP	National Earthquakes Hazards Reduction Program
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
RFC	Repetitive Flood Claims Grant Program
RL	Repetitive Loss
SA	Spectral Acceleration
SHELDUS	Spatial Hazard Events and Losses Database
SRL	Severe Repetitive Loss
TIH	Toxic Inhalant Exposure
USGS	United States Geological Survey

Appendix 1.2 References

General References:

National Sites:
Federal Alliance for Safe Homes
http://www.flash.org/
National Institute for Occupational Safety and Health
http://www.cdc.gov/niosh/topics/emres/
U.S. Department of Homeland Security
http://www.ready.gov/
National Pipeline Mapping System
http://www.npms.rspa.dot.gov/
Disaster News Network
http://www.disasternews.net/index3.php
Inderscience Publishers
http://www.inderscience.com/
Natural Hazards Center
http://www.colorado.edu/hazards/o/
Western States Seismic Policy Council
http://www.wsspc.org/pubs/news/Default.htm
Federal Emergency Management Agency (FEMA)
http://www.fema.gov/
Flood Hazard Mapping-FEMA http://www.fema.gov/fhm/
Mitigation Division-FEMA http://www.fema.gov/fima/
Planning Resource Center-FEMA http://www.fema.gov/fima/planresource.shtm
Hazard Maps
http://www.hazardmaps.gov/atlas.php
Forest Service—Department of Agriculture
http://www.fs.fed.us/fire/fuelman/
Geo-Community
http://data.geocomm.com/
National Geophysical Data Center
http://www.ngdc.noaa.gov/maps/interactivemaps.html
National Atlas
http://nationalatlas.gov/

KY SITES:
Geology of Kentucky
http://www.uky.edu/KGS/coal/webgeoky/kygeolgy.htm
Kentucky's Geographic Explorer
http://kygeonet.ky.gov/
KY State Nature Preserves Commission
http://www.naturepreserves.ky.gov/
Kentucky Heritage Council
http://www.kyheritage.org/khchome.htm
KY Public Service Commission
http://psc.ky.gov/pschome.htm

Kentucky Virtual Library
http://www.kyvl.org/
Governor's Office for Technology
http://got.ky.gov/
KY Division of Waste Management
http://www.waste.ky.gov/
KY Office of Geographic Information
http://ogis.state.ky.us/
KY Emergency Management Mitigation
http://kyem.dma.state.ky.us/mitigation/mitigation_home.htm
http://kyem.dma.state.ky.us/index.html Homepage
Kentucky Geodetic Advisor
http://ngs.state.ky.us/
Bluegrass Tomorrow
http://www.bluegrasstomorrow.org/
KY Transportation Cabinet-Division of Planning
http://www.kytc.state.ky.us/planning/index.shtm
KY Housing, Buildings, and Construction
http://hbc.ppr.ky.gov/BCE.htm
KY Mines and Minerals
http://dmm.ppr.ky.gov/
Kentucky Emergency Operations Plan
http://kyem.dma.state.ky.us/KY%20EOP/tableofcontents.htm

State Links:
Access Indiana
http://www.state.in.us/
University of Arkansas—Geographic Information Systems and Maps
http://libinfo.uark.edu/GIS/us.asp
Arkansas Department of Emergency Management
http://www.adem.state.ar.us/
Area Development Districts
http://www.bgadd.org/index1.html
Colorado Office of Emergency Management
http://www.dola.state.co.us/oem/
Delaware Emergency Management Agency
http://www.state.de.us/dema/
Georgia Emergency Management Agency
http://www2.state.ga.us/GEMA/
Indiana State Hazard Mitigation Council
http://www.in.gov/sema/emerg_mgt/mitigation/mit_age.html
Iowa Department of Public Defense STRATEGIC PLAN
http://www.state.ia.us/government/dpd/emd/ResourceRoom/5yrStrategy/strat.htm
New Jersey Office of Emergency Management
http://www.state.nj.us/njoem/opb.html
State of New Hampshire Natural Hazards Mitigation Plan
http://www.nhoem.state.nh.us/mitigation/default.htm
New York State Emergency Management Office
http://www.nysemo.state.ny.us/

Alabama Emergency Management Agency
http://66.182.139.196/websites/NewEMA/ema-front.asp?ID=2
Arizona Division of Emergency Management
http://www.dem.state.az.us/
Connecticut Office of Emergency Management
http://www.ct.gov/oem/site/default.asp
Florida Disasters
http://www.floridadisaster.org/
Hawaii Hazard Mitigation
http://www.mothernature-hawaii.com/
Hazard Mitigation in North Carolina
http://www.dem.dcc.state.nc.us/mitigation/
Louisiana Homeland Security and Emergency Preparedness
http://www.loep.state.la.us/
The State of Idaho—Bureau of Disaster Services
http://www2.state.id.us/bdsmitigation/index.html
State of Rhode Island Department of Environmental Management
http://www.state.ri.us/dem/
Texas Department of Public Safety
http://www.txdps.state.tx.us/
State of Alaska—Division of Homeland Security and Emergency Management
http://www.ak-prepared.com/

Local Sites:

Economic Geology of Fayette County
http://www.uky.edu/KGS/coal/webgeoky/county/fayetteecon.html

Citations:

2010 U.S. Census
http://2010.census.gov/2010census/
http://factfinder2.census.gov
Article 19 – Floodplain Conservation and Protection
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2543
Best Management Practices (BMP) for Yards
Contact Division of Planning, http://www.lexingtonky.gov/index.aspx?page=328
Building Elevation Requirements
Contact Transportation Planning, http://www.lexingtonky.gov/index.aspx?page=334
Building Your Home Booklet
Contact Division of Planning, http://www.lexingtonky.gov/index.aspx?page=328
Center for Hazards Research and Policy Development
http://hazardcenter.louisville.edu/
Center for Hazards Research & Policy Development Twitter
http://twitter.com/CHR_PD
Channel 3
http://www.lexingtonky.gov/index.aspx?page=992
Chemical Stockpile Emergency Preparedness
http://www.fema.gov/technological-hazards-division-0/chemical-stockpile-emergency-preparedness-program
http://www.lexingtonky.gov/index.aspx?page=1725
Climactic Data Center
http://www.ncdc.noaa.gov
Commerce Lexington Inc. Economic Development
http://locateinlexington.com/
Commonwealth Hazard Assessment Mitigation Planning System (CHAMPS)
Contact Center for Hazards Research and Policy Development, http://hazardcenter.louisville.edu/
Community Assistance Program State Support Services Element
http://www.fema.gov/government/grant/government.shtm#4
Community Emergency Response Team
http://www.lexingtonky.gov/cert
Construction Inspection Manual
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=1897
Cooperative Technical Partnership (CTP) Agreement
http://home.fema.gov/plan/prevent/fhm/ctp_qa1.shtm
Cooperating Technical Partners Program Management
http://www.fema.gov/plan/prevent/fhm/ctp_main.shtm
http://www.fema.gov/government/grant/government.shtm#4
Department of Planning
http://www.lexingtonky.gov/index.aspx?page=328
Detention Basin Inspection Team
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=16424
DEM Alert Notification System: LEAN Lexington's Emergency Alerts and Notifications
http://www.lexingtonky.gov/lean http://lexcall.lexingtonky.gov/
DEM Outreach Initiatives
Contact Division of Emergency Management, http://www.lexingtonky.gov/index.aspx?page=713
Digital Flood Insurance Maps (DFIRMS), FEMA

www.msc.fema.gov
Disaster Mitigation Act of 2000 (DMA 2000), Pub. L. no. 106-390, 114 Stat 1552 (2000). Print.
http://www.fema.gov/library/viewRecord.do?id=1935
Division of Water Quality
http://www.lexingtonky.gov/index.aspx?page=665
Economic Adjustment Assistance
https://www.cfda.gov/index?s=program&mode=form&tab=step1&id=b6288a16987f7dcbbff7a5a23d12d99f
Emergency Operations Center & Plan
http://www.lexingtonky.gov/index.aspx?page=718
Emergency Management Performance Grants
http://www.fema.gov/government/grant/government.shtm#4
Emergency Support Function # 5 Plan
http://www.au.af.mil/au/awc/awcgate/frp/frpesf5.htm
Facility Shelter Surveys/Disaster In-Services-Training
Contact Division of Emergency Management, http://www.lexingtonky.gov/index.aspx?page=713
Fayette Local Emergency Planning Committee
http://fayettelepc.com/
FEMA Region IV
http://www.fema.gov/region-iv
Floodplain Mailings
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Floodplain Management Plan
http://www.floods.org/PDF/5_Year_Plans/5yr_KY.pdf
Flood Mitigation Assistance Grant Program
http://www.fema.gov/flood-mitigation-assistance-program
Geotechnical Manual
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=1922
GIS
http://www.lexingtonky.gov/index.aspx?page=416
Greenways
http://www.lexingtonky.gov/index.aspx?page=784
Greenways Master Plan
http://www.lexingtonky.gov/index.aspx?page=791
Greenway Manual
http://www.lexingtonky.gov/index.aspx?page=796
Hazard Mitigation Grant Program (HMGP)
www.fema.gov/government/grant/hmgp/index.shtm
http://www.fema.gov/hazard-mitigation-grant-program
Hazard Mitigation Update Project Website
http://www.lexington-mitigation.org
Hazardous Material Emergency Response
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2755
Healthcare Emergency Planning Committee
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=5698
Home Flood-Proofing Program
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Infrastructure Development Manual
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=1727

Infrastructure Hearing Board
Contact Transportation Planning, http://www.lexingtonky.gov/index.aspx?page=334
Kentucky Cabinet for Economic Development
http://www.thinkkentucky.com/
Kentucky Division of Emergency Management
http://kyem.ky.gov
Kentucky Geological Survey
http://www.uky.edu/KGS/
Kentucky Revised Statutes
http://www.lrc.ky.gov/statrev/frontpg.htm
Kentucky Transportation Cabinet Maintenance Costs
http://transportation.ky.gov
Letters of Map Revisions in compliance with the National Flood Insurance Program (NFIP)
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Lexington Fayette Urban County Government
http://www.lexingtonky.gov
Lexington Herald-Leader Newspaper
http://www.kentucky.com/
Lexington Transit Authority
http://lextran.com/
LFUCG Division of Emergency Management
http://www.lexingtonky.gov/dem
LFUCG Comprehensive Plan (2007)
http://www.lexingtonky.gov/index.aspx?page=341
LFUCG Floodplain Ordinance
Contact Division of Planning, http://www.lexingtonky.gov/index.aspx?page=328
Local Mitigation Plan Review Guide
http://www.fema.gov/library/viewRecord.do?id=4859
Local Mitigation Plan Review Tool (Appendix A of Local Mitigation Plan Review Guide)
http://www.fema.gov/library/viewRecord.do?id=4859
Local Mitigation Plan Review Crosswalk Comparison Tool
http://www.fema.gov/library/viewRecord.do?id=4989
Metropolitan Medical Response System
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=5697
Mining Ordinance, Ord. No. 252-91, § 1, 12-12-91
http://library.municode.com/index.aspx?clientId=11163
National Dam Safety Program
http://www.fema.gov/plan/prevent/damfailure/ndsp.shtm
http://www.fema.gov/plan/prevent/damfailure/stategrant.shtm
http://www.fema.gov/government/grant/government.shtm#4
National Disaster Medical System
http://www.phe.gov/preparedness/responders/ndms/Pages/default.aspx
National Earthquakes Hazards Reduction Program
http://www.fema.gov/plan/prevent/earthquake/nehrp.shtm
National Flood Insurance Program
http://www.fema.gov/government/grant/government.shtm#4
http://www.fema.gov/business/nfip/
Neighborhood Emergency Network
http://www.lexingtonky.gov/index.aspx?page=736

Park Land Priority and Acquisition Study
http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CF0QFjAA&url=http%3A%2F%2Fwww.communitypreservation.org%2FLexington_Preservation_Plan.doc&ei=faARUKHIIIGg6QGKrYGgCw&usg=AFQjCNGu3O-jz9MGY48uIXBKQ6XzM1KoKQ&sig2=UifkbLEdo4vdnOJhCCtfuA
Pre-Disaster Mitigation Grant Program
http://www.fema.gov/pre-disaster-mitigation-grant-program
Property Acquisition
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Purchase of Development Rights Program
http://www.lexingtonky.gov/index.aspx?page=497
Reforest the Bluegrass
http://www.lexingtonky.gov/index.aspx?page=2864
Repetitive Flood Claims Grant Program
http://www.fema.gov/repetitive-flood-claims-program
Roadway Manual
http://www.lexingtonky.gov/index.aspx?page=777
Rural Service Area Land Management Plan
http://www.lexingtonky.gov/index.aspx?page=606
Sanitary Sewer Capital Improvement Plan (2011)
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Sanitary Sewer Manual
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2029
Severe Repetitive Loss Grant Program
http://www.fema.gov/severe-repetitive-loss-program
Severe Storms and Earthquake Preparedness Program
Contact Division of Emergency Management, http://www.lexingtonky.gov/index.aspx?page=713
Severe Weather Warning Systems
Contact Division of Emergency Management, http://www.lexingtonky.gov/index.aspx?page=713
Sinkhole Ordinance
http://www.epa.gov/safewater/sourcewater/pubs/techguide_ord_ky_lexington_sinkhole.pdf
http://library.municode.com/index.aspx?clientId=11163
Sinkhole Regulation
http://library.municode.com/HTML/11163/level4/COOR_CH16SEGAREWE_ARTXSTDI_DIV5RESOER.html#COOR_CH16SEGAREWE_ARTXSTDI_DIV5RESOER_S16-101PRSTSUERSECOPLOBLADIPELADILEONAC
SKYWARN Program
http://skywarn.org/
StormReady Campus – University of Kentucky
http://wwwagwx.ca.uky.edu/stormready/
Stormwater Manual
http://www.lexingtonky.gov/index.aspx?page=780
Stormwater Funding Study
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Stormwater Projects Priority List (2011)
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Stormwater Quality Projects Incentive Grant Program
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Structures Manual

http://www.lexingtonky.gov/index.aspx?page=781
Subdivision Regulations
http://www.lexingtonky.gov/index.aspx?page=771
Sump Pump Redirection Program
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Terrorism and Weapons of Mass Destruction
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2730
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2722
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2720
http://www.lexingtonky.gov/Modules/ShowDocument.aspx?documentid=2713
Tree Protection Ordinance, Ord. No. 70-94, § 1, 5-5-94
http://library.municode.com/HTML/11163/level2/COOR_CH17BSTTR.html#COOR_CH17BSTTR_S17B-9TRPR
Urban Service Area Boundary
See Comprehensive Plan, http://www.lexingtonky.gov/index.aspx?page=341
Variance to the Weed Ordinance
Contact Division of Planning, http://www.lexingtonky.gov/index.aspx?page=328
Watershed Gauges
Contact Division of Water Quality, http://www.lexingtonky.gov/index.aspx?page=665
Zoning Ordinance
http://www.lexingtonky.gov/index.aspx?page=638

LFUCG Local Capabilities Assessment Matrix

Citation: [0] Location, Title, *issue addressed*, Resource (Year last updated).

[1a] Section 1613: *Earthquake Loads*, KBC (2011).
[1b] Section 106.2, Site Plan: *Flood Hazard Area* & Section 109.3.3 *Lowest floor elevation*, KBC (2011).
[1c] Section 1604.3: *Wind Loading*, KBC (2011).
[1d] Section 1608: *Snow Loads*, KBC (2011).
[2a] Article 6-4(j) Subdivisions in the A-R, A-B, and A-N Zones, (4) Structures, (b) Non-Agricultural Structures and Designation of Buildable and Non-Buildable AREAS: *Flood hazard areas*, Subdivision Code (2011).
[2b] Ibid: *karst areas* & Article 6-11(a)(4) *Sinkholes*, Subdivision Code (2011).
[2c] Article 6-11(a) Standards for Environmentally Sensitive Areas and Geologic Hazard Areas: *Slope exceeding 15%*, Subdivision Code (2011).
[2d] Article 6-7 *Stormwater Disposal Standards*, Subdivision Code (2011).
[2e] Article 5-4(h)(1) Private Street (or Access Easement) Responsibilities of Owners: *Snow Removal*, Subdivision Code (2011).
[3a] I. Natural Environment, pp 1, *pollutant discharge into water bodies*, Expansion Area Master Plan (1996).
[3b] I. Natural Environment, pp 1, *flood plains and floodways*, Expansion Area Master Plan (1996).
[3c] Expansion Area 3: Greenways, Public Land and Roadways, pp 1, 26, *sinkholes*, Expansion Area Master Plan (1996).
[3d] I. Natural Environment, pp 1, *steep slopes*, Expansion Area Master Plan (1996).
[4] 1.1 Water Quantity and Water Quality Benefits, *filter pollutants from stormwater*, Greenway Management Plan (2001).
[4b] 1.1 Water Quantity and Water Quality Benefits, *absorb floodwaters*, Greenway Management Plan (2001).
[5] Section IV: Special Plan Elements, Environmentally Sensitive Areas, Rural Environmental Concerns, *Floodplain areas should be left in their natural states*, Rural Service Area Land Management Plan (1999).
[6] Article 19 Floodplain Conservation and Protection, *designation of flood hazard zones*, Zoning Ordinance (2012).
[6b] Article 8-3(d) Agricultural Natural Areas (A-N) Zone, *sinkhole and karst areas*, Zoning Ordinance (2012).
[6c] Article 8-3(d) Agricultural Natural Areas (A-N) Zone, *slopes exceeding 15%*, Zoning Ordinance (2012).
[7] Section 1.2 Project Types for Which Use of Manual is Applicable, *Sanitary and Storm Sewers, Pump Stations, Retention/Detention Facilities*, Geotechnical Manual (2005).
[7b] Section 2.2.2 Topographic and Geologic Quadrangle Maps and Natural Resources Conservation Service Data, *sinkhole presence detection on proposed construction site*, Geotechnical Manual (2005).
[7c] Section 2.2.1 Reviews of Available Plans and Documents, Design Plans, *proposed grades of the embankment slopes*, Geotechnical Manual (2005).
[8] Section 1.3 Federal, State, and Local Permits, General Requirements: *Construction of structures or embankments over or along a body of water will require permits*, Structures Manual (2005).
[9] Infrastructure Development Process, Improvement Plans 8: *engineer prepares improvement plans in accordance with no disturbance areas (floodplain and sinkholes)*, infrastructure Development Manual (2005).
[9b] Ibid
[9.5] Charter and Code of Ordinances, Lexington Fayette Urban County Government, Chapter 16A *Hazardous Materials*, http://library.municode.com/index.aspx?clientId=11163
[11] Section 1: *Petroleum Products*, Underground Storage Tank Regulation (1990).
[11b] Section 7(A)(1) Secondary Containment: *required near environmentally sensitive areas*, Underground Storage Tank Regulation (1990).
[12] Chapter 2.2 Kentucky Division of Water Floodplain Construction Permits, *dams or other improvements obstructing the movement of water*, Stormwater Manual (2009).
[12b] Chapter 10 Stormwater Best Management Practices for Water Quantity and Water Quality Control: *Non-point source pollution*, Stormwater Manual (2009).
[12c] Chapter 1.3.3 Purpose and Overview, Post Development Floodplain: *flood protection elevation*

Appendix 2.1 Plan Adoption Documents

Placeholder

Appendix 3.1 Planning Team Contact Information

The Planning Team staff documented all steps taken in the development of the Plan and was responsible for all aspects of the Plan development including collecting data, reviewing plans/studies, facilitating public input, drafting the Plan, and for all required documentation. In addition, Project Staff facilitated the process to review the hazard assessments and profiles, assisted in developing a mitigation strategy, including the design of a detailed action plan, and stakeholder participation.

Lexington Fayette Emergency Management

Patricia Dugger, RS MPA Director
(859) 425-2490
patd@lexingtonky.gov

Stephen Jackson, Operations Manager
(859) 258-3786
sjackson@lexingtonky.gov

Center for Hazards Research, University of Louisville

Josh Human, Director
(502) 852-8922
josh.human@louisville.edu

Andrea Pompei, Project Manager
(502) 852-7952
andrea.pompei@louisville.edu

Nathan Bush, Research Assistant
(502) 852-1211
nathan.bush@louisville.edu

Stantec Consulting Services Inc.

Mike Greene, GISP, CFM
(859) 422-3079
Mike.Greene@stantec.com

Moore Enterprises, WBE

Pamela Moore, Mitigation Specialist
(502) 479-8118
p382@bellsouth.net

Appendix 3.2 Public and Local Agency Involvement

Steering Committee Members

The steering committee represents hazard-related agencies/organizations from local, state, and federal agencies, as well as community representatives, local business leaders, academia, government, businesses, public health and hospitals, neighborhoods, citizens, and volunteer/public service organizations. The steering committee includes a cross-section of the community with over 25 agencies/organizations.

(Chart on following Page)

LFUCG Meeting Attendance

		Attendance			
Organization	**Name**	**11/2/2012**	**2/1/2012**	**3/21/2012**	**9/27/2012**
American Red Cross Bluegrass Chapter	Terry, Sarah		X		
Columbia Gas	Mueller, Dave				
Community Emergency Response Team	Rambo, Doyle		X	X	
Department of Public Safety	Curtis, Rick	X	X	X	X
Division of Building Inspection	Bryant, John		X	X	X
Division of Code Enforcement	Jarvis, David	X	X		X
Division of Code Enforcement	Walter, Rob		X	X	
Division of Emergency Management	Bobel, John	X	X	X	
Division of Emergency Management	Birkholz, Doreen	X	X	X	X
Division of Emergency Management	Dugger, Patricia	X	X		
Division of Emergency Management	Gooding, Irene	X			
Division of Emergency Management	Jackson, Stephen	X	X	X	X
Division of Emergency Management	Lambert, Hazel	X			
Division of Fire and Emergency Services	Gribbin, Michael		X	X	X
Division of Planning	Martin, Thomas		X	X	
Division of Water Quality	Lubeck, Greg	X	X	X	X
KY American Water	Lancho, Susan				
KY American Water	Shehee, David				X
KY Bluegrass Area Development District	Scott, Kyle		X		
KY Geological Survey	Andrews, Drew	X			
KY Geological Survey	Crawford, Matt	X		X	
KY Geological Survey	Currens, James C	X			
KY Hazard Mitigation Grant Program Office	Gathy, Brian	X			
KY Hazard Mitigation Grant Program Office	Grinstead, Nick				X
KY Hazard Mitigation Grant Program Office	White, Esther				X
Lextran	Givens, John	X	X	X	X
LFUCG GIS	Baker, Dustin				
LGE-KU	Alexander, Keith	X	X	X	X
LGE-KU	Claypool, Brian				X
LGE-KU	Guy, David	X	X	X	
Local Emergency Planning Committee	Wright, Robin	X		X	
Mayor's Office	Brown, Glen	X	X	X	X
Multi-Cultural Affairs	Bencz, Craig			X	
Multi-Cultural Affairs	Taylor, Isabel		X		X
Property Valuation Administration	Hall, Patti			X	
Property Valuation Administration	O'Neill, David	X			
Public Works	Louise			X	
Public Works	Edmonds, Louise		X		
Public Works	Wente, Kevin	X		X	
Risk Management	Johnston, Patrick	X	X	X	
University of Kentucky Crisis Management	Giles, Christy	X			
University of Kentucky Crisis Management	Matlock, Thomas	X		X	
University of Kentucky Crisis Management	Wood, Laurel			X	
Windstream	Dudley, Jason			X	

Appendix 3.3 Steering Committee Meetings (SCM)

DATE	PURPOSE OF MEETING	HOST LOCATION
November 2, 2011	Establish the role of the Plan Development Team by defining numerous objectives. Conduct break out session to identify local, known hazards and their impact area. Give an overview of the HMGP process, start a discussion on hazardous areas and events within the county and to work with the invited stakeholders to determine data needs and availability.	Phoenix Building
February 1, 2012	Present the results of the vulnerability assessment. Provide information on and identify completed, existing and future mitigation planning efforts.	Kentucky Utilities Building
March 21, 2012	To further the development the "Mitigation Strategies" section of the plan.	Kentucky Utilities Building
September 27, 2012	Provide an introduction to the final draft plan, mitigation strategy, and plan maintenance section. Educate about funding opportunities by the Kentucky Hazard Mitigation Grant Program Office	Kentucky Utilities Building

Appendix 3.4 Steering Committee Meeting 1

Steering Committee Meeting 1: Invitation

YOU ARE INVITED

TO ATTEND

Steering Committee Meeting on November 2

LEXINGTON FAYETTE URBAN COUNTY GOVERNMENT

TO UPDATE ALL HAZARDS MITIGATION PLAN

The Division of Emergency Management (DEM) will host the first steering committee meeting to update LFUCG's All Hazards Mitigation Plan. This process is required under federal law to help communities better prepare for natural and man-made disaster events.

The meeting will be held at
Phoenix Building
101 E Vine St, 3rd Floor Conference Room, Lexington, KY 40507
1:30 p.m. to 3:30 p.m. on Wednesday, November 2, 2011

Presentations and handouts will be provided to attendees to explain the update planning process and how local organizations can aide in data collection and hazard identification. DEM is partnering with the University of Louisville's Center for Hazards Research to update the local plan and has convened a Steering Committee of local agencies and organizations to oversee the update of the plan during a 9-month timeframe.

Pursuant to the Disaster Mitigation Act of 2000, as a local community, Lexington/Fayette Urban County Government (LFUCG) is required to update the comprehensive All Hazards Mitigation Plan. To help us be better prepared for a countywide disaster, it is important that our community develop a strategy to mitigate losses. The updated plan will outline additional areas that are at-risk in Lexington and determine vulnerabilities. The objective is to develop a program of activities to mitigate the community's vulnerability to natural and man-made hazards that LFUCG will adopt.

For More Information Contact:
Pat Dugger or Stephen Jackson at the Division of Emergency Management
(859) 258-3784, patd@lexingtonky.gov or sjackson@lexingtonky.gov

Steering Committee Meeting 1: Agenda

Lexington Fayette Hazard Mitigation Plan Update

Steering Committee Kick-off Meeting

November 2, 2011

1:30-3:30 pm

Phoenix Building

101 E Vine St, **3rd Floor Conference Room**

1:30 – 1:45 PM	**Registration**
1:45 – 2:00 PM	**Welcome and Opening Comments** Pat Dugger, Director *LFUCG Division of Emergency Management*
2:00 – 2:30 PM	**Overview of Hazard Mitigation Planning** Andrea Pompei, Project Manager *Center for Hazards Research and Policy Development* **Grant Requirements: Tracking Your Time for the Plan** Pat Dugger, Director LFUCG Division of Emergency Management
2:30 - 2:40 PM	**Information and Data Needs** Josh Human, Associate Director *Center for Hazards Research and Policy Development*
2:40 – 2:50 PM	**Break**
2:50 – 3:20 PM	**Break Out Session** Hazard identification exercise
3:20 – 3:30 PM	**Closing Remarks, Next Meeting Discussion**

Steering Committee Meeting 1 Handout: Informational Sheet

Lexington-Fayette Urban County Government
Hazard Mitigation Plan Update

The purpose of updating the Hazard Mitigation Plan for Lexington-Fayette Urban County Government (LFUCG) is to ensure the continuation of hazard mitigation activities.

The Hazard Mitigation Plan is designed to help build a foundation and a vision for enhanced coordination and collaboration among local government and other community stakeholder groups in order to prepare for and reduce the risks posed by natural hazards. To be successful, mitigation practices must be integrated into current and future policy plans and documents at the local and state level.

The Center for Hazards Research and Policy Development (CHR) at the University of Louisville has been contracted to update the mitigation plan under the supervision of the LFUCG Division of Emergency Management and through the guidance of a steering committee.

Benefits of Mitigation Planning:

- Reduced vulnerability to future hazard events, specifically: reduced loss of life, property, essential services, critical facilities and economic hardship;
- Reduced short-term and long-term recovery and construction costs;
- Quicker resumption of operations;
- Increased cooperation and communication within the community through the planning process; and
- Increased potential for state and federal funding for mitigation and recovery projects.

4 Phases of the Hazard Mitigation Plan:

Planning process: The plan must document the "planning process" including public comment; who was involved; how public, private, and non-profit entities were involved; and how the plan was prepared.

Risk assessment: The risk assessment provides a factual basis for activities proposed in the plan by identifying the hazards affecting LFUCG, profiling the history of these hazards, creating an inventory of assets, and estimating potential losses.

Mitigation strategies: The mitigation strategy provides LFUCG'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.

Plan maintenance: The plan maintenance process will include the method and schedule for monitoring, evaluating, and updating the plan.

Natural Hazards to be examined:

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

CENTER FOR HAZARDS RESEARCH AND POLICY DEVELOPMENT
UNIVERSITY OF LOUISVILLE

Where are we now in the Planning Process?

Currently, we are collecting data to inform the **Risk Assessment.**

The Risk Assessment phase is divided into four sections, providing a comprehensive analysis and review for LFUCG's vulnerabilities.

- Identifying Hazards
- Profiling Hazard Events
- Assessing Vulnerability: Inventory assets
- Assessing Vulnerability: Estimating Potential Losses

The vulnerability assessment is used to determine the likelihood of damage to vulnerable buildings and critical facilities as the result of a hazard event. The data needed to build the database for the vulnerability assessment is found from several different groups, many of which are represented by the Steering Committee.

From this database, a Risk/Vulnerability Assessment Model is created that will estimate the potential losses in the event of a hazardous occurrence.

Variables used in the Vulnerability Model:

Occupancy (population)
Building Values (current and replacement)
Building Category (office, housing, etc.)
Insured Contents
Square footage
Current Building Condition
Construction Type
Lat/Long of the building
Year Built
Critical Facility (categories)
Hazmat Information
Information on vulnerable populations
Information on Shelter locations
Repetitive Loss Data
Building Permits (post-disaster)
Facility Replacement Costs

What do we need from you?

Data, in excel format or GIS shapefile, for the variables listed above. A vulnerability assessment and potential loss estimate is calculated for each individual building, so it is important that we receive data that is linked to a building name, building address, and lat/long (if possible).

This data will be compiled and entered into a Microsoft Excel Spreadsheet, and joined to a Geographic Information System (GIS) file that will produce maps that will geographically display vulnerabilities to each examined hazard.

Below is an example of useful data:

Do you have information that can help inform this assessment?
If so, please contact:

Andrea Pompei
Project Manager
Center for Hazards Research
andrea.pompei@louisville.edu

or

Stephen Jackson
Operations Manager
Division of Emergency Management
sjackson@lexingtonky.gov

Steering Committee Meeting 1: Mapping Hazards Exercise

Hazard Identification Exercise

Lexington All Hazard Mitigation Plan	
Hazard:	
Location:	
Dot Color and Marking:	
Contact Information:	

Red: **Atmospheric:** Severe Storm, Winter Storm, Hail, Tornado

Green: **Geologic:** Landslide, Mine Subsidence, Earthquake, Karst/Sinkhole

Blue: **Water Related:** Flood, Dam Failure

Yellow: **Other:** Hazardous Materials, Drought, Wildfire

Example

Note: Please use this as an example for your Hazard Identification Report.

Hazard Identification Exercise

Lexington All Hazard Mitigation Plan	
Hazard:	**Landslide**
Location:	**Street Name**
Dot Color and Marking:	**Green and 1**
Contact Information:	**Stephen Jackson, Operations Manager**
	sjackson@lexingtonky.gov
	859-258-3784

Landslide event 1984 caused damage to three houses and over $50,000 worth of damage.

Red: **Atmospheric:** Severe Storm, Winter Storm, Hail, Tornado

Green: **Geologic:** Landslide, Mine Subsidence, Earthquake, Karst/Sinkhole

Blue: **Water Related:** Flood, Dam Failure

Yellow: **Other:** Hazardous Materials, Drought, Wildfire

Hazard Identification Exercise Tabulation Nov. 2, 2011

Image 3.2.2: Steering Committee Members identify local hazards in LFUCG by their indigenous and specialty specific knowledge.

Following are the results of the Hazard Identification Exercise Tabulation:

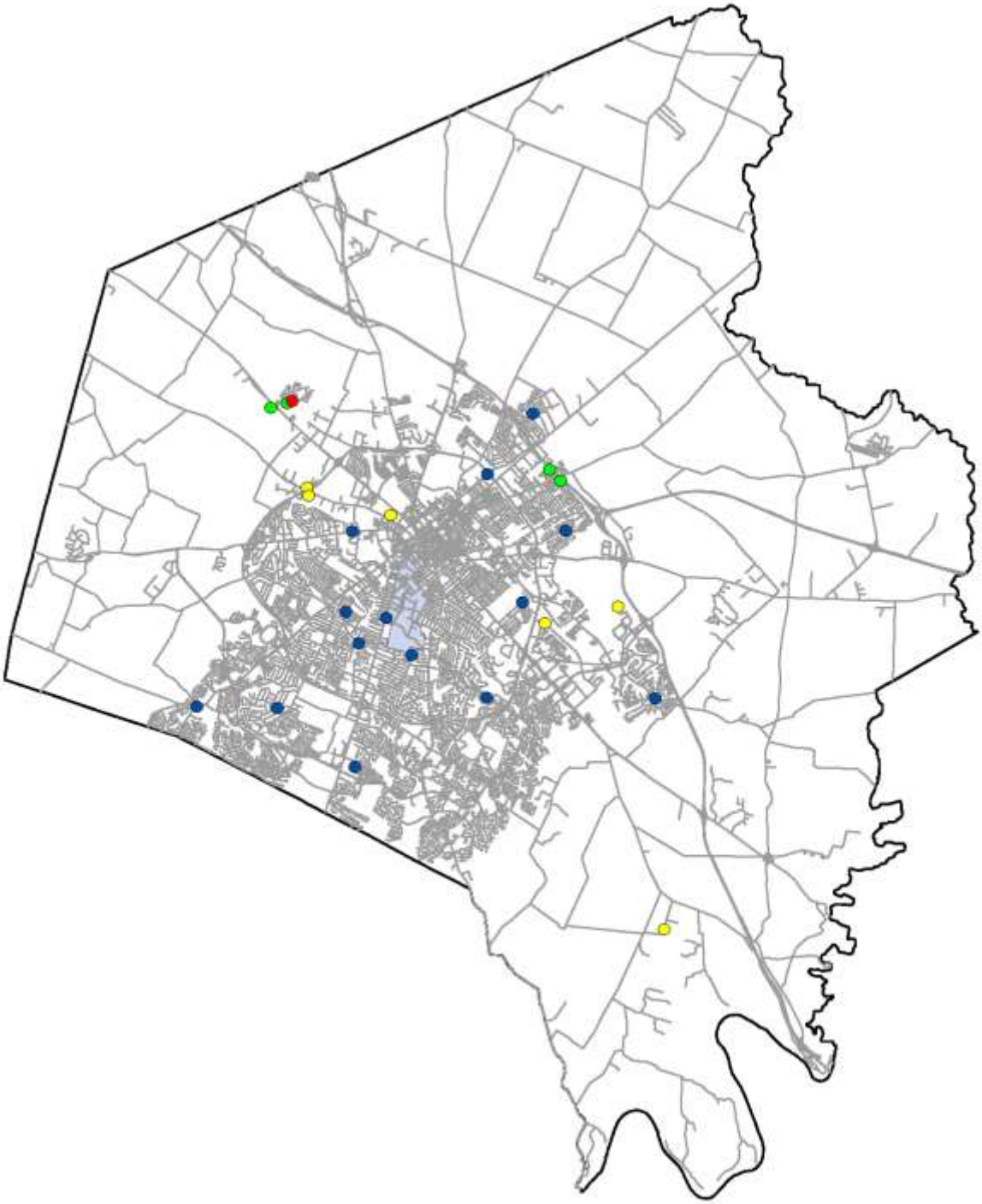
Hazard: **WATER RELATED**			
Location	**Dot Color & Marking**	**Map**	**Contact**
Southland Drive	Blue, 7	B2	Greg Lubeck
Walhampton	Blue, 1	B2	Greg Lubeck
Lafayette/Southland	Blue, 10	B2	Greg Lubeck
Versailles/Trafton	Blue, 11	B2	Greg Lubeck
Harrodsburg/Military	Blue, 12	B1	Greg Lubeck
Idle Hour	Blue, 8	B2	Greg Lubeck
Bellefonte Drive	Blue, 9	B2	Greg Lubeck
Ft. Sumter/Gayle	Blue, 6	B2	Greg Lubeck
New Circle Road/ N. Broadway (Road Flooding)	Blue, 4	B2	Patrick Johnston
S75/Autumn Ridge (Neighborhood/Golf Course)	Blue, 2	B2	Patrick Johnston
Alumni Drive (Dam Repair)	Blue, K1	B2	K. Wente/S. Jackson
Cindy Blair Way (Sinkhole Flooding)	Blue, K1	B1	Kevin Wente
University Drive	Blue, 3	B2	
Allen Drive	Blue, 5	B2	
Spears Road	Blue, C2	C2	

Hazard: **Other/HAZMAT**			
Location	**Dot Color & Marking**	**Map**	**Contact**
Southern Fayette Co.	Yellow, CSEPP 1	C2/C3	Pat Dugger
Laco Drive	Yellow	B2	
Sir Barton Way (24" Crude Oil Pipeline)	Yellow, 4	B2	Patrick Johnston
Manchester Street (RS Corman Railroad Switchyard)	Yellow, 1	B2	
Palumbo Drive (Compressed Gas Facility)	Yellow, 2	B2	Patrick Johnston
Old Frankfurt Pike (Petroleum Storage Facility)	Yellow, 3	B2	Patrick Johnston

Hazard: **GEOLOGICAL**			
Location	**Dot Color & Marking**	**Map**	**Contact**
McConnells Trace Masterson Station (Sinkhole 'Mania')	Green, K1, K2	B1	Kevin Wente
Wickland Drive	G1	B2	
Anniston Drive	G2	B2	

Hazard: **ATMOSPHERIC**			
Location	**Dot Color & Marking**	**Map**	**Contact**
Masterson Station (Tornado)	Red, SJ	B1	Steve Jackson

Geocoded Hazard Identification



Appendix 3.5 Steering Committee Meeting 2

Steering Committee Meeting 2: Invitation

YOU ARE INVITED

TO ATTEND

Steering Committee Meeting on February 1, 2012
LEXINGTON FAYETTE URBAN COUNTY GOVERNMENT
TO UPDATE ALL HAZARDS MITIGATION PLAN

The Division of Emergency Management (DEM) will host the second steering committee meeting to update LFUCG's All Hazards Mitigation Plan. This process is required under federal law to help communities better prepare for natural and man-made disaster events.

The meeting will be held at

Kentucky Utilities Building

One Quality Street and Vine Street, Main Lobby

1:30 p.m. to 4:00 p.m. on Wednesday, February 1, 2012

DEM is partnering with the University of Louisville's Center for Hazards Research and Policy Development to update the local plan and has convened a Steering Committee of local agencies and organizations to oversee the update of the plan during a 9-month timeframe.

At this meeting, the preliminary results of the risk assessment will be shared and, as a group, we will begin to build the "Mitigation Strategies" section of the plan. Steering Committee members are expected to provide information on completed, existing, and identify future mitigation planning efforts. During this meeting, we will revisit the mitigation strategies section from the previous plan as a basis for creating the updated version (see mitigation action table to review and assess outlined strategies from the previous plan).

Pursuant to the Disaster Mitigation Act of 2000, as a local community, Lexington/Fayette Urban County Government (LFUCG) is required to update the comprehensive All Hazards Mitigation Plan. To help us be better prepared for a countywide disaster, it is important that our community develop a strategy to mitigate losses. The updated plan will outline additional areas that are at-risk in Lexington and determine vulnerabilities. The objective is to develop a program of activities to mitigate the community's vulnerability to natural and man-made hazards that LFUCG will adopt.

For More Information Contact:

Pat Dugger
Division of Emergency Management
(859) 258-3784
patd@lexingtonky.gov

Stephen Jackson
Division of Emergency Management
(859) 258-3784
sjackson@lexingtonky.gov

Steering Committee Meeting 2: Agenda

Lexington Fayette Hazard Mitigation Plan Update

Steering Committee Meeting #2
February 1, 2012
1:30-4:00 pm
Kentucky Utilities
One Quality Street and Vine Street
Main Lobby
(Participants will be escorted to meeting room)

1:30 – 1:45 PM	**Registration**
1:45 – 1:50 PM	**Welcome and Opening Comments** Pat Dugger, Director *LFUCG Division of Emergency Management*
1:50 – 2:35 PM	**Risk Assessment: Preliminary Results** Josh Human, Director *Center for Hazards Research and Policy Development*
2:35 – 2:45 PM	**Break**
2:45 – 3:05 PM	**Mitigation Strategy: Goals, Objectives, and Actions** Andrea Pompei, Project Manager *Center for Hazards Research and Policy Development*
3:05 – 3:55 PM	**Group Discussion: Updating the Action Matrix** Review old matrix and update project statuses
3:55 – 4:00 PM	**Closing Remarks, Next Meeting Discussion**

Steering Committee Meeting 2: Handouts

LFUCG All Hazard Mitigation Action Report Form

Please fill out to the best of your knowledge the below form for any project that is ongoing, completed, or for a hazard mitigation project that you would like to implement in the future. Use one form for each project.

LFUCG: Project/Action Report	
Date:	
Department/Unit:	
Contact Name:	
Contact Title:	
Telephone Number:	
E-Mail Address:	
Facsimile Number:	
• Please list any hazard mitigation projects/actions that your department has funded, implemented or would be interested in implementing.	
• Who is/would be the Lead Department and Contact Person/Project Manager for this mitigation project? • Are there other departments or organizations involved with implementing this project? If yes, please list:	

• What hazard(s) does/would this project address? (Tornado, Flood, Severe Storm, Severe Winter Storm, Hailstorm, Drought, Earthquake, Extreme heat, hazmat, Karst/Sinkhole, Mine Subsidence, Landslide, and Wildfire)
• What is/will be the project location?
• Please identify funding sources for this project. (i.e. state, federal, university) If multiple sources are used please list all by percentage if possible.
• What is the total/estimated cost of this project?
• Is this project ongoing or one time?
• What is the purpose of this project and how does it mitigate/reduce/eliminate the risks of hazards for the Lexington Fayette Urban County Government?
• What is the proposed timeline for project completion?
• Additional Comments:

Example form

Note: Please use this as an example for your Action Report.

Hazard Mitigation Actions Report:

Please fill out to the best of your knowledge the below form for any projects that are ongoing, completed, or for hazard mitigation projects that you would like to implement in the future. You may fill out more than one form if needed.

University of Kentucky: Project/Action Report	
Date:	**10/13/08**
Department/Unit:	**University of Kentucky Emergency Management**
Contact Name:	**Sara Smith**
Contact Title:	**Project Manager**
Telephone Number:	**257-3800**
E-Mail Address:	**Sara.smith@uky.edu**
Facsimile Number:	**257-4100**

- Please list any hazard mitigation projects/actions that your department has funded, implemented or would be interested in implementing.

UKEM wants to upgrade the electrical wiring and install a generator in Patterson Office Tower to support an area to be used as the alternative emergency operations center (EOC) in the event of a major emergency.

- Who is/would be the Lead Department and Contact Person/Project Manager for this mitigation project?

Christy Giles, Director UKEM. See above for contact information.

Are there other departments or organizations involved with implementing this project? If yes, please list:

Capital Project Management, Bob Smith and Campus Physical Plant Division, John Hancock

- What natural hazard(s) does/would this project address? (Tornado, Flood, Severe Storm, Severe Winter Storm, Hailstorm, Drought, Earthquake, Extreme Heat, Karst/Sinkhole, Mine Subsidence, Landslide, and Wildfire)

All Hazards

- What is/will be the project location?

Patterson Office Tower

- Please identify funding sources for this project. (i.e. state, federal, university) and if multiple sources are used please list all by percentage if possible.

75% State Funds

25% University Funds

- What is the total/estimated cost of this project?

The total cost for this project was $50,000.

- Is this project ongoing or one time?

The creation of this project was a one-time process. However the end result of this project will provide on-going mitigation action.

- What is the purpose of this project and how does it mitigate/reduce/eliminate the risks of natural hazards for the University?

The purpose of this project was to provide an alternative Emergency Operation Center. This will reduce the risks to the campus during a natural hazard event through providing an alternative location for the set up of an EOP. This could save lives and property during an event that wipes out the current EOP.

- What is the proposed timeline for project completion?

This project will take a year to finish 10/1/08-10/01/09

- Additional Comments:

Steering Committee Meeting 2 Handout: Mitigation Action Categories and Techniques

Mitigation Action Categories and Techniques

The below mitigation categories and techniques are examples that may be helpful in order to identify past, present, and future mitigation actions for Lexington-Fayette Urban County Government.

Hazards to be examined:

Dam Failure	Drought
Flood	Earthquake
Hailstorm	HazMat
Karst/Sinkhole	Landslide
Mine Subsidence	Severe Storm
Tornado	Winter Storm

Mitigation Categories:

Prevention

Preventative activities are intended to keep hazard problems from getting worse. They are particularly effective in reducing future vulnerability, especially in areas where capital improvements have not been substantial. Examples of preventative activities include:

Planning for Land Use	Open space preservation
Floodplain regulations	Stormwater mgt
Drainage system maintenance	Capital Improvements Programming
Riverine/fault zone setbacks	

Property Protection

Property protection measures protect existing structures by modifying the building to withstand hazardous events, or removing structures from hazardous locations. Examples include:

Acquisition	Relocation
Building elevation	Insurance
Retrofitting (i.e., windproofing, floodproofing, seismic design standards, etc.)	Critical facilities protection Safe Rooms

Public Information and Awareness

Public information and awareness activities are used to advise the public 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	Library materials
Speaker series / demonstration events	School children education
Hazard map information	Hazard expositions

Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their mitigated functions. Such areas include floodplains, wetlands and dunes. Parks, recreation or conservation agencies and organizations often implement these measures.

Examples include:

Floodplain protection	Erosion and sediment control
Riparian buffers	Habitat preservation
Fire resistant landscaping	Wetland preservation and restoration
Fuel Breaks	Slope stabilization

Emergency Services

Although not typically considered a "mitigation technique," emergency service measures 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	Sandbagging for flood protection
Evacuation planning and management	Installing shutters for wind protection

Structural Projects

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

Reservoirs	Erosion and sediment control
Levees / dikes / floodwalls	Diversions / Detention / Retention
Channel modification	Storm sewers

Steering Committee Meeting 2: Mitigation Action Item Matrix

Complete	In-process	Not Started	Keep for Update? Y/N	Timeframe (Years)	Action	Description	Offices Responsible	Comments
GOAL 1 - Attempt to minimize the loss of life and injuries that could be caused by natural hazards.								
Objective 1.1 Facilitate the strengthening of public emergency services, its infrastructure, facilities, equipment, and personnel to natural hazards.								
				1-2	**1.1.1**	Research & determine best practices and standard equipment needed by the fire departments and law enforcement to respond to, and recover from, natural hazard events.	Fire & Police	Emergency Services
				2-3	**1.1.2**	Inventory existing fire department and law enforcement equipment to determine what additional natural hazards related equipment is needed.	Fire & Police	Emergency Services
				3-5	**1.1.3**	Utilizing available grant sources, purchase the required fire department and law enforcement equipment, and training needed to respond to, and recover from, natural hazard events.	Fire & Police	Emergency Services
Objective 1.2 To keep people away from, and/or inform them about, areas or circumstances susceptible to hazards and having a great potential for loss of human life during a natural hazards.								
				3-5	**1.2.1**	Educate citizens on how to receive up-to-date evacuation instructions, shelter-in-place procedures and information pertaining to hazardous material exposure.	DEEM & Government Communications	Public Information and Awareness
Objective 1.3 Minimize or prevent losses to critical facilities and infrastructure from natural hazards.								
				1-5	**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 DEEM.	DEEM, KU, LG&E, Ky. American Water, Columbia Gas, Alltel, Insight, Cingular, Verizon, Sprint	Prevention
				1-5	**1.3.2**	As resources permit, conduct mitigation assessments on LFUCG owned and operated buildings to ensure that they are resistant to natural hazard events.	DEEM, Engineering, Code Enforcement, Building Inspection, Police & Fire	Prevention
				1-5	**1.3.3**	As resources permit, conduct updates, maintenance and training on Emergency Plans of LFUCG owned and operated buildings.	DEEM, Engineering, Code Enforcement, Building Inspection, Police & Fire	Emergency Services

Appendix 3.6 Steering Committee Meeting 3

Steering Committee Meeting 3: Agenda

Lexington Fayette Hazard Mitigation Plan Update
Steering Committee Meeting #3
March 21, 2012
1:30-4:00 pm
Kentucky Utilities
One Quality Street and Vine Street
Main Lobby
Sign in with security at the front lobby

1:30 – 1:45 PM	**Registration**
1:45 – 1:50 PM	**Welcome and Opening Comments**
	Pat Dugger, Director
	LFUCG Division of Emergency Management
1:50 – 1:55 PM	**Project Overview**, *Josh Human*
1:55 – 2:10 PM	**"Hazard Mitigation & How it Can Help You" UK Video**
2:10 – 3:10 PM	**Mitigation "Snapshots" – Ongoing and Stand-alone Mitigation Projects**
2:10-2:20	Greg Lubeck, Acting Section Manager, Division of Water Quality
2:20-2:30	David Guy, Director of System Restoration and Dispatch, LGE-KU
2:30-2:40	Laurel Wood, Business Continuity Coordinator, UK
2:40-2:50	Matt Crawford, Geologist, Kentucky Geological Survey, UK
2:50-3:00	Shelly Bendall, CERT, Preparedness Coordinator, Div. Public Safety
3:00-3:10	Pat Dugger, Director, Division of Emergency Management
3:10– 3:20 PM	*Break*
3:20 – 3:55 PM	**Mitigation Strategy Update and Discussion: What we have so far…**
	Andrea Pompei, Project Manager
	Center for Hazards Research and Policy Development
3:55 – 4:00 PM	**Closing Remarks, Next Meeting Information: www.lexington-mitigation.org**

Meeting Follow-up:

1. WANTED: Feedback on mitigation goals, objectives, and action items.
2. Filling in the gaps: Has your organization completed mitigation projects that need to be included and haven't been mentioned?
3. WANTED: What is on your mitigation project "wish-list"? "If we could, then we would….."

Steering Committee Meeting 3: Handout

MITIGATION STRATEGY COMMENT FORM

If you have questions, comments, or additions for a Wish List, please fill out this Comment Form and submit to a Project Staff member at the conclusion of the Steering Committee Meeting or email responses to Andrea Pompei, Project Manager at andrea.pompei@louisville.edu

ACTION ITEM #	COMMENT
OUR ORGANIZATION'S PROJECT "WISH LIST"	
Type of Project	Description

Appendix 3.7 Steering Committee Meeting 4

Lexington Fayette Hazard Mitigation Plan Update

Steering Committee Meeting #4

September 27, 2012

1:30-3:30 pm

Kentucky Utilities
One Quality Street and Vine Street
Main Lobby
Sign in with security at the front lobby

1:30 – 1:45 PM	**Registration**
1:45 – 1:50 PM	**Welcome and Opening Comments** Pat Dugger, Director *LFUCG Division of Emergency Management*
1:50 – 2:30 PM	**Draft Plan Overview** *Josh Human & Andrea Pompei* *Center for Hazards Research and Policy Development*
2:30 –3:00 PM	**Draft Plan Discussion/Feedback** *Steering Committee and Planning Team*
3:00 - 3:30 PM	**Funding Opportunities** *Esther White* *UK Hazard Mitigation Grant Program*

Appendix 3.8 Open Public Involvement

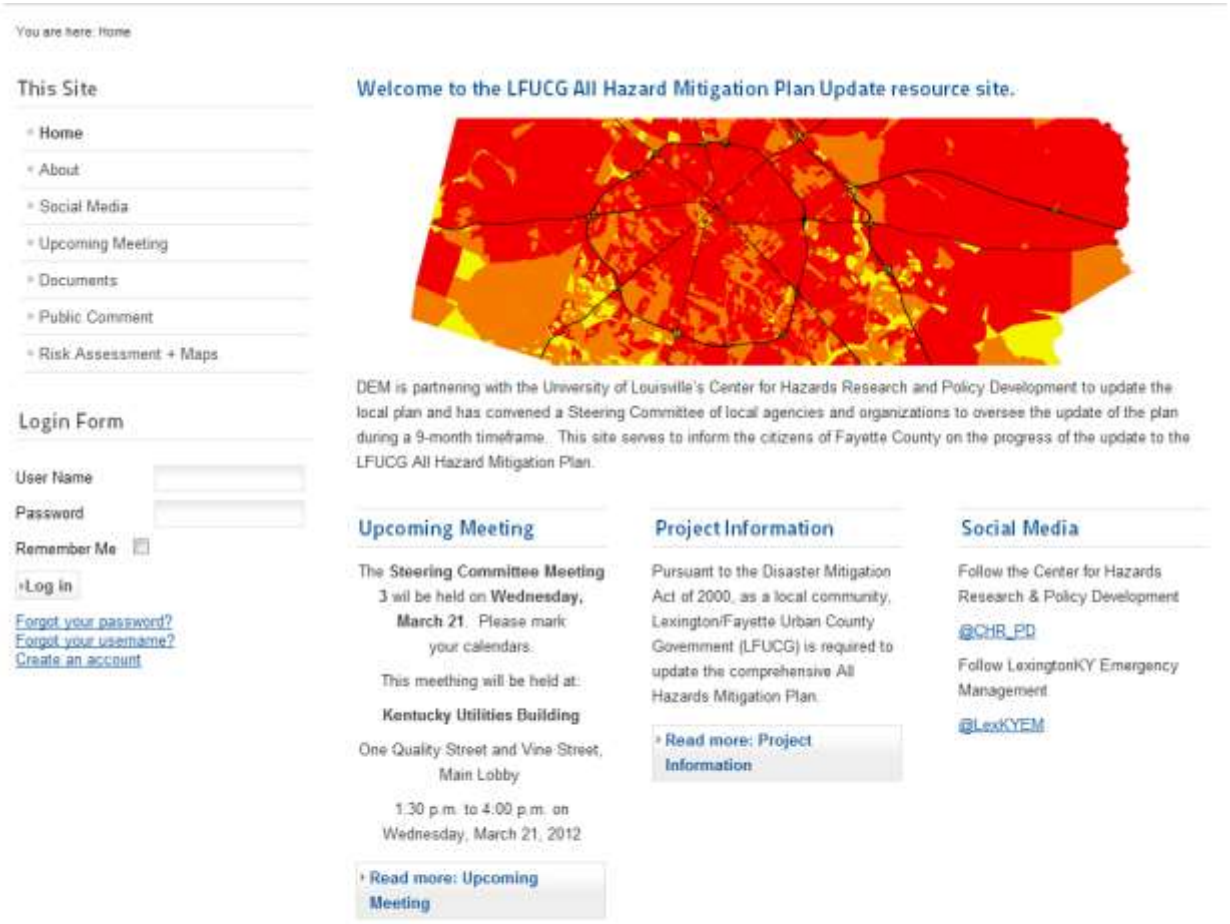
Public Involvement in Social Media: Social Media including Twitter was used as an alternative method of engaging the public during the planning process. Updates were provided on "@CHR_PD" and "@LexKYEM" on Twitter.

Announcements of SCM by Twitter

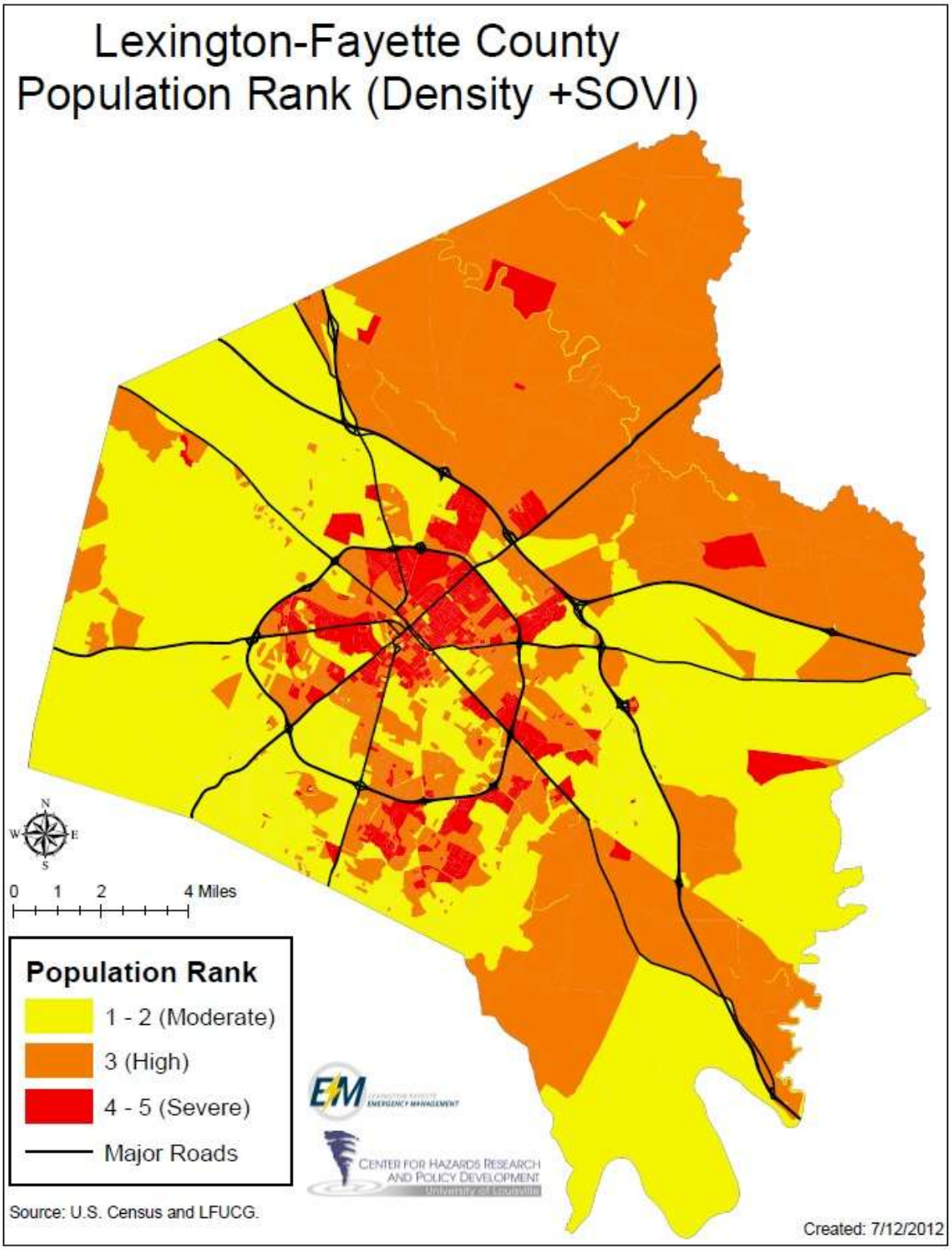
Live Coverage of SCM on Twitter

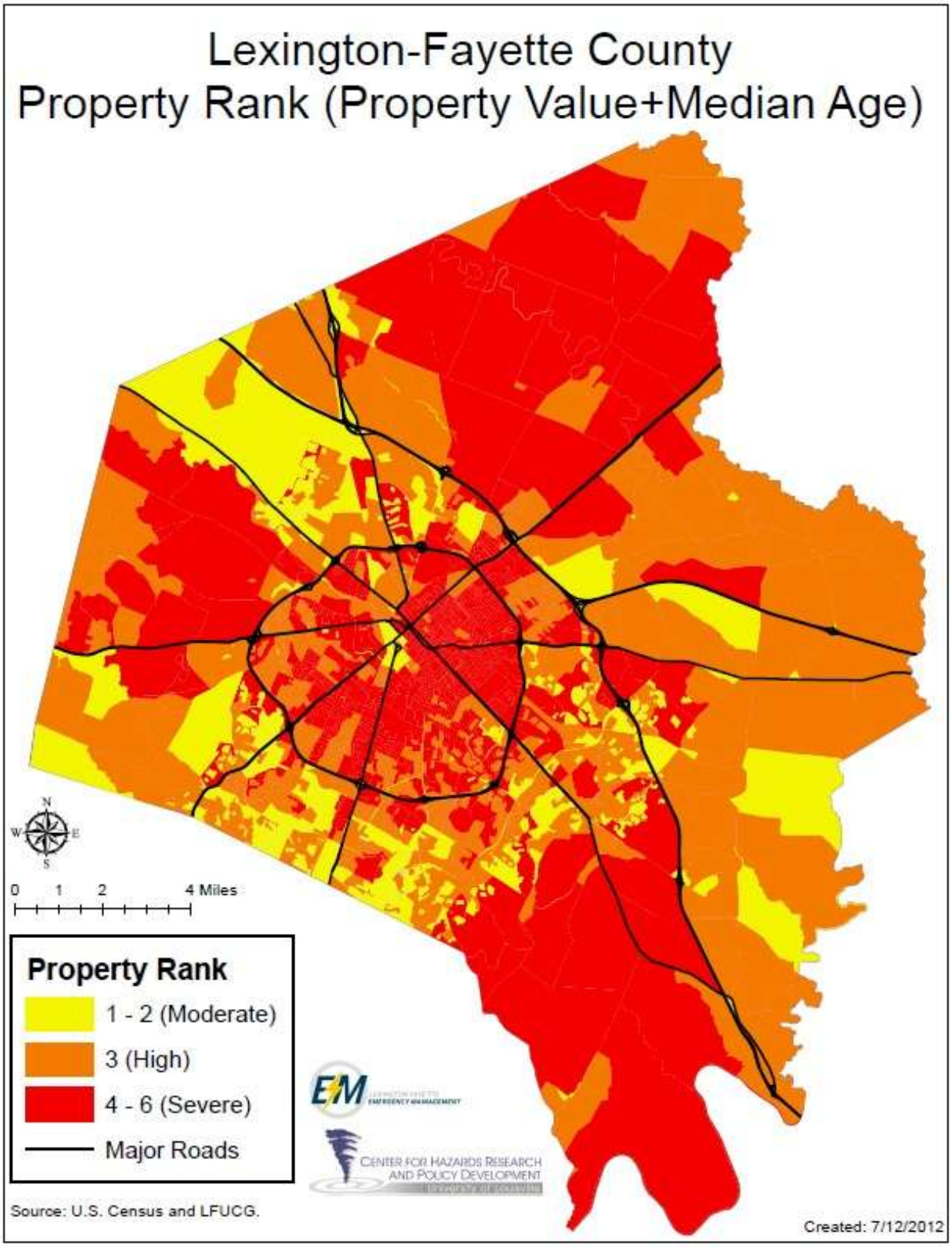
Live Coverage of SCM on Twitter

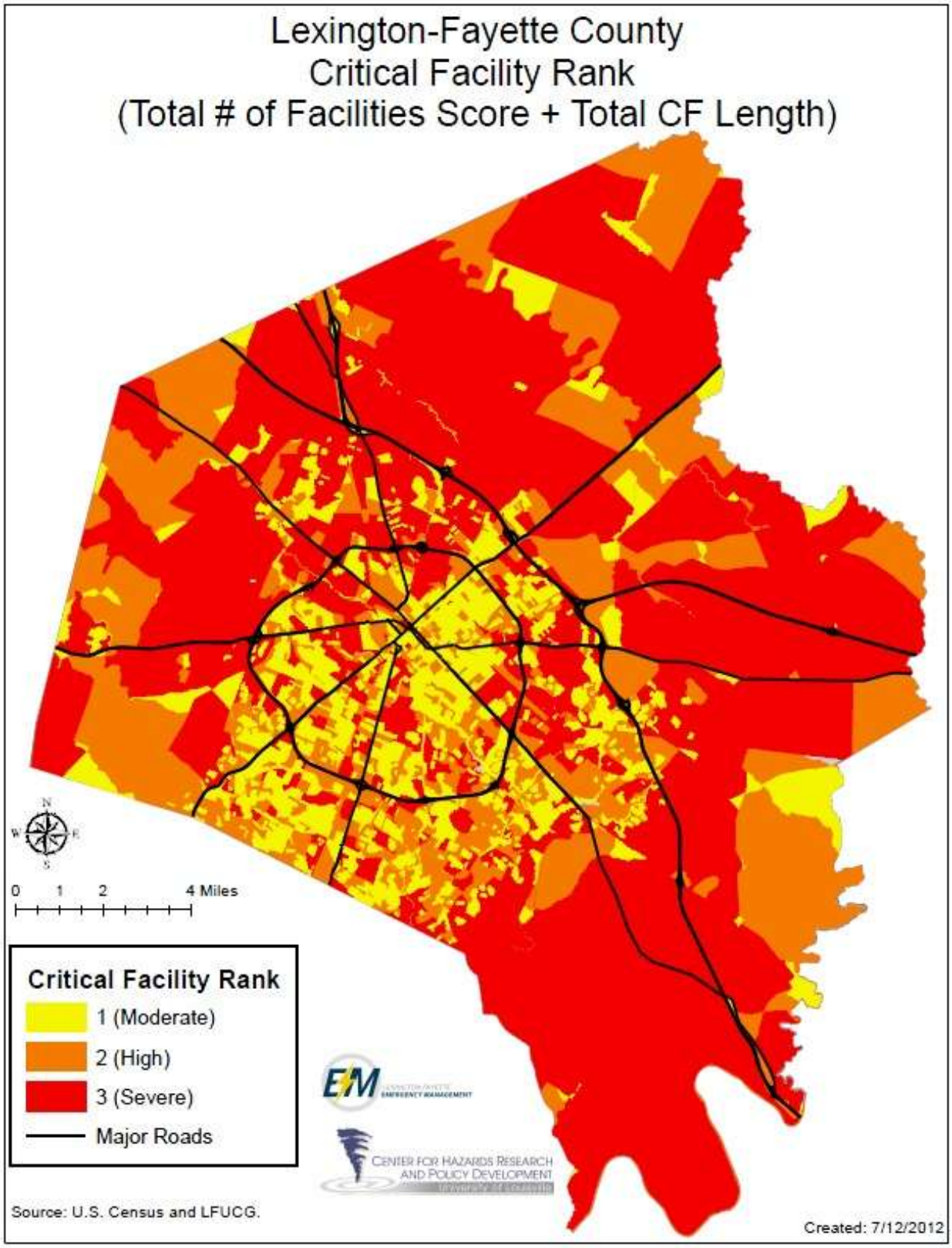
www.Lexington-Mitigation.org website was utilized to announce upcoming meetings and post documents.

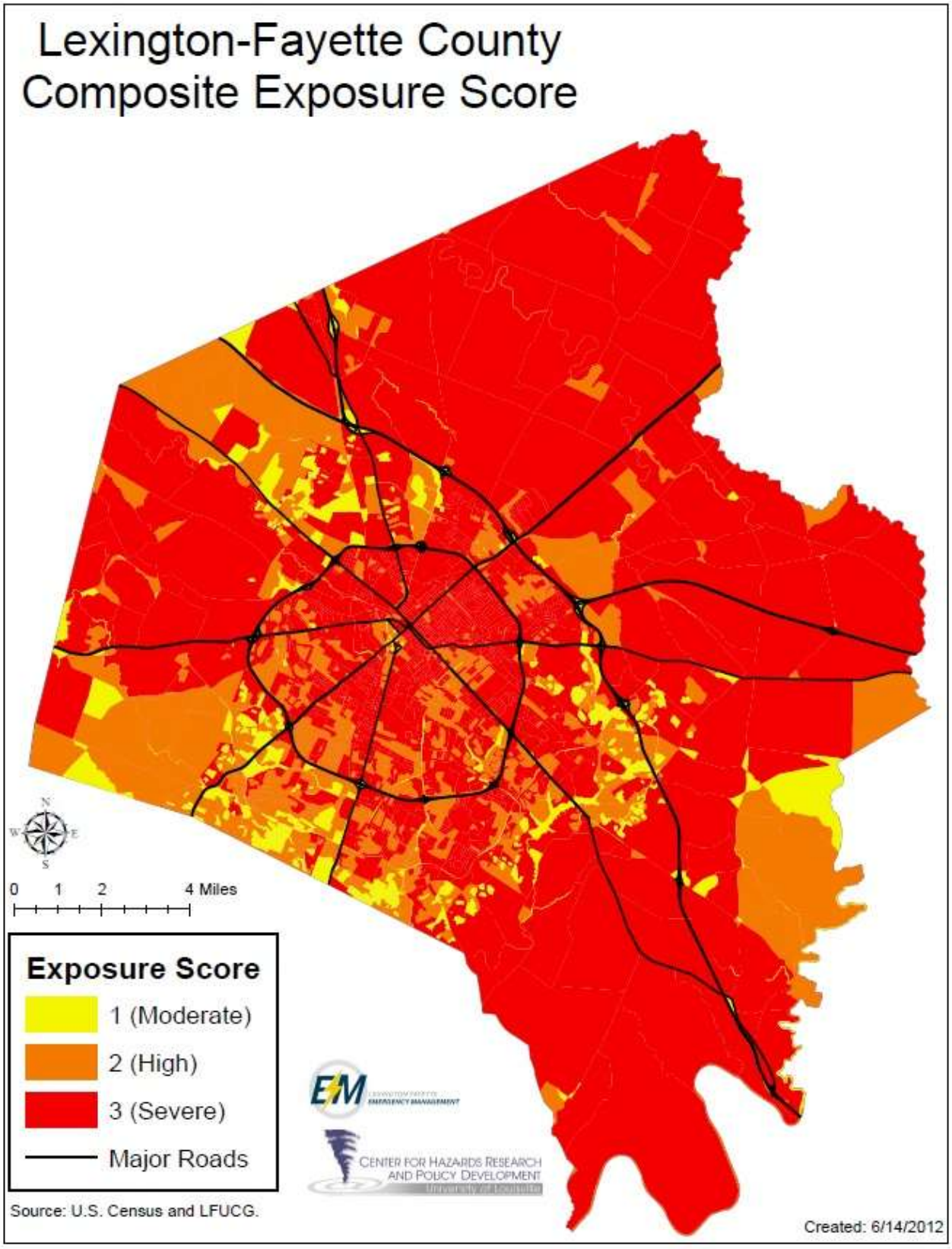


Appendix 4.1 Exposure Maps




Lexington-Fayette County
Property Rank (Property Value+Median Age)
N
W
E
S
0 1 2 4 Miles
Property Rank
1 - 2 (Moderate)
3 (High)
4 - 6 (Severe)
Major Roads
EM
Center for Hazards Research and Policy Development
Source: U.S. Census and LFUCG.
Created: 7/12/2012


Lexington-Fayette County
Critical Facility Rank
(Total # of Facilities Score + Total CF Length)
N
W
E
S
0 1 2 4 Miles
Critical Facility Rank
1 (Moderate)
2 (High)
3 (Severe)
Major Roads
EM
CENTER FOR HAZARDS RESEARCH AND POLICY DEVELOPMENT
Source: U.S. Census and LFUCG.
Created: 7/12/2012


Lexington-Fayette County
Composite Exposure Score
N
W
E
S
0 1 2 4 Miles
Exposure Score
1 (Moderate)
2 (High)
3 (Severe)
Major Roads
EM
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
Source: U.S. Census and LFUCG.
Created: 6/14/2012

Appendix 4.2 HAZUS Report

Hazus-MH: Earthquake Event Report

Region Name: Fayette County KY Earthquake

Earthquake Scenario: 1980 Earthquake Historical

Print Date: July 20, 2012

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
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

General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes 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 285.27 square miles and contains 61 census tracts. There are over 108 thousand households in the region which has a total population of 260,512 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 94 thousand buildings in the region with a total building replacement value (excluding contents) of 22,494 (millions of dollars). Approximately 91.00 % of the buildings (and 72.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,975 and 618 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 94 thousand buildings in the region which have an aggregate total replacement value of 22,494 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 79% 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 13 dams identified within the region. Of these, 4 of the dams are classified as 'high hazard'. The inventory also includes 45 hazardous material sites, 0 military installations and 0 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 2,593.00 (millions of dollars). This inventory includes over 228 kilometers of highways, 159 bridges, 4,128 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	159	194.20
	Segments	115	1,583.30
	Tunnels	0	0.00
	Subtotal		1,777.40
Railways	Bridges	13	1.50
	Facilities	2	5.30
	Segments	90	99.60
	Tunnels	0	0.00
	Subtotal		106.50
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	5	5.30
	Subtotal		5.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	1	10.70
	Runways	2	75.90
	Subtotal		86.60
	Total		1,975.80

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	41.30
	Facilities	3	97.90
	Pipelines	0	0.00
	Subtotal		139.20
Waste Water	Distribution Lines	NA	24.80
	Facilities	3	195.80
	Pipelines	0	0.00
	Subtotal		220.60
Natural Gas	Distribution Lines	NA	16.50
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		16.50
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	3	323.40
	Subtotal		323.40
Communication	Facilities	16	1.60
	Subtotal		1.60
	Total		701.20

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	1980 Earthquake Historical
Type of Earthquake	Historical
Fault Name	NA
Historical Epicenter ID #	3997
Probabilistic Return Period	NA
Longitude of Epicenter	-83.89
Latitude of Epicenter	38.19
Earthquake Magnitude	5.20
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Building Damage

Hazus estimates that about 55 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 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.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	444	0.47	2	1.00	1	1.44	0	1.93	0	1.06
Commercial	5,468	5.82	25	10.12	7	13.01	1	16.92	0	11.42
Education	202	0.22	1	0.32	0	0.44	0	0.56	0	0.61
Government	112	0.12	0	0.17	0	0.22	0	0.28	0	0.30
Industrial	1,546	1.65	8	3.13	2	4.13	0	5.33	0	2.76
Other Residential	13,637	14.52	48	19.22	11	21.67	1	19.24	0	20.51
Religion	564	0.60	3	1.20	1	1.64	0	2.15	0	1.92
Single Family	71,920	76.60	161	64.63	30	57.44	2	53.58	0	61.43
Total	**93,893**		**249**		**51**		**4**		**0**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	74,321	79.15	113	45.61	11	21.27	0	0.00	0	0.00
Steel	2,533	2.70	12	4.69	3	5.77	0	6.35	0	0.00
Concrete	655	0.70	2	0.83	0	0.62	0	0.40	0	0.00
Precast	673	0.72	3	1.26	1	2.88	0	4.69	0	0.00
RM	385	0.41	1	0.45	0	0.74	0	0.82	0	0.00
URM	13,767	14.66	104	41.94	32	62.63	4	86.53	0	100.00
MH	1,559	1.66	13	5.22	3	6.10	0	1.21	0	0.00
Total	**93,893**		**249**		**51**		**4**		**0**	

*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 2,043 hospital beds (98.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 99.00% of the beds will be back in service. By 30 days, 100.00% 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	11
Schools	92	0	0	92
EOCs	0	0	0	0
PoliceStations	2	0	0	2
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

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	After Day 7
Highway	Segments	115	0	0	115	115
	Bridges	159	0	0	159	159
	Tunnels	0	0	0	0	0
Railways	Segments	90	0	0	90	90
	Bridges	13	0	0	13	13
	Tunnels	0	0	0	0	0
	Facilities	2	0	0	2	2
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	5	5
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

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	After Day 7
Potable Water	3	0	0	3	3
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 (kms)	Number of Leaks	Number of Breaks
Potable Water	2,064	0	0
Waste Water	1,238	0	0
Natural Gas	826	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	108,288	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 77.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 80 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2 households to be displaced due to the earthquake. Of these, 1 people (out of a total population of 260,512) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	1	0	0	0
	Total	**1**	**0**	**0**	**0**
2 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**1**	**0**	**0**	**0**
5 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**1**	**0**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 3.49 (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.

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 3.47 (millions of dollars); 42 % 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 45 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.02	0.24	0.02	0.02	0.30
	Capital-Related	0.00	0.01	0.25	0.01	0.00	0.27
	Rental	0.05	0.10	0.21	0.01	0.01	0.36
	Relocation	0.16	0.06	0.23	0.03	0.05	0.53
	Subtotal	**0.20**	**0.19**	**0.93**	**0.06**	**0.08**	**1.46**
Capital Stock Losses							
	Structural	0.29	0.11	0.26	0.06	0.06	0.78
	Non_Structural	0.51	0.22	0.27	0.04	0.06	1.09
	Content	0.04	0.02	0.04	0.01	0.01	0.13
	Inventory	0.00	0.00	0.00	0.00	0.00	0.01
	Subtotal	**0.84**	**0.34**	**0.57**	**0.12**	**0.13**	**2.00**
	Total	**1.04**	**0.53**	**1.50**	**0.18**	**0.21**	**3.47**

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.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,583.25	$0.00	0.00
	Bridges	194.15	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**1777.40**	**0.00**	
Railways	Segments	99.64	$0.00	0.00
	Bridges	1.48	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	5.33	$0.01	0.10
	Subtotal	**106.50**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	5.34	$0.01	0.12
	Subtotal	**5.30**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	10.65	$0.01	0.06
	Runways	75.93	$0.00	0.00
	Subtotal	**86.60**	**0.00**	
	Total	**1975.80**	**0.00**	

Table 13: Utility System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	97.90	$0.00	0.00
	Distribution Lines	41.30	$0.00	0.00
	Subtotal	**139.18**	**$0.00**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	195.80	$0.00	0.00
	Distribution Lines	24.80	$0.00	0.00
	Subtotal	**220.57**	**$0.00**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	16.50	$0.00	0.00
	Subtotal	**16.51**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	323.40	$0.00	0.00
	Subtotal	**323.40**	**$0.00**	
Communication	Facilities	1.60	$0.00	0.00
	Subtotal	**1.57**	**$0.00**	
	Total	**701.24**	**$0.00**	

Table 14. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

LOSS	Total	%

Appendix A: County Listing for the Region

Fayette,KY

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Kentucky	Fayette	260,512	16,307	6,186	22,494
Total State		**260,512**	**16,307**	**6,186**	**22,494**
Total Region		**260,512**	**16,307**	**6,186**	**22,494**

Appendix 5.1 State Hazard Mitigation Capability Matrix

STATE AND LOCAL CAPABILITY ASSESSMENT MATRIX					
	Effect on Mitigation of Hazards at the County Level				Hazard Mitigation Application
	Pre-Disaster	Post-Disaster	Affects Development in Hazard Prone Areas	Capable of Funding Mitigation Initiatives	
Authorities					
Floodplain Management Ordinances	X	X	X	X	County level floodplain ordinances/regulations regulate development within floodplains through special permitting. These regulations allow the community to participate in the NFIP and makes flood insurance available to its citizens and businesses.
			X		KRS 151 - The Energy and Environment Cabinet shall administer KRS 151 and establish the requirements for obtaining a floodplain development permit (KRS 151.250).
	X		X		The water resources authority shall develop a public information program for use by local units of government which will assist them in the development of floodplain management and flood hazard mitigation programs (KRS 151.600).
	X			X	KRS 147 - Any general fund appropriations made for the Local Match Participation Program may be used for flood control planning and mitigation activities and straight sewage pipe removal and mitigation activities (KRS 147A.029).

STATE AND LOCAL CAPABILITY ASSESSMENT MATRIX					
	Effect on Mitigation of Hazards at the County Level				Hazard Mitigation Application
	Pre-Disaster	Post-Disaster	Affects Development in Hazard Prone Areas	Capable of Funding Mitigation Initiatives	
Buildings Codes	X		X		KRS 198B - The Uniform State Building Code (KRS 198B.050) addresses issues concerning seismic and severe wind construction in response to the Commonwealth's potential earthquake and wind threats.
Zoning Regulations	X		X		KRS 100.201(2) states the local jurisdictions may enact permanent land use regulations, including zoning and other growth management regulations to promote public health, safety, morals, and general welfare of the jurisdiction.
Subdivision Regulations	X	X	X		Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls typically require that sub dividers install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. They prohibit the subdivision of land subject to flooding unless flood hazards are overcome through filling or other measures, and they prohibit filling of floodway areas. Subdivision regulations require that subdivision plans be approved prior to the division/sale of land. Subdivision regulations are a more limited tool than zoning and only indirectly affect the type of use made of land or minimum specifications for structures.
Fire Prevention Codes (State)	X		X		KRS 227.320 Local authorities will adopt and enforce the standards of safety promulgated by the commissioner. Rules and regulations set up by the commissioner prescribes a standard of safety from fire loss; these rules and regulations establish a minimum requirement concerning the matters covered.

STATE AND LOCAL CAPABILITY ASSESSMENT MATRIX					
	Effect on Mitigation of Hazards at the County Level				Hazard Mitigation Application
	Pre-Disaster	Post-Disaster	Affects Development in Hazard Prone Areas	Capable of Funding Mitigation Initiatives	
Fire Prevention Codes (State) Continued	X				KRS 149.400 There are two official fire hazard seasons as established by the state legislature. The fire seasons run from February 15 - April 30 and October 1- December 15. During the official fire seasons, "it shall be unlawful for any person to set fire to, or procure another to set fire to any flammable material capable of spreading fire, located in or within one hundred fifty (150') of any woodland or brushland, except between the hours of 6:00 p.m. and 6:00 a.m., prevailing local time, or when the ground is covered with snow".
	X				Open burning requirements are outlined in 401 KAR 63:005.
Stormwater Management Plan	X		X		Federal mandated program for Urban Areas as designated by the 2000 Census. The plans must provide six minimum controls on the management of storm water runoff to include; public education and outreach on storm water impacts, Public Involvement/Participation, Illicit discharge detection and elimination, construction site storm water runoff control, and post-construction storm water management in new development and redevelopment.
Hazardous Materials Ordinance	X	X	X		County level ordinance that regulate the storage and control of hazardous materials and requires reporting of releases of hazardous materials into the environment within the county.
Programs					
NWS Storm Ready Program	X	X			StormReady helps community leaders and emergency managers strengthen local safety programs through education and preparedness training

STATE AND LOCAL CAPABILITY ASSESSMENT MATRIX					
	Effect on Mitigation of Hazards at the County Level				Hazard Mitigation Application
	Pre-Disaster	Post-Disaster	Affects Development in Hazard Prone Areas	Capable of Funding Mitigation Initiatives	
Emergency Support Functions (ESF #5)	X	X		X	ESF #5, emergency management, is responsible for supporting overall activities of the Federal Government for domestic incident management. DEM is in the process of developing an ESF #5 Plan to replace the current EOP.
Community Rating System (CRS)	X	X	X	X	The rating system rewards communities that voluntarily take steps beyond the minimum requirements of the NFIP to reduce flood risk and increase the effectiveness of flood insurance protection. Such activities can fall under one or more of the following categories: Flood Preparedness; Flood Damage Reduction; Mapping and Regulations; and Public Awareness.
Flood Map Modernization	X		X		Modernization is a cornerstone for helping communities to be better prepared for flood disasters. The NFIP currently serves 4.5 million policyholders and provides $650 billion in coverage nationwide. Kentucky is in the process of updating flood maps statewide with the goal of identifying flood hazards for areas that drain more than 1 square mile (640 acres). It is important to remember that every stream, large or small, has a floodplain and that any downstream structure may be damaged during flooding. The new aerial-photo-base maps will show areas that are likely to be flooded during a 1-percent-annual-chance flood. To accomplish map modernization, KDOW has formed partnerships with the KYTC, KGS, Kentucky KyEM, USGS, Kentucky Council of Area Development Districts (ADDs), and U.S. Army Corps of Engineers (USACE).
Resources					
Local Economic Development				X	A possible resource for supporting growth and development throughout the county, some counties have economic development authorities some only have foundations
Regional Development Agency				X	Regional resource that assists in the development of a local hazard mitigation plan, grant writing and possible funding sources.

STATE AND LOCAL CAPABILITY ASSESSMENT MATRIX					
	Effect on Mitigation of Hazards at the County Level				Hazard Mitigation Application
	Pre-Disaster	Post-Disaster	Affects Development in Hazard Prone Areas	Capable of Funding Mitigation Initiatives	
Local Emergency Management Agency	X	X	X	X	Lexington's Division of Emergency management serves as a conduit for the local authority to manage and disseminate actions in pre-disaster and post-disaster localities throughout the state. Their mission is to enhance the public safety of Lexington Fayette County residents and businesses through emergency preparedness, mitigation, response and recovery.
State Emergency Management Agency	X	X	X	X	KRS 39A.050 The KyEM shall coordinate for the Governor all matters pertaining to the comprehensive emergency management program and disaster and emergency response of the Commonwealth. The division shall be the executive branch agency of state government having primary jurisdiction, responsibility, and authority for the planning and execution of disaster and emergency assessment, mitigation, preparedness, response, and recovery for the Commonwealth.
Local Emergency Planning Committee	X	X	X	X	The primary mission of the Fayette Local Emergency Planning Committee (LEPC) is to develop and implement a community emergency response plan for releases of Extremely Hazardous Substances (EHS); provide an interface between facilities handling EHS and the public; and provide education for appropriate protective actions to the community.
Floodplain Management Plan	X		X	X	The Floodplain Management Plan is a mandatory element of participation in the CRS Program and must be updated every five years. The most recent plan update was in 2011.
Kentucky Drought Mitigation and Response Plan	X	X	X		Fulfills the directive of Senate Joint Resolution 109 December 31, 2008. This plan serves as a foundation to a proactive drought planning process intended to reduce drought risk in Kentucky. The plan describes a collaborative approach to accelerate the decision-making processes of state and federal agencies that are necessary to assist local government efforts in drought response.

Appendix 5.2 Five-Year Action Plan

Hierarchical Action Matrix (Low to Very High)

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
2.3.5 *Implement*	B	Very High	2 yrs.	Flooding	Review and implement proposed Greenway Manual in alignment with revisions to the Stormwater Manuals and related regulations	DOWQ Planning	Departmental
1.1.3 *Acquire and Train*	B	High	1-5 yrs.	All-hazards	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.	Division of Fire and Emergency Services Division of Police	Grant
1.1.4 *Train*	B	High	Annually	All-hazards	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.	FC Public Schools First Responders Communications Multicultural Affairs	Grants Department
1.1.8 *Fund*	B	High	Immediate to 3 yrs.	Severe Storm Tornado	Obtain funding to maintain and upgrade existing outdoor warning systems.	DEM	Grant Internal
1.1.9 *Fund*	B	High	Annually	HAZMAT	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.	DEM DOWQ First Responders	Grant
1.2.2 *Install*	C	High	1-3 years	Flooding	Install flood marker signs that include both a “Road May Flood” sign, as well as signage indicating water depth.	DEM DOWQ KDOH	Internal
1.3.1 *Assess*	B	High	Annually	All-hazards	Request that natural hazard mitigation assessments be conducted on the current utility and communication infrastructure and the conclusions to be provided to DEM.	DEM KY Utilities	Internal

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.3.2 *Assess*	B	High	3-5 yrs.	All-hazards	As resources permit, conduct mitigation assessments on LFUCG owned and operated buildings to ensure that they are resistant to natural and man-made hazard events.	Building Inspection Code Enforcement DEM DOWQ First Responders Risk Management	Grant
1.3.3 *Update, Maintain, and Train*	B	High	Annually	All-hazards	As resources permit, conduct updates, maintenance and training on Emergency Plans of LFUCG owned and operated buildings.	Building Inspection Code Enforcement DEM DOWQ First Responders Risk Management	Internal
2.2.1 *Inventory*	B	High	2-5 yrs.	All-hazards	Develop inventory of farmland in order to build a business plan.	DEM UK Ag	Departmental Internal
3.1.1 *Fund*	B	High	Immediate to 3 yrs.	All-hazards	Obtain funding to hire a planner for the DEM	Council DEM Mayor	Internal
3.1.2 *Integrate Info*	B	High	Every 2 yrs.	All-hazards	Better integrate ESF-5 and 14 into the planning process for the Emergency Operations Plan	DEM	Internal
3.1.3 *Exercise*	B	High	3-5 yrs.	All-hazards	Conduct an exercise with a priority of focusing on mitigation and recovery.	DEM	Grant Internal
3.1.4 *Integrate Info*	B	High	3-5 yrs.	All-hazards	Better incorporate regional and state assets/resources into pre-disaster planning programs	DEM	Departmental
3.2.1 *Community Outreach*	B	High	Annually	All-hazards	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.	DEM	Internal
3.3.1 *Guide Policy*	B	High	Every 2 years	All-hazards	Review, assess, and make recommendations on hazard related laws, regulations, codes, policies, and other guidelines. Ensure LEP populations are included in said policies and guidelines.	DEM Code Enforcement/ Building Inspection Multicultural Affairs	Internal Departmental

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
5.1.1 *Methodology*	B	High	1-3 yrs.	All-hazards	**a.** Establish stakeholder taskforce quarterly meetings. **b.** Design a methodology and system to better archive and manage local data types after a natural and/or man-made hazard event, including at-risk LEP populations.	Code Enforcement/ Building Inspection DEM DOWQ Engineering Multicultural Affairs Public Works Risk Management	Internal Departmental
5.3.2 *Map and Enhance*	B	High	3-5 yrs.	Severe Storm Tornado	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.	DEM Division of Fire and Emergency Services Division of Police	Grant
1.1.1 *Research*	D	Medium	Annually	All-hazards	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.	Division of Fire and Emergency Services Division of Police LFUCG Agencies	Grant Internal
1.1.2 *Inventory*	D	Medium	Annually	All-hazards	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.	Division of Fire and Emergency Services Division of Police LFUCG Agencies	Grant Internal
1.1.5 *Educate*	D	Medium	Annually	All-hazards	Provide cross-cultural communication training to first responders to educate and assist with effectively communicating with the LEP population.	First Responders LEP Experts and Support Groups Multicultural Affairs	Internal
1.1.6 *Upgrade*	B	Medium	3-5 yrs.	All-hazards	Upgrade existing DEM facilities for a stand-alone Emergency Operations Center.	DEM	Grant
1.1.7 *Fund*	B	Medium	Annually	Severe Storm Tornado	Explore funding opportunities for community tornado shelter construction in accordance with FEMA guidelines.	DEM	Grant Internal

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
1.2.1 *Educate*	D	Medium	Annually	All-hazards	Conduct outreach to educate citizens on how to receive up-to-date evacuation instructions, shelter-in-place procedures, and information pertaining to hazardous material exposure.	DEM LEPC	Internal
2.1.1 *Develop*	D	Medium	1-5 yrs.	All-hazards	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.	DEM DOWQ G.I.S. & I.T. Hospitals	Internal
2.1.2 *Collect Data*	D	Medium	2-3 yrs.	All-hazards	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.	DEM LEP Experts and Support Groups Multicultural Affairs	Departmental
2.3.1 *Provide Info*	D	Medium	Every 2 yrs.	Flooding	Provide information to the housing industry through publications and electronic resources about residential floodproofing, tornado safe rooms and community tornado shelters, as well as guidelines and criteria for construction.	DEM Engineering Code Enforcement Building Inspection Communications	Departmental
2.3.2 *Acquisition*	B	Medium	Annually	Flooding	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.	CAO Office DOWQ Parks & Recreation PDR Planning	Internal
2.3.3 *Acquisition*	A	Medium	Annually	Flooding	When resources permit, work to purchase and demolish floodprone structures that meet NFIP/CRS guidelines for repetitive loss or for having repeated or extensive flood damage.	Engineering	Grant

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
2.3.4 *Fund*	A	Medium	Annually	Flooding	To seek and request consistent funding sources for the completion of prioritized stormwater projects in accordance with identified priority storm water projects.	DOWQ	Grant Departmental
3.1.5 *Integrate Info*	D	Medium	1-3 yrs.	All-hazards	Once available, explore the opportunity to participate in the Commonwealth Hazard Assessment Mitigation Planning System (CHAMPS) as advised by KyEM.	DEM	Internal
3.2.2 *Fund*	D	Medium	Annually	All-hazards	When available, obtain funding and support for CERT supplies and equipment, volunteer coordination, and recognition/appreciation events for volunteers.	DEM	Grant Internal
3.2.3 *Partner*	D	Medium	2-5 yrs.	All-hazards	Develop LEP partnerships; invite LEP reps to the table in planning and education efforts.	DEM LEP Experts and Support Groups Multicultural Affairs	Departmental
3.2.4 *Community Outreach*	D	Medium	1-3 yrs.	All-hazards	Increase business and private sector (i.e. the Lexington Chamber of Commerce) involvement in the emergency management system.	Chamber of Commerce DEM	Internal
3.3.2 *Partner*	D	Medium	Annually	All-hazards	Combine and submit annual request for mitigation project updates and annual reporting for the FMP and HMP.	DEM Planning	Internal Departmental
4.1.1 *Provide Info*	D	Medium	Annually	All-hazards	Provide multi-lingual information to LFUCG agencies, media, and other LEP organizations, CERT, and the public at-large through publications and electronic resources about emergency procedures.	Code Enforcement DEM LEPC LEP Experts and Support Groups Multicultural Affairs	Internal
4.1.2 *Provide Info*	D	Medium	3 yrs.	All-hazards	Identify source (such as FEMA) and disseminate educational information in top foreign (macro) languages like Spanish, French, Swahili, and Arabic as funds allow.	DEM FC Public Schools LEP Experts and Support Groups Multicultural Affairs	Internal Departmental

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
4.2.1 *Outreach*	D	Medium	1-2 yrs.	All-hazards	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.	DEM Planning	Internal
4.2.2 *Training*	D	Medium	3-5 yrs.	All-hazards	When funding permits, conduct hazard mitigation related training seminars and workshops for local building code enforcement officials.	Code Enforcement/ Building Inspection DEM	Grant
4.3.1 *Assess Cost*	D	Medium	2-4 yrs.	All-hazards	Assess feasibility and cost of providing Lexington Fayette's Local Channel 3 to Direct TV and satellite subscribers.	DEM TV Station Providers	Internal
4.3.2 *Educate*	D	Medium	2-4 yrs.	All-hazards	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.	DEM FC Public Schools Multicultural Affairs Private Schools	Internal Grant
4.3.3 *Integrate Info*	D	Medium	1-3 yrs.	All-hazards	Encourage and leverage national, state, or local resources already available in other languages to be made available to general public and LEP communities.	Communications FC Public Schools Multicultural Affairs Private Schools	Internal
5.1.2 *Collect Data*	D	Medium	Annually	HAZMAT	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.	DEM DOWQ Hospitals KY Utilities Railroad Carriers	Internal Departmental
5.2.1 *Distribute Info*	D	Medium	Annually	Flooding	Share and distribute HMP and FMP CRS and annual reports to LFUCG agencies and other steering committee members for review as outlined in the plan maintenance timeline of this plan.	DOWQ Engineering Planning	Internal
5.2.2 *Integrate Info*	D	Medium	5 yrs.	Flooding	Merge future HMP annual progress reporting process with CRS FMP annual reporting process as outlined in the plan maintenance	DEM DOWQ Planning	Internal Departmental

Action	Benefit Ranking	C-B	Time Frame	Hazards Addressed	Description	Offices Responsible	Funding Consideration
					section of this plan.		
5.3.1 *Community Outreach*	D	Medium	Annually	All-hazards	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.	DEM Code Enforcement/ Building Inspection Planning Home Builders Association	Internal

Appendix 6.1 Mitigation Five-Year Planning Workbook

The "Mitigation Five-Year Planning Workbook" was developed to provide DEM and DP a tracking and mitigation project implementation tool to update the statuses of identified projects from both the HMP and FMP plans, and make new project revisions. This workbook brings the Five-Year Action Plan and Plan Maintenance tasks to life by allowing DEM to continually monitor action item statuses within one tabular workbook. Below are snap shots of each worksheet as described in Chapter 6.1.4.

Annual Reporting Schedule:

Frequency	Description	Quarter 1 01/01-03/31	Quarter 2 04/01-06/30	Quarter 3 07/01-09/30	Quarter 4 10/01-12/31	2013	2014	2015	2016	2017
Ongoing	Monitor and evaluate progress of Five-Year Action Plan.	DEM				Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Ongoing	Coordinate local efforts to monitor evaluate and update plan.	DEM				Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Annual	1. Submit request for completion of project progress reports for FMP and HMP to the Steering Committee.		DEM/DP			Future	Future	Future	Future	Future
Annual	2. Complete and return project progress reports.		SC			Future	Future	Future	Future	Future
Annual	3. Compile progress reports and produce annual report.		DEM/DP			Future	Future	Future	Future	Future
Annual	4. Conduct annual steering committee meeting to present draft annual report.			DEM/DP/SC		Future	Future	Future	Future	Future
Annual	5. Finalize and issue FMP and HMP annual report.			DEM/DP		Future	Future	Future	Future	Future
Annual	6. Submit annual report to Mayor/CRS/FEMA/State/Steering Committee by October 1.			DEM/DP		Future	F			
Annual	7. Issue press release and post link to annual report on website(s).			DEM/PI		Future	F			
5 years	Submit updated plan to State and FEMA	DEM				Future	F			

Abbreviations:

CRS	Community Rating System
DEM	Division of Emergency Management
DP	Division of Planning
FEMA	Federal Emergency Management Agency
FMP	Floodplain Management Plan
HMP	Hazard Mitigation Plan
PI	Public Information
SC	Steering Committee

Goals and Objectives:

GOAL 1	**Attempt to minimize the loss of life and injuries that could be caused by natural hazards.**
Objective 1.1	Facilitate the strengthening of public emergency and support agencies, including infrastructure, facilities, equipment, and personnel to natural and man-made hazards.
Objective 1.2	To build awareness of and inform citizens about areas or circumstances susceptible to hazards and having a great potential for loss of human life during a natural and man-made hazard event.
Objective 1.3	Control factors or prevent losses to critical facilities and infrastructure from 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.**
Objective 2.1	Support efforts that will assist with the continuity of critical business operations.

Mitigation Action Item Checklist:

Plan Source	Action	Cost/ Benefi	Timeframe (Years)	Hazards Addressed	Description	Offices Responsible	Funding/Budget Consideration	2013	2014	2015	2016	2017
Hazard Mitigation Plan	5.3.2 *Map and Enhance*	High	3-5 yrs	Severe Storm Tornado	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.	DEM Division of Fire and Emergency Services Division of Police	Grant	Future	Future	Future	Future	Future
Floodplain Management Plan	1		Ongoing	Flooding	Floodplain Ordinance	Planning	N/A	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing

Project Checklist Example Row:

Project Name/Title	Responsible Agency	Description	Action Item Addressed	Hazard Addressed	Type of Project	Status	Cost Type	Cost	Start Date	Completion Date	Comments
Derby Drive Stormwater Improvement Project	**DOWQ**	Acquire and demolish 4 flood prone properties	2.3.3	Flood	Acquisition	Complete	Final	$360,000	06/01/12	05/01/12	By removing these residences, property damage and potential safety issues are mitigated.

Amendment Record:

Amendment Number	Sponsor	Date	Amendment Purpose	Current Text	Section	Page	Line	Amended Text	Section	Page	Line
1											
2											
3											
4											

Annual Progress Reporting Timeline:

Frequency	Description	Quarter 1 01/01-03/31	Quarter 2 04/01-06/30	Quarter 3 07/01-09/30	Quarter 4 10/01-12/31	2013	2014	2015	2016	2017
Ongoing	Monitor and evaluate progress of Five-Year Action Plan.	DEM				Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Ongoing	Coordinate local efforts to monitor evaluate and update plan.	DEM				Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
Annual	1. Submit request for completion of project progress reports for FMP and HMP to the Steering Committee.		DEM/DP			Future	Future	Future	Future	Future
Annual	2. Complete and return project progress reports.		SC			Future	Future	Future	Future	Future
Annual	3. Compile progress reports and produce annual report.		DEM/DP			Future	Future	Future	Future	Future
Annual	4. Conduct annual steering committee meeting to present draft annual report.			DEM/DP/SC		Future	Future	Future	Future	Future
Annual	5. Finalize and issue FMP and HMP annual report.			DEM/DP		Future	Future	Future	Future	Future
Annual	6. Submit annual report to Mayor/CRS/FEMA/State/Steering Committee by October 1.			DEM/DP		Future	Future	Future	Future	Future
Annual	7. Issue press release and post link to annual report on website(s).			DEM/PI		Future	Future	Future	Future	Future
5 years	Submit updated plan to State and FEMA	DEM				Future	Future	Future	Future	Future

Abbreviations:

CRS	Community Rating System
DEM	Division of Emergency Management
DP	Division of Planning
FEMA	Federal Emergency Management Agency
FMP	Floodplain Management Plan
HMP	Hazard Mitigation Plan
PI	Public Information
SC	Steering Committee

Appendix 6.2 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 Project Checklists" 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. In the "Mitigation Project Checklists" excel workbook, a worksheet titled "Amendment Record" will allow DEM to document amendments as they occur.

Lexington Fayette County Hazard Mitigation Plan

Amendment Form

Amendment Sponsor: _____

Amendment #: _____

Date: MM/DD/YYYY

Current Text:_____
_____
_____
_____
_____
_____

Section:_____ Page_____ Line_____

Amended Text: _____
_____
_____
_____
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Section:_____ Page_____ Line_____

Purpose of Amendment: _____
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