RESOLUTION NO. 001, SERIES 2023

AN EMERGENCY RESOLUTION AUTHORIZING METRO GOVERNMENT TO ENDORSE ITS HAZARD MITIGATION PLAN UPDATE.

SPONSORED BY: COUNCIL PRESIDENT DAVID JAMES

WHEREAS, Louisville/Jefferson County Metro Government ("Metro Government") through the assistance of the Louisville/Jefferson County Information Consortium (LOJIC) and the Hazard Mitigation Planning Team and Advisory Committee pledged to endorse the development of a disaster resistant community plan using the guidance of the Disaster Mitigation Act of 2000; and

WHEREAS, such a Hazard Mitigation Plan was created, and pursuant to the Disaster Mitigation Act of 2000, the Hazard Mitigation Plan must be updated and approved every five (5) years; and

WHEREAS, Louisville Metro Emergency Management Agency serves as the coordinator for the development of the Hazard Mitigation Plan and has guided the planning process and assisted committees in developing appropriate mitigation activities to resolve or reduce the natural hazards inherent to this community; and

WHEREAS, the Advisory Committee's work has updated the proactive Hazard Mitigation Plan that will save lives and help government, local agencies, residents and businesses to prepare for a natural disaster and prevent or reduce losses; and

WHEREAS, the preparation of the Hazard Mitigation Plan update was delayed due to COVID-19 and the protests of 2020, but despite requests from both Metro Government and the Commonwealth of Kentucky, the Federal Emergency Management Agency ("FEMA") refused to grant any extensions for the update; and

WHEREAS, this Resolution requires emergency consideration as authorized by Council Rule 7.01 because the limitations of the regular Metro Council calendar combined with FEMA's requirement that such resolution must be passed before January 20, 2023 or Louisville Metro and the Louisville/Jefferson County Metropolitan Sewer District will lose out on grant opportunities relating to disaster prevention and relief, as well as upgrades to the sewer system, would make it impossible to review this matter without either emergency passage or the scheduling of special meetings.

NOW, THEREFORE, BE IT RESOLVED BY THE LEGISLATIVE COUNCIL OF THE LOUISVILLE/JEFFERSON COUNTY METRO GOVERNMENT AS FOLLOWS:

SECTION I: Metro Government is authorized to endorse the Hazard Mitigation Plan Update.

SECTION II: This Resolution shall take effect upon its passage and approval or otherwise becoming law.

Sonya Harward
Metro Council Clerk

Markus Winkler
President of the Council

Craig Greenberg
Mayor

January 11, 2023
Approval Date

APPROVED AS TO FORM AND LEGALITY:

Michael J. O'Connell
Jefferson County Attorney

LOUISVILLE METRO COUNCIL
ADOPTED
January 3, 2023

By: M. Holliday Hopkins

2022 Louisville Metro Hazard Mitigation Plan

LOUISVILLE METRO EMERGENCY SERVICES

AECOM

STATEMENT BY MANAGING DIRECTOR

The Louisville Metro Government is the catalyst for creating a world-class city that provides all its residents and visitors with safe and vibrant neighborhoods, great jobs, a strong system of education and innovation, and a high quality of life. The mission of Louisville Metro Emergency Services is to provide high quality and compassionate emergency and non-emergency response to the citizens and visitors of Louisville Metro and its local, regional, and state partners to achieve the most favorable outcomes for people, property, and the environment. Hazard Mitigation planning plays an important role in obtaining this mission.

According to the Federal Emergency Management Agency (FEMA), Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters. It begins with identifying natural disaster risks and vulnerabilities that are common to the area and then developing long-term strategies for protecting people and property from future similar events.

Therefore, Louisville Metro has developed this Hazard Mitigation Plan to act as a roadmap for identifying, assessing, and addressing community risk. Of note in 2022, we have refined the goals of the plan to address the changing risk in our communities: addressing inequities to ensure every resident has the resources to stay informed and protected before, during, and after a disaster; fostering opportunities for partnerships and collaboration across the whole community; and reducing hazards in areas of high risk. This plan includes updated assessments of the hazards identified in the 2016 Hazard Mitigation Plan, as well as incorporating several new hazards to include civil unrest, cyber incidents, and public health emergencies to include pandemics such as Covid-19.

By putting mitigation at the forefront, Louisville Metro is prioritizing building community resilience. Doing so permits us to execute all mission areas of Emergency Management from a safer perspective. The plan complies with federal and state hazard mitigation planning requirements to establish eligibility for funding under FEMA grant programs.

Edward "Jody" Meiman
Managing Director
Louisville Metro Emergency Services

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EXECUTIVE SUMMARY

Hazard mitigation helps to reduce or eliminate potential losses from future disasters. Hazard mitigation planning helps to establish and maintain a process that leads to the implementation of hazard mitigation actions. Louisville Metro is intimately familiar with the impacts of hazards on its residents, visitors, infrastructure, and economy. This 2022 update to Hazard Mitigation Plan (Plan) again re-affirms the jurisdiction's commitment to continual improvements to its local mitigation strategy and program.

The 2022 hazard mitigation planning process began with the identification of a broad-reaching local Hazard Mitigation Team, led by the Louisville Metro Emergency Services, which guided the development of the updated plan. Based on significant updates and actions from the major Lead Agencies charged with implementation of the Plan and other stakeholders, as well as the inclusion of three new hazards, this Plan includes significant changes compared to those completed in a typical update cycle. Since the 2016 Plan was approved, the state has been subjected to several major disasters, a challenge in any operating environment. But 2020 presented new hurdles, the challenges brought on by the ongoing coronavirus pandemic and Covid-19 response (currently the most expensive Presidentially declared disaster in American history), and civil unrest brought on by the Breonna Taylor protests.

The steps involved in plan development included the detailed identification of natural, technological, and human-caused hazards that can impact Louisville Metro, and an assessment of the vulnerability, and ultimately the risk, presented by those hazards. Next steps included a thorough evaluation of current mitigation capabilities, followed by an update to Louisville Metro's overall mitigation strategy.

This strategy identified several overarching Mitigation Themes and Objectives that define Louisville Metro's path forward to implementing hazard mitigation. These include:

- Identifying natural hazards that are most likely to impact Louisville Metro—now and in the future—providing an opportunity for a focused risk analysis and prioritization of mitigation strategies and resiliency efforts
- Minimizing the loss of life and personal injuries from all-hazard events
- Reducing losses and damage to Louisville Metro and private assets
- Decreasing federal, state, local, and private costs of disaster response and recovery
- Developing strategies and actions for three new hazards: public health emergencies (to include Covid), cyber incidents, and civil unrest
- Supporting mitigation initiatives and policies that promote disaster resiliency, nature-based solutions, cultural resources and historic preservation, and climate adaptation strategies
- Verifying critical facilities and Louisville Metro asset data
- Maximizing opportunities for collaboration and excitement between stakeholders over future hazard mitigation opportunities to ensure the safety of Louisville Metro's citizens, protection of property, environmental sustainability, community resiliency, and the preservation of cultural and historic resources for future generations

Implementation of these overarching themes and objectives requires goals, strategies, and actions. **Section 6** of the Plan outlines these measures.

Early in the planning process, the Steering Committee developed a list of Plan goals, to include seven goals carried over from the 2016 Plan, and a new consideration for social equity and environmental justice. This brings the total number of Plan goals to 8. Each goal, including the newly developed goal for 2022 (emphasized in bold) is presented below.

2022 Louisville Metro Hazard Mitigation Plan Goals

1. Minimize the loss of life and injuries that could be caused by multi-hazards
2. Facilitate a sustainable economy by protecting agriculture, business, and other economic activities from multi-hazards
3. Facilitate the strengthening of public emergency services, its infrastructure, facilities, equipment, and personnel to multi-hazards
4. Develop a community-wide mitigation effort by building stronger partnerships between government, businesses, and the general public
5. Increase public and private understanding of multi-hazard mitigation through the promotion of mitigation education and awareness of multi-hazards.
6. Enhance existing or design new policies and technical capabilities that will reduce the effects of multi-hazards
7. Enhance existing technical and GIS data and capabilities that will reduce the effects of multi-hazards.
8. **Promote the development of policies, programs, initiatives, and projects that prioritize diversity, equity, and environmental justice.**

The final and most important piece of the Plan is defining the path forward. The planning process defined a clear direction for implementation and maintenance. The Plan addresses each required element of 2 Code of Federal Regulations (CFR) §201.4. Louisville Metro has developed this Plan update to proactively supports Louisville Metro's Emergency Management Agency (EMA) Hazard Mitigation program and ensure that during the 5 years of this plan's lifecycle, it will be used to support grant sub-application submissions.

The Plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (DMA) (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (2 CFR §201.4 and §201.5), and finalized on October 31, 2007. (Hereafter, these requirements, and regulations will be referred to collectively as the Disaster Mitigation Act.)

The Disaster Mitigation Act of 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), created the framework for state, local, tribal, and territorial governments to engage in hazard mitigation planning to receive certain types of non-emergency disaster assistance. Requirements and procedures to implement hazard mitigation planning provisions may be found in CFR, Stafford Act Title 44, Chapter 1, Part 201 (44 CFR Part 201).

Since the Disaster Mitigation Act of 2000 amended the Stafford Act, additional laws have been passed that help to shape hazard mitigation policy. These revisions are included in the Sandy Recovery Improvement Act (SRIA) of 2013, the National Flood Insurance Act of 1968, and the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016.

The following grant programs have an approved and adopted hazard mitigation plan eligibility requirement:

- Hazard Mitigation Grant Program (HMGP)
- Public Assistance Grant Program (PA)
- Building Resilient Infrastructure and Communities (BRIC)
- Pre-Disaster Mitigation (PDM)
- HMGP Post Fire Assistance (HMGP-PFA)
- Flood Mitigation Assistance (FMA)

Louisville Metro assures that it will comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding in compliance with 2 CFR Part 200, Subpart C. Louisville Metro will amend the Plan whenever necessary to reflect changes in local, state, or federal laws and statutes, as required in 44 CFR §201.6. The adoption of this Plan demonstrates Louisville Metro's commitment to fulfilling the mitigation objectives in the Plan, and authorizes the agencies identified in the Plan to execute their responsibilities.

1 Introduction

Louisville Metro's 2022 Hazard Mitigation Plan Update (Plan) builds on the Louisville Metro Hazard Mitigation Plan of 2016. In addition to ensuring that all requirements outlined in 2 CFR §201.4 are met, sections of the Plan were updated, expanded, newly developed, and consolidated to provide a more concise picture of Louisville Metro mitigation activities.

This plan follows guidance contained in the Federal Emergency Management Agency's (FEMA) Local Mitigation Plan Review Guide (Guide) dated October 1, 2011. This guide is FEMA's official source for defining the requirements of original and updated Local Mitigation Plans. The Guide represents FEMA's interpretation of a statutory or regulatory requirement

The intended use of the Guide is to help Federal and State officials assess Local Mitigation Plans in a fair and consistent manner, and to ensure approved Local Mitigation Plans meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations (CFR) §201.6.

1.1 Scope

The Disaster Mitigation Act of 2000 (DMA 2000) requires state, local, and tribal governments to have an adopted, Federal Emergency Management Agency (FEMA)-approved hazard mitigation plan to be eligible for federal hazard mitigation and certain federal disaster recovery funding programs. DMA 2000 requires that these plans be updated on a 5-year cycle. Louisville Metro's latest hazard mitigation plan was adopted in 2016.

The Louisville Metro Hazard Mitigation Plan covers all of the jurisdictions within Jefferson County. Since 2003, Louisville's borders have been the same as those of Jefferson County, after a city-county merger. The official name of this consolidated city-county government is the Louisville/Jefferson County Metro Government, abbreviated to Louisville Metro. Despite the merger and renaming, the term "Jefferson County" continues to be used in some contexts in reference to Louisville Metro, particularly including the incorporated cities outside the "balance" that make up Louisville proper.

According to the U.S. Census, the estimated 2021 population of Louisville (city) was 246,161, while the balance of Jefferson County had a population of 386,883, making a combined population total of 633,044[1]. The balance total of 633,044 excludes other incorporated places and semi-autonomous towns within the county, but is the population listed in most sources and national rankings. The Louisville-Jefferson County, KY-IN Metropolitan Statistical Area (MSA) includes Louisville-Jefferson County and 12 surrounding counties: seven in Kentucky, and five in Southern Indiana. As of 2020, the MSA had a population of 1,395,855, ranking 43rd nationally.

[1] https://www.census.gov/quickfacts/fact/table/louisvillecitykentucky, louisvillejeffersoncountymetrogovernmentbalancekentucky/PST045221

Under the authority of the Louisville Metro Council, Louisville Metro Emergency Services is the authorized applicant agent and is primarily responsible for the coordination and development of the plan. The Project Team for the 2022 Plan Update included Louisville Metro ES, Planning & Design Services, Louisville Metropolitan Sewer District (MSD), and the Louisville/Jefferson County Information Consortium (LOJIC). AECOM provided guidance and plan development during the planning process.

The Louisville Metro Office of Planning & Design Services (PDS) is responsible for administering the policies, programs, and regulations that guide Metro's development. Responsibilities include development plan review, overseeing design overlays and historic preservation programs, and advising the Planning Commission, Board of Zoning Adjustment, Historic Landmarks and Preservation Districts Commission, and Design Overlay Committees on decisions affecting the built environment. PDS is also responsible for maintaining and monitoring compliance with the Land Development Code.

The Mission of PDS is to oversee land use planning and design services in directing economic growth and physical development in a manner that ensures the prosperity, health, safety, and general welfare of the community. PDS will ensure coordination between the hazard mitigation plan update and the comprehensive plan update.

MSD administers the Floodplain Management Ordinance, National Flood Insurance Program (NFIP), Community Rating System (CRS) program, and portions of the Hazardous Materials Ordinance. LOJIC is a Geographic Information System (GIS) consortium of local public and government agencies that will house and disseminate the geo-spatial data.

1.2 2022 Plan Organization

Each Plan section contains the associated element and requirement in a table format from the FEMA publication "Local Mitigation Plan Review Guide," released in 2011. The Guide is intended to facilitate consistent evaluation and approval of local mitigation plans, as well as to facilitate compliance with the mitigation planning requirements when updating plans.

Noting the elements and requirements for each Plan section provides readers an opportunity to review these requirements in association with Louisville Metro's commitment to meet all of the requirements through the presentation of data analysis, maps and figures, activities, capabilities, and ideas for the future, which are presented throughout the document.

Plan sections are presented in the following order:

Executive Summary	Provides a general outline of Plan contents. Describes Plan goals and establishes links to federal compliance.
Section 1.0 Introduction	Discusses Plan Scope and Organization.
Section 2.0 Community Profile	Provides details of the Louisville Metro community, including information on geology, geography, climate, demographics, land use, climate and physiography, and topography.
Section 3.0 Plan Development Process	Provides information on the planning process, to include outreach efforts and public comment.
Section 4.0 Hazard Identification and Risk/Vulnerability Assessment	Provides information on the hazards that can potentially affect Louisville Metro along with the vulnerabilities associated with each.
Section 5.0 Mitigation Strategies	Contains information on funding sources and resources for implementing mitigation actions.
Section 6.0 Mitigation Actions	Provides information on current and future mitigation actions to include responsible parties and proposed timelines.
Section 7.0 Plan Management and Maintenance	Provides information on plan ownership, updates, and revision procedures.
Section 8.0 Plan Adoption	Provides documentation from the Louisville Metro indicating the Plan has been adopted and is in force as of January 2023.
Appendices	Contains supplemental information needed to support findings, strategies, and conclusions and recommendations.

2 Community Profile

Louisville is the largest city in the Commonwealth of Kentucky, and the 28th most-populous city in the United States.[2] Louisville is the historical seat, and since 2003, the nominal seat of Jefferson County, Kentucky. Louisville was founded in 1778 by George Rogers Clark and named after King Louis XVI of France. The area was settled and became a major shipping port due to the location of the Falls of the Ohio. River boats had to be unloaded in Louisville so goods could continue downriver past the falls. With the merger of Louisville and Jefferson County in 2003, Louisville Metro's population includes all 83 incorporated places in Jefferson County.

Louisville Metro Location
Courtesy: Google Maps

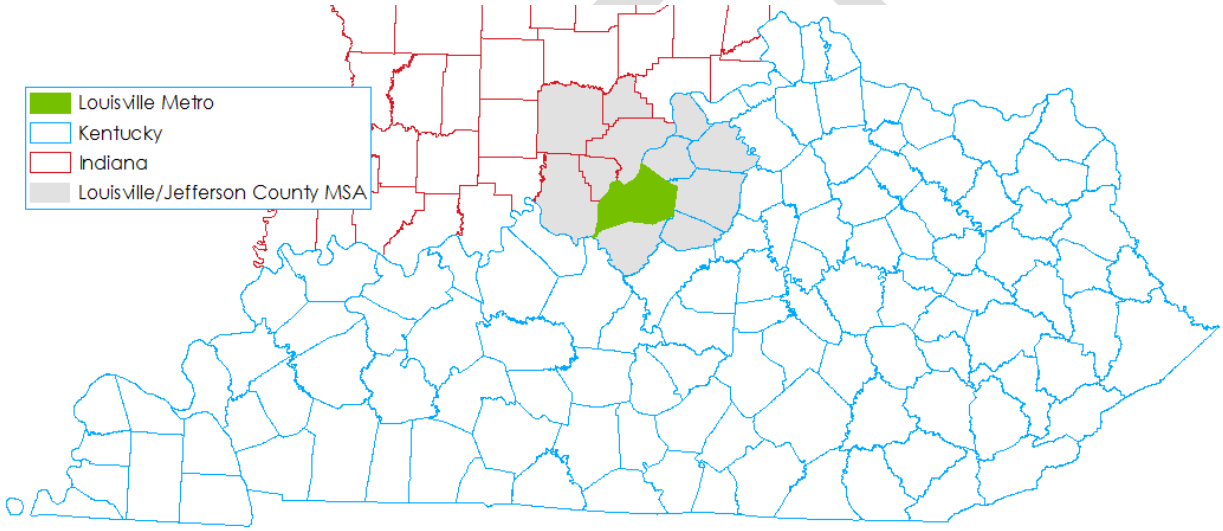
The Louisville metropolitan area is the 43rd largest metropolitan statistical area (MSA) in the United States. It had a population of 1,395,855 in 2020, according to the latest official census, and Louisville is its principal city.

The metropolitan area was originally formed by the United States Census Bureau in 1950, and consisted of the Kentucky county of Jefferson and the Indiana counties of Clark and Floyd. As surrounding counties saw an increase in their population densities and the number of their

[2] https://www.census.gov/data/datasets/time-series/demo/popest/2010s-total-cities-and-towns.html

residents employed in Jefferson County, they met Census criteria to be added to the MSA. Jefferson County, Kentucky, plus twelve outlying counties (seven in Kentucky and five in Southern Indiana) are now a part of this MSA.

The formal name given to the area by the Census Bureau is the Louisville–Jefferson County, Kentucky–Indiana, metropolitan statistical area, although it is regularly referred to as Kentuckiana. It is now the primary MSA of the Louisville/Jefferson County–Elizabethtown–Bardstown, KY-IN Combined Statistical Area, created by the United States Bureau of the Census in 2000, and recently redefined in 2018. The combined statistical area (CSA) adds the counties of Hardin County, Kentucky, LaRue County, Kentucky, Jefferson County, Indiana, and Nelson County, Kentucky, and comprises the Louisville–Jefferson County MSA, the Elizabethtown–Fort Knox, Kentucky, MSA, the Bardstown, Kentucky, micropolitan statistical area, and the Scottsburg, Indiana micropolitan statistical area. In 2020, the Census Bureau measured the combined statistical area's population at 1,601,309.



The Louisville Metro Metropolitian Statistical Area is presetend in the graphic above.

2.1 Geography and Climate

Louisville Metro is a 398-square-mile jurisdiction located along the southern banks of the Ohio River. The Louisville Metro area is a well-known geographic area highlighted by rolling hillsides and meandering streams. Approximately 790 miles of streams drain into eleven major watershed systems in the Louisville Metro area.

The surface elevation of the Ohio River at downtown Louisville is approximately 420 feet, while the city's highest point, located in the south-central portion of the county near Jefferson Memorial Forest, has an approximate elevation of 898 feet.

Climate

The Louisville Metro area has a humid subtropical climate typical of the Upper South, and is in United States Department of Agriculture hardiness zones 6b and 7a[3]. Springlike conditions typically begin in mid-to-late March, summer from mid-to-late May to late September, with fall in the October–November period. Seasonal extremes in both temperature and precipitation are not uncommon during early spring and late fall; severe weather is not uncommon, with occasional tornado outbreaks in the region. Winter typically brings a mix of rain, sleet, and snow, with occasional heavy snowfall and icing.

Summers are typically hazy, hot, and humid, with long periods of 90–100 degree Fahrenheit (°F) temperatures, and drought conditions at times. Louisville averages 38 days a year with high temperatures at or above 90°F. According to official weather records maintained at Weather.gov, the average temperature in Louisville is 58.4°F, with the coldest month being January (34.9°F average), and the warmest being July (79.1°F average)[4]. The first and last freezes of the season on average fall on November 4 and April 1, respectively. The highest recorded temperature was 107°F, which last occurred on July 14, 1936; and the lowest recorded temperature was −22°F on January 19, 1994. In 2007, Louisville had the hottest summer on record, with an average monthly temperature of 85.0°F. The coldest month on record was January 1977, when the average monthly temperature was just 18.5°F.

The wettest seasons are spring and summer, although rainfall is fairly constant year-round. During the winter, particularly in January and February, numerous days of snow can be expected. Because the city exemplifies the urban heat island effect, temperatures in commercial areas and in the industrialized areas along interstates are often higher than in the suburbs, often as much as 5°F.

Winds in the Louisville Metro area average between 6.3 mph in July to 9.2 miles per hour (mph) in March. The strongest measured wind gust at Louisville International Airport was 84 mph from the southwest on April 3, 1974.

In an average year, between sunrise and sunset, there are 94 clear days, 103 partly cloudy days, and 168 cloudy days. December is the cloudiest month and August is the clearest month.

Table 2-1 below shows average temperature and precipitation data for each month These data go back to 1950 through 2021.

Table 2-1: Louisville Metro Monthly Precipitation and Temperature Data

Month	Total Precipitation Normal (inches)	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
January	3.39	43.6	27.8	35.7
February	3.41	48.3	30.7	39.5
March	4.60	58.1	38.6	48.4

[3] https://planthardiness.ars.usda.gov/

[4] https://forecast.weather.gov/MapClick.php?lat=38.254890000000046&lon=-85.76665999999994#.YxLKCnbMKUk

Month	Total Precipitation Normal (inches)	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
April	4.80	69.6	48.5	59.0
May	5.18	77.8	58.7	68.3
June	4.27	85.7	67.2	76.4
July	4.05	89.0	70.8	79.9
August	3.71	88.4	69.5	78.9
September	3.66	82.2	61.9	72.0
October	3.72	70.5	50.1	60.3
November	3.42	57.6	39.4	48.5
December	4.13	47.2	32.1	39.6
Annual	48.34	68.2	49.6	58.9

Table 2-2 below also shows temperature data for Louisville Metro going back to 1950 *in 5-year increments.* This is presented to show how temperatures are steadily rising. The average annual temperature in 1950 was 55.6°F, while the average annual temperature in 2000 was 56.0°F. However, by 2020 the average annual temperature was 59.8°F. This represents a rise of over 3.0 degrees in just 20 years, and over 4.0 degrees since 1950. Based on these data, the climate in Louisville Metro is rapidly warming.

Table 2-2: Historical Monthly Mean Avg Temperature for Louisville Area, KY (°F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1950	44.6	39.0	42.5	52.3	67.0	73.1	74.7	73.1	67.6	62.3	40.5	30.5	55.6
1955	33.6	37.6	47.4	61.8	67.7	69.7	81.2	80.0	73.4	58.3	43.3	35.1	57.4
1960	38.0	33.8	32.5	60.6	63.9	71.0	74.2	76.9	70.5	57.4	45.0	29.9	54.5
1965	34.3	35.9	38.9	58.2	69.9	73.4	76.3	75.2	70.5	55.7	47.3	42.3	56.5
1970	27.9	33.6	42.3	59.2	67.2	72.9	75.8	76.0	73.4	58.1	45.3	39.5	55.9
1975	38.1	40.1	43.3	54.4	69.0	75.4	77.7	79.2	66.2	59.3	50.6	38.9	57.7
1980	33.5	29.5	41.8	53.6	66.8	73.4	81.5	80.9	73.5	55.8	46.3	38.3	56.2
1985	25.4	32.8	50.2	60.3	66.5	72.0	77.2	74.8	69.2	61.4	53.7	30.3	56.2
1990	43.1	44.3	51.1	55.5	64.2	75.1	78.5	77.5	71.7	58.7	52.0	40.7	59.4
1995	35.6	36.2	49.5	57.8	65.6	74.9	79.7	82.3	68.7	59.2	40.5	34.0	57.0
2000	33.5	44.2	50.1	54.7	68.3	74.0	75.4	75.5	67.0	60.9	43.7	25.0	56.0
2005	37.0	40.0	41.7	57.1	62.6	75.1	77.5	78.8	71.8	58.8	47.8	32.4	56.7
2010	30.1	30.9	49.0	62.6	70.5	81.1	82.9	82.8	75.1	63.1	49.9	30.8	59.1
2015	33.8	27.8	46.6	60.2	70.7	77.4	79.5	76.4	73.7	61.3	52.9	50.0	59.2
2020	41.7	40.4	53.3	55.9	65.4	76.8	82.2	77.9	71.3	60.0	52.9	39.8	59.8

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	33.7	37.3	46.4	57.2	66.3	74.6	78.3	77.1	70.3	58.6	46.9	37.8	57.1
Max	44.6 1950	49.0 2017	59.6 2012	65.3 2017	76.0 2018	81.1 2010	84.5 2012	85.0 2007	79.7 2019	66.2 2016	53.7 1985	50.0 2015	60.8
Min	18.5 1977	23.8 1978	32.5 1960	49.2 1961	59.0 1961	68.7 1974	73.4 2009	72.1 2004	63.2 1974	51.9 1952	39.4 1951	25.0 2000	54.4

Climate Change

According to Louisville's Official City web site "The impacts of climate change are being experienced in Louisville with more intense heat waves, bigger storms, and increased flooding. These changes affect all aspects of our communities, including human health, natural resources, infrastructure, emergency response, economics, and others[5]."

What Climate Change Means for Louisville

The climate is what defines any given locality, and for many of us, makes it home. There are many vulnerabilities associated with climate change—some more predictable than others. According to Louisville Metro's 2019 Climate Trends Primer report prepared by the GEOS Institute, some predicted impacts of continued climate change in Louisville Metro include:

- An increase in average temperatures. In 60 years, Louisville will experience a climate similar to today's Bastrop, Louisiana, Jackson, Mississippi, or Montgomery, Alabama.[6]
- Worsening of severe storms and flooding causing impacts to property, health, and safety.[7]
- Lower and warmer streams, degradation of aquatic habitat, and impacts to water quality.[8]
- Greater incidence of drought, leading to crop loss, loss of commercial river transportation, and loss of tourism revenue.
- Warmer waters increasing the incidence of vector- and water-borne disease such as Zika, West Nile virus, Dengue, and chikungunya.
- Disruption and damage to transportation infrastructure, energy infrastructure, and real estate due to increased heat and more frequent flooding.

[5] https://louisvilleky.gov/government/sustainability/climate-action-and-resilience-plans

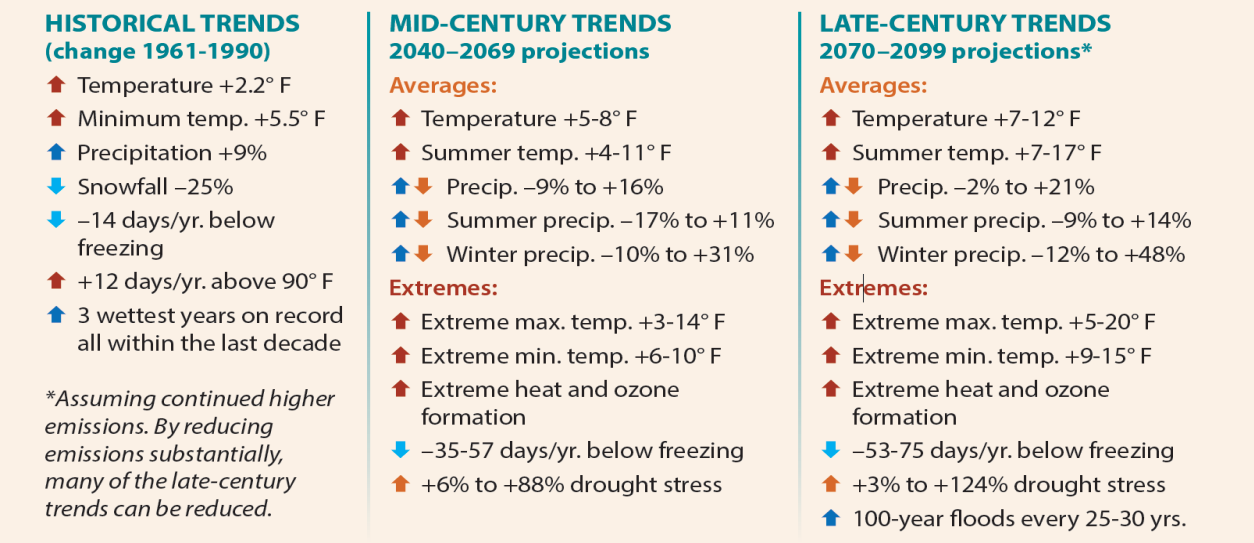
[6] Fitzpatrick, M. C. and R. R. Dunn. 2019. Contemporary climate analogs for 540 North American urban areas in the late 21st century. Nature Communications 10:614.

[7] Carter, L., A. Terando, K. Dow, K. Hiers, K.E. Kunkel, A. Lascurain, D. Marcy, M. Osland, and P. Schramm, 2018: Southeast. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II

[8] EPA. 2016. What Climate Change Means for Kentucky. EPA Publication 430-F-16-019.

- Increased disruptions in electric supply that come hand-in-hand with extreme heat and drought conditions.
- Reduced air quality as heat increases ground level ozone, which is associated with heart and respiratory disease.
- Longer and more severe heat waves affecting the elderly, outdoor workers, infants, homeless residents, and other vulnerable groups.
- Increased stress and incidence of mental illness, especially associated with prolonged periods of heat, flooding, and other extreme events.
- Increase in economic and racial inequities due to uneven distribution of climate impacts.
- Loss of fish and wildlife habitat and forest diversity.
- Loss of important benefits from natural systems, including water filtration, flood abatement, and recreational opportunities.

Specifically, the March 2020 "Climate Change Vulnerability in Louisville Kentucky" provides the following "Climate Change Snapshot" in an attempt to predict both mid-century and late-century climate trends.

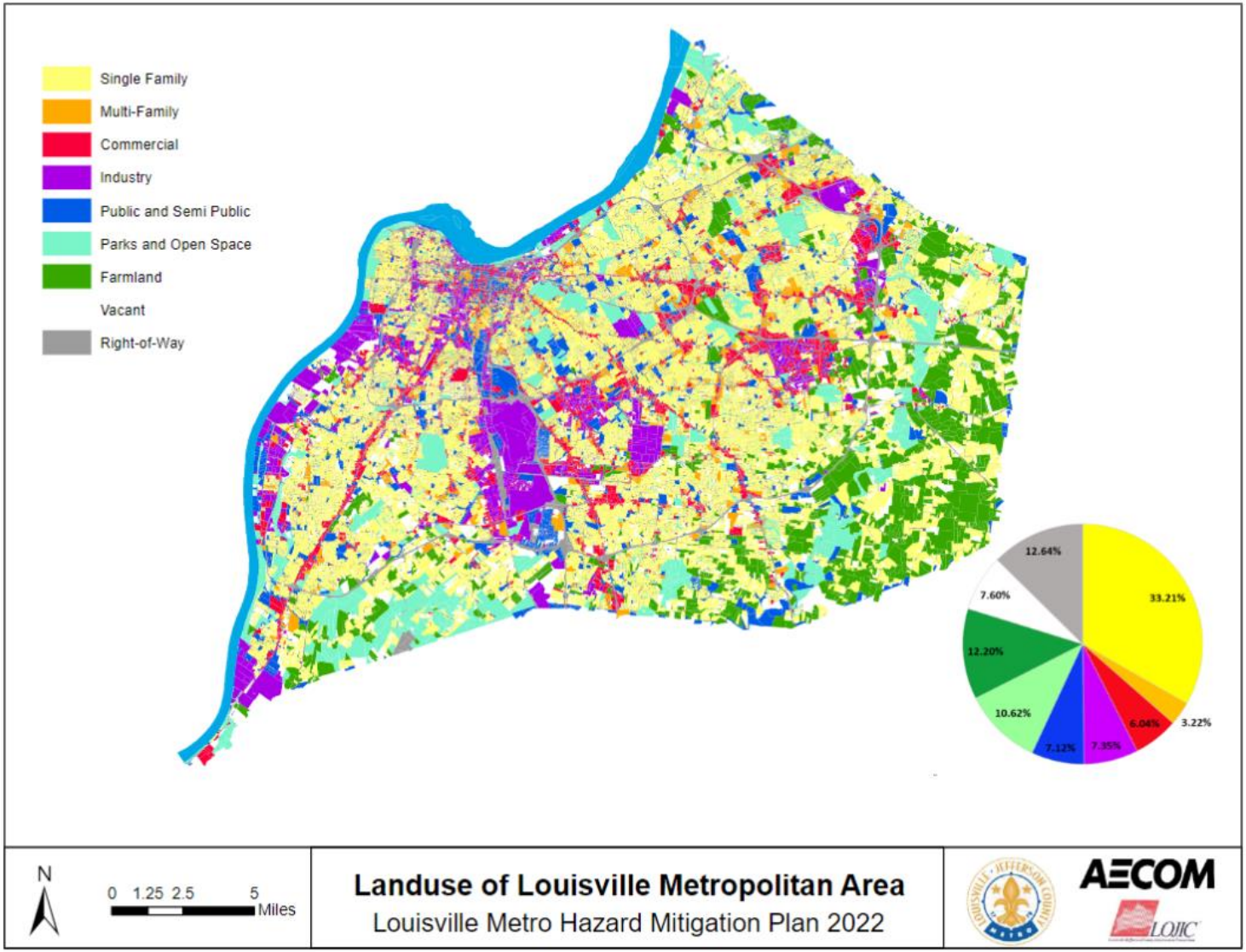


In an effort to combat the effects of climate change, in 2017, Mayor Greg Fischer joined the bipartisan Climate Mayors network of almost 500 mayors across the U.S. dedicated to accelerating city-led climate action to create a low-emission and climate-resilient future. He was appointed to the Steering Committee in January 2020, and tasked to build political will for federal and global climate action while demonstrating a local commitment. Throughout this plan, Louisville Metro will make forward-looking statements related to climate change and how mitigation solutions may be available.

2.2 Land Use

Land use in the Louisville Metro area is typical of most American cities and counties. Commercial uses (approximately 8%) are concentrated in downtown areas, in a few suburban nodes, and along primary transportation corridors. Single-family homes are the largest category of land use at just over 33%, while multi-family space occupies approximately 3%. Industrial uses (approximately 7%) are primarily concentrated in Louisville Metro's western and southwestern parts, while the eastern area is home to a majority of farmland (12%). Figure 2-1 represents county's current land use map and the percentage breakdown of land uses by type.

Figure 2-1: Land use of Louisville Metropolitan Area



The land use of the Louisville Metro area 2022 is similar to that identified in 2016. Specifically, for the Land Use categories tracked in both plans, the following changes were identified

Land Use Category	Land Use Percentage 2016	Land Use Percentage 2022	+/- Change 2016-2022
Single Family	33.39%	33.21%	-0.18%
Multi-Family	3.23%	3.22%	-0.01%
Commercial	6.05%	6.04%	-0.01%
Industry	7.10%	7.35%	0.25%
Public and Semi-Public Use	7.13%	7.12%	-0.01%
Farmland	12.24%	12.20%	-0.04%
Vacant	7.62%	7.60%	-0.02%
Parks and Open Sace	10.56%	10.62%	0.06%
Right-of-Way	12.67%	12.64%	-0.03%

2.3 Demographics

According to the U.S. Census, Louisville Metro's population has increased by roughly 5.6% between 2010 and 2020, going from 741,096 to 782,969. The current population is about 51.7% female and almost 16.7% are 65 or older. Approximately 22.4% of the population identifies as African American, 3.0% as Asian, and 5.9% as Hispanic.

To better anticipate and plan for future demands on land, and in turn prepare for mitigation activities, decision makers must understand whether or not growth in population, housing units, and/or jobs is expected over the planning horizon. Utilizing the expertise of the Kentucky State Data Center and the University of Louisville's Urban Studies Institute, "Plan 2040 – A Comprehensive Plan for Louisville Metro" dated 2019, provided demographic and economic projections for Louisville Metro and its region through 2040. This report indicates that the population of Louisville Metro and its region are expected to grow.

Between 2010 and 2040, the population of the 12-county Louisville MSA is projected to increase to 1,551,542. Jefferson County is forecasted to experience the largest share of the predicted growth of the MSA, accounting for 42% of projected population growth. The population of Jefferson County alone is projected to increase to 872,231. This projected growth is consistent with a steady increase in Jefferson County's population since 1990, after two decades of population decline between 1970 and 1990.

Table 2-3 provides basic Louisville Metro demographic characteristics as provided by the United States Census Bureau.

Table 2-3: United States Census Bureau Louisville Metro Selected Demographic Characteristics

PEOPLE	
Population	
Population Estimates, July 1 2021	777,874
Population, Census, April 1, 2020	782,969
Population, Census, April 1, 2010	741,096
Population Growth April 1, 2012-April 1, 2020	+41,873
10-Year Population Growth %	5.65%
Age and Sex	
Persons under 5 years, percent	6.0%
Persons under 18 years, percent	22.1%
Persons 65 years and over, percent	17.0%
Female persons, percent	**51.4%**
Race and Hispanic Origin	
White alone, percent	70.9%
Black or African American alone, percent(a)	22.8%
American Indian and Alaska Native alone, percent(a)	0.2%
Asian alone, percent(a)	3.3%
Native Hawaiian and Other Pacific Islander alone, percent(a)	0.1%
Two or More Races, percent	2.8%
Hispanic or Latino, percent(b)	6.6%
White alone, not Hispanic or Latino, percent	66.1%
Population Characteristics	
Veterans, 2016-2020	43,552
Foreign born persons, percent, 2016-2020	8.1%
HOUSING	
Housing units, July 1, 2021,	357,918
Owner-occupied housing unit rate, 2016-2020	61.5%
Median value of owner-occupied housing units, 2016-2020	$178,100
Median selected monthly owner costs -with a mortgage, 2016-2020	$1,325
Median selected monthly owner costs -without a mortgage, 2016-2020	$490
Median gross rent, 2016-2020	$901
Building permits, 2021	1,917

Families & Living Arrangements	
Households, 2016-2020	316,411
Persons per household, 2016-2020	2.38
Living in same house 1 year ago, percent of persons aged 1 year+, 2016-2020	84.6%
Language other than English spoken at home, percent of persons aged 5 years+, 2016-2020	9.9%
Computer and Internet Use	
Households with a computer, percent, 2016-2020	91.3%
Households with a broadband Internet subscription, percent, 2016-2020	86.5%
EDUCATION	
High school graduate or higher, percent of persons aged 25 years+, 2016-2020	90.8%
Bachelor's degree or higher, percent of persons aged 25 years+, 2016-2020	33.9%
HEALTH	
With a disability, under age 65 years, percent, 2016-2020	10.5%
Persons without health insurance, under age 65 years, percent	5.7%
ECONOMY	
In civilian labor force, total, percent of population age 16 years+, 2016-2020	65.9%
In civilian labor force, female, percent of population age 16 years+, 2016-2020	61.6%
TRANSPORTATION	
Mean travel time to work (minutes), workers aged 16 years+, 2016-2020	22.6
INCOME & POVERTY	
Median household income (in 2020 dollars), 2016-2020	$58,196
Per capita income in past 12 months (in 2020 dollars), 2016-2020	$34,365
Persons in poverty, percent	11.4%
BUSINESSES	
Total employer establishments, 2020	19,902
Total employment, 2020	459,956
Total annual payroll, 2020 ($1,000)	24,857,441
Total employment, percent change, 2019-2020	0.1%
Total non-employer establishments, 2019	58,524
GEOGRAPHY	
Population per square mile Louisville City, 2020	4,003.7
Population per square mile Jefferson County, 2020	2,056.1
Land area in square miles Louisville City, 2020	61.48
Land area in square miles Jefferson County, 2020	380.80

All data curtesy of: https://www.census.gov/quickfacts/fact/table/jeffersoncountykentucky,louisvillecitykentucky,US/PST045221

2.4 Economy

The Louisville Metro area has a vibrant and growing economy. The region is home to two 2022 Fortune 500 companies; Humana at No. 40 and Yum Brands at No. 490.[9] Louisville's transportation, warehousing, and wholesale trade industries are some of the strongest in the nation, with United Parcel Service's (UPS) air operations headquarters located at the Louisville International Muhammad Ali International Airport. The area also continues to have a strong manufacturing base, highlighted by two Ford Motor Company assembly plants and the Haier home appliance manufacturing facility. The city has a robust health care sector due to Humana headquarters being located downtown, along with several large senior care providers, including Kindred Healthcare and Atria Senior Living. Tourism has also become a significant business, with the Kentucky Derby and bourbon tours leading a $3.5B industry. Finally, the University of Louisville, just south of the downtown area, is a major employer and economic engine for the community, as well as the Commonwealth of Kentucky. Because of these factors, Louisville's overall economic picture reflects its position as the state's economic leader.

Income, poverty, education, insurance coverage levels, and unemployment rates outperform the state as a whole. The cost of living in Louisville is more than 10 percent below the national average, and more affordable than nearly all of its peers. The Cost of Living Index for the Louisville-Jefferson County, KY-IN Area is 88.4 on a scale of 100[10].

A listing of the Louisville Metro area's largest employers[11] is presented below in Table 2-4.

Table 2-4: Louisville Metro Largest Employers

Company	No. of Local Employees	Product Service
United Parcel Service	25,090	Package delivery, transportation and logistics
Jefferson County Public Schools	14,484	Education
Norton Healthcare	13,828	Health care services
Ford Motor Co. (2 plants)	13,020	Automotive production
Humana Inc.	12,360	Health and well-being
UofL Health	12,000	Health care services
The Kroger Co.	9,300	Retailer
Baptist Healthcare System Inc.	7,346	Health care services
Walmart Inc.	6,650	Retailer
University of Louisville	6,000	Research university, education
GE Appliances, a Haier company	6,000	Home appliances

[9] https://fortune.com/franchise-list-page/visualize-the-fortune-500-2022/

[10] https://www.bestplaces.net/cost_of_living/city/kentucky/louisville

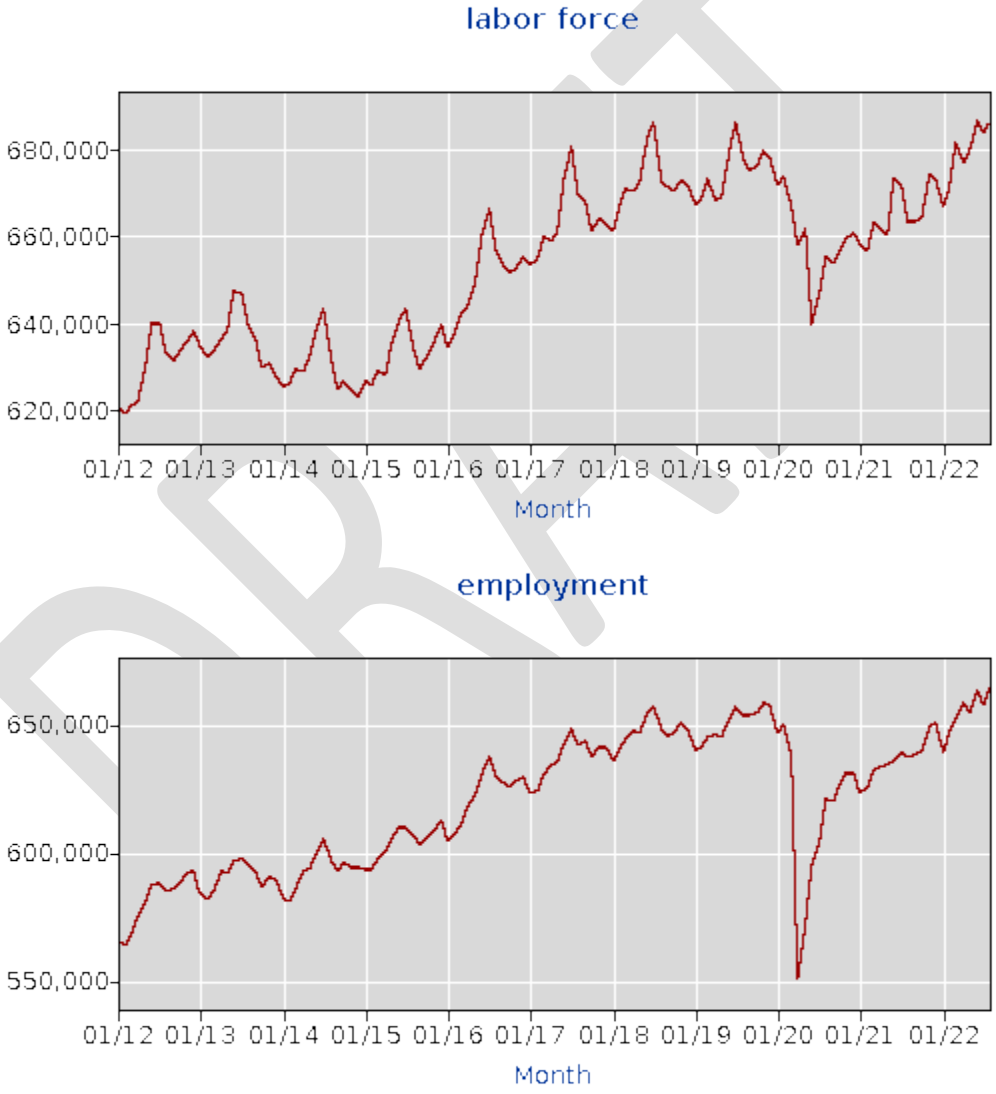
[11] https://www.greaterlouisville.com/talent/major-employers/

Company	No. of Local Employees	Product Service
Amazon.com	5,700	Logistics and customer service
Louisville-Jefferson County Metro Government	5,646	Metropolitan government
Spectrum	2,330	Call center, cable, Internet
Manna Inc.	2,300	Quick service & casual dining restaurants
LG&E and KU Energy LLC	2,240	Gas and electric generation and distribution
Archdiocese of Louisville	2,202	Catholic schools, churches, agencies
U.S. Census Bureau	2,113	Government
Robley Rex VA Medical Center	1,922	Health care services
Bullitt County Public Schools	1,753	Education
Oldham County Public Schools	1,710	Education
U.S. Postal Service	1,691	Mailing and shipping
Samtec Inc.	1,601	Electronic connectors and microelectronics
Rawlings Group	1,531	Health insurance subrogation and audit services
Texas Roadhouse	1,452	Food Service
New Albany-Floyd County Consolidated School Corp.	1,414	Education
Brown-Forman Corp	1,300	Producer & marketer of alcoholic beverage brands
Papa John's International Inc.	1,485	Pizza restaurants
Greater Clark County Schools Corporation	1,251	Education
Anthem Blue Cross and Blue Shield	1,320	Health Insurance
Caesars Southern Indiana	1,200	Hospitality
Faurecia	1,200	Exhaust systems, interiors and seat systems
JBS USA	1,200	Pork products
Kindred Healthcare Inc.	1,185	Health care services
Clark Memorial Health	1,063	Health care services
BrightSpring Health Services	1,058	Health and human services provider
ADP Inc.	1,000	Healthcare management, call center
Churchill Downs	1,000	Racing, gaming and online entertainment

Again utilizing “Plan 2040” information, Jefferson County should continue to experience growth in the following sectors: professional, health care and social assistance sector, transportation and warehousing, and hospitality/tourism. Manufacturing remains a question. Most analysts believe

that manufacturing employment will reach some "floor," and remain relatively constant around that floor for the future.

In order to reflect changes in economic growth between the 2016 plan and this effort, the two graphs generated by the Bureau of Labor Statistics[12] below compare key economic metrics for the Louisville Metro area. As the first graph shows, the labor force has risen from approximately 620,000 in January 2012 to over 680,000 in January 2022. While the second graph shows how employment has steadily grown, even capturing all job losses associated with the 2020 Covid-19 pandemic.



[12] https://data.bls.gov/timeseries/LAUMT2131140000000006?amp%253bdata_tool=XGtable&output_view=data&include_graphs=true

Finally, the table below showcases the change in economic capacity found in the Louisville Metro area since 2012. As the table shows, the labor force and employment have increased, while unemployment and the unemployment rate have fallen.

Year	Period	Labor Force	Employment	Unemployment	Unemployment Rate
2012	Jan	620,543	565,824	54,719	8.8%
2016	Jan	634,509	604,875	29,634	4.7%
2022	Jan	666,640	639,119	27,521	4.1%

2.5 Geology

Geologic hazards, such as earthquakes, landslides, and sinkholes, cause millions of dollars in losses in Kentucky each year. Jefferson County is in parts of two physiographic regions—the Outer Bluegrass and the Knobs. The Outer Bluegrass Physiographic Region covers the northeastern 95 percent of the county, and the Knobs Physiographic Region covers the remaining 5 percent, in the southwestern part of the county. The Outer Bluegrass Physiographic Region occurs on geologic strata of the Ordovician and Silurian Systems, while the Knobs Physiographic Region occurs on geologic strata of the Mississippian and Devonian Systems. In addition to these geologic systems, the floodplains and terraces of the county are on deposits of the Quaternary System. Because the county occurs in two physiographic regions and on five geologic systems, it is very diverse in landforms and geologic material. The diversity is expressed in the variety of soils that formed from the differential weathering and/or erosion of the bedrock. The major geologic strata underlying the soils in the county are of the Paleozoic era. The upper Mississippian, Devonian, Silurian, and Ordovician sedimentary rocks were deposited in moderately deep to shallow seas 250 to 500 million years ago, while the lower Mississippian sedimentary rocks were deposited in a deltaic environment. The southwestern and central parts of the county have a thick to thin mantle of terrace sediments and/or loess deposits of the Quaternary System that overlie either the Mississippian or Ordovician System. The Ohio River valley and the tributaries flowing to the Ohio River consist of alluvial material of the Quaternary System.

The five geologic systems identified within Jefferson County have been further subdivided into a number of formations, members, beds, or deposits. The materials of these divisions have influenced the landscape and the soils that have formed on them. For discussion, the geologic systems and their different subdivision are listed in the following paragraphs, in sequence from youngest to oldest.

Quaternary System: The Quaternary System consists of alluvial deposits on floodplains and terraces along the Ohio River and its tributaries, and along intermittent and perennial drains throughout the county. Alluvial deposits can be found in both the Knobs and Outer Bluegrass Physiographic Regions. The largest of these deposits is along the Ohio River, Floyds Fork, Mill Creek, and Pond Creek. These Quaternary deposits include recent alluvium, lacustrine deposits, outwash, loess, and eolian sand.

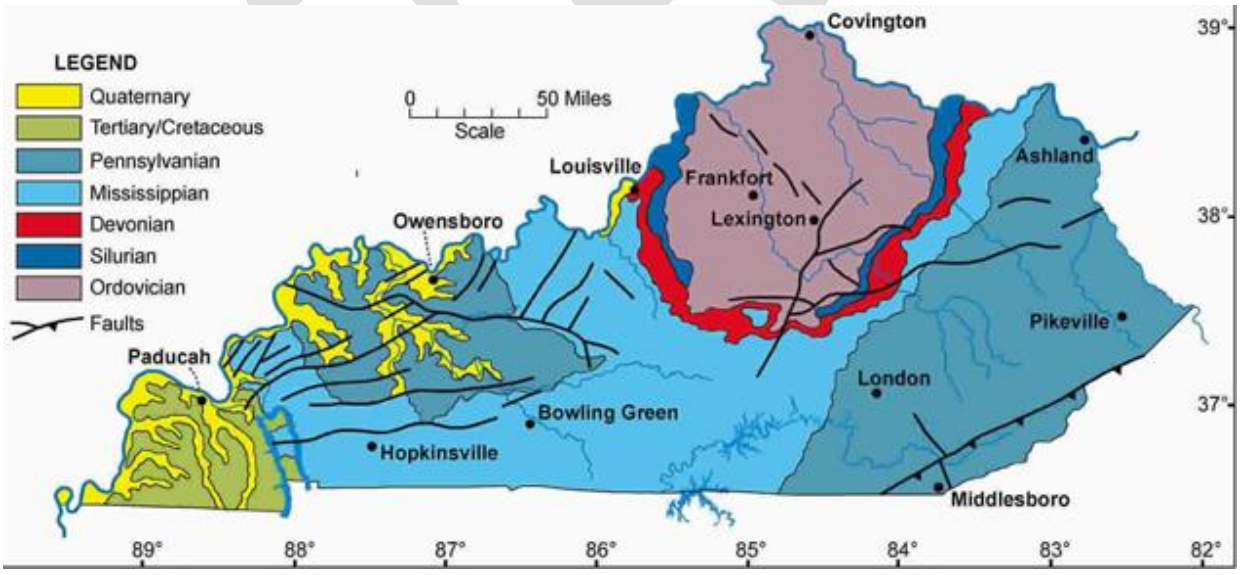
Mississippian and Devonian Systems: The Mississippian and Devonian Systems form the side slopes and knobs in the southern part of the county. The geological weathering of these systems produces conical formations, or knobs, from which the Knobs Physiographic Region derives its name. The Knobs region is very narrow in the county, and is included with the Bluegrass Major Land Resource Area. The Mississippian System consists of the Harrodsburg Limestone and Borden Formations and their respective members. The system forms the ridgetops and side slopes in the southwestern part of Jefferson County. The Harrodsburg Limestone is on narrow to moderately wide ridgetops.

Silurian System: The Silurian System covers the central part of the county. This system consists of interbedded calcareous shale and dolomitic limestone of the Louisville Limestone, Waldron Shale, Laurel Dolomite, and the Osgood and Brassfield Formations. The Louisville Limestone is predominately dolomitic limestone. As it weathered, it formed broad, nearly level ridgetops and short side slopes. Elevations range from about 500 to 750 feet.

Ordovician System: The Ordovician System covers the eastern quarter of Jefferson County. This system is made up of interbedded, dolomitic limestone and shale of the Saluda Dolomite, interbedded limestone and shale of the Bardstown and Rowland Members of the Drakes Formation, and limestone and shale of the Grant Lake Limestone. As these formations weathered, they formed narrow to broad, rolling ridgetops and short to long side slopes. Elevations range from about 480 to 760 feet.

Figure 2-2 below represents the Geology of Kentucky as developed by the Kentucky Geological Survey.

Figure 2-2: Geology of Kentucky



Map Courtesy of Kentucky Geological Survey

2.6 Physiography and Topography

A physiographic region is a large-scale portion of land defined by its distinct geology (the rocks underneath the soil), topography (hills, valleys, and flat spots), communities of native plants, and animals and history[13].

Figure 2-3: Physiographic Diagram of Kentucky

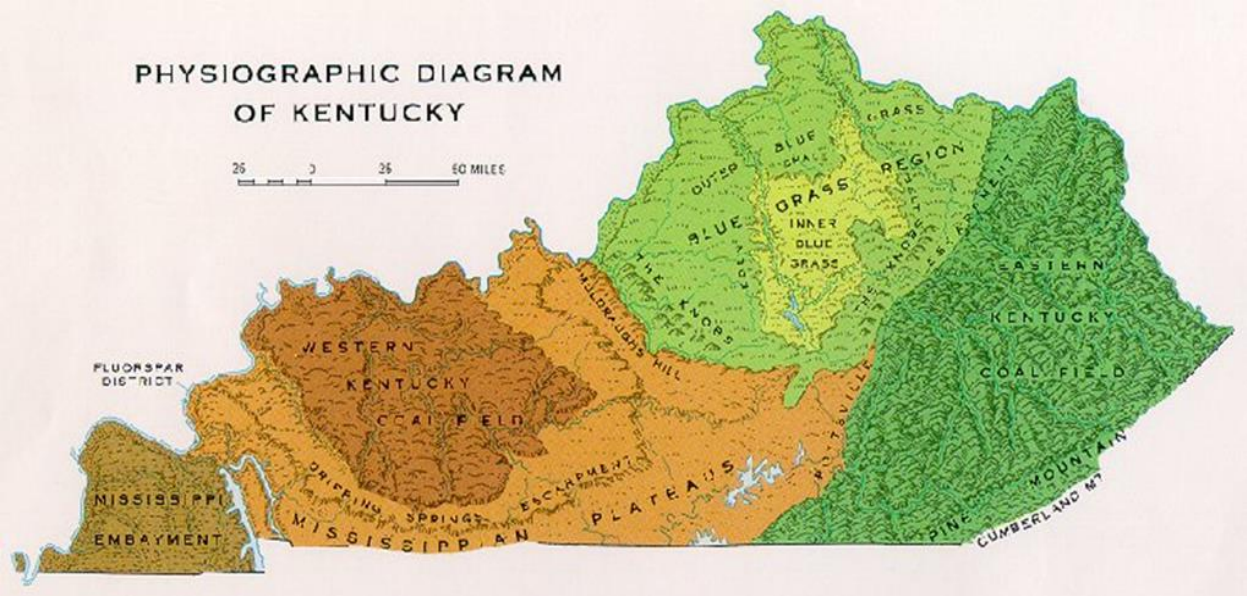


Figure 2-3 above shows the extent of Kentucky's physiographic regions, the distribution of prominent topographic features that border the regions, and the general trend of major rivers. The names of some regions, such as the Knobs and the Plateaus, are descriptive; other regions, such as the Bluegrass, Jackson Purchase, and Western Coal Field, are not named for their landforms, but are nevertheless well-recognized geographic areas with common socioeconomic histories related to their natural resources. Each region is characterized by distinctive landscapes produced by erosion and deposition of different rock types.

Four distinct topographic regions exist in Louisville Metro as the map shows of the regions. The four areas include the Flood Plain, Knobs, Central Basin, and Eastern Uplands.

The “Flood Plain” is a strip of land bordering 0.5 to 5 miles wide along the Ohio River. The Flood Plain extends from the Salt River in the southwest, north to downtown Louisville, and continues northeast to the Oldham County line. The lowest elevations in the county are found in this region and generally range from 430 to 440, with occasional terraces to 460. The area is best characterized as flat to gently rolling, and with very flat sloped stream beds. Mill Creek and the combined sewer system drain the majority of this region.

[13] https://louisvilleky.gov/government/louisville-loop/what-are-physiographic-regions

The “Knobs” region covers a triangular area in the southwestern portion of the county bounded approximately by Iroquois Park on the north, South Park Hills on the southeast, and the Southern Railroad on the southwest. The hills in this region have been highly dissected by stream erosion. Side slopes of 30% to 50% are common, and this region contains the highest elevations in the county, probably approaching the level of the original Appalachian Plateau. These steep-sided hills rise 300 to 400 feet above their surroundings, and numerous streams originate here. The majority of these streams drain to Pond Creek, which has eroded a trench, effectively bisecting this region from east to west.

The west-central portion of the county, bounded approximately by Interstate 264 (I-264) on the north, Shepherdsville Road on the east, and the “Knobs” region on the south and west, is the “Central Basin.” This is a former slack-water region of shallow soils and nearly flat terrain with elevations ranging between 450 and 500. Various improvements to the Northern and Southern Ditch systems have helped alleviate the lack of natural drainage in the region.

The “Eastern Uplands” cover the remainder and largest portion of the county. This region is characterized by gently rolling to hilly plains to moderate to very steep valleys. Elevations range between 500 and 800. Goose Creek, Harrods Creek, Floyds Fork, and the Beargrass Creek system drain this region.

From a topography standpoint, Louisville Metro is located between two plateaus, the karst plateau of Southern Indiana and the Bluegrass plateau of Kentucky, both with an elevation of around 900 feet. Elevations drop off the Indiana plateau very sharply via the Muldraugh Escarpment, whereas the rise in elevation up to the Bluegrass plateau is more gradual.

The floodplain is much longer north to south than it is east to west. For example, within several miles of downtown, the Highlands sitting at 540 feet is out of the thousand-year floodplain, whereas areas 10 miles from downtown such as Fairdale and Okolona (both between 7 and 11 miles from the river) have the same elevation as downtown Louisville. Most areas in the eastern end have an elevation from 600 to 700 feet, which, with the typically eastbound winds, trap in heat and pollutants.

Areas along and west of the south fork of Beargrass Creek (and more generally, I-65) are located where the Ohio River once ran, so the land here is very flat and is composed of harder rocks. Prior to urbanization, much of this area was composed of wetlands, and early roads through these were made of wooden planks. This history is occasionally still readily evident in street names; for example, the spoke road Poplar Level, whose name describes its original construction on planks of poplar. Third Street was formerly called Central Plank Road for the same reason. Because an industry, namely Standiford Field airport, moved into the area in the 1950s, most creeks through the area were rerouted into ditches to alleviate the area's poor drainage and constant flooding.

Areas east of I-65 were generally not in the floodplain, and therefore are mostly gentle rolling hills composed of soft loess soils, resulting in roads here (such as Eastern Parkway) being very prone to potholes. The southern quarter of Jefferson County is in the scenic and rugged Knobs region. This is the only part of Jefferson County not to have experienced any urbanization, and is today almost entirely parkland for the Jefferson Memorial Forest. The eastern third is in the Eden Shale Hills section of the Bluegrass region, and has also experienced less urbanization than the floodplain, although that is starting to change.

2.6.1 Louisville Metro Watersheds

Jefferson County is an approximately 375-square-mile political subdivision within the much larger 203,900-square-mile physiographic Ohio River Basin, which embraces parts of fourteen states. The large drainage system originates in the Allegheny Mountains, flows generally in a southwesterly direction converging with numerous tributaries, and eventually discharges into the Mississippi River. Slightly less than one-half (91,170 square miles) of the Ohio River Basin lies upstream of Jefferson County.

In the Louisville Metro area, there are two major drainage systems: the Ohio River and the Salt River. The Ohio River receives discharges from Mill Creek, Beargrass Creek, Goose Creek, Harrods Creek, and the combined sewer system. Cedar Creek and Pennsylvania Run discharge into Floyds Fork, which in turn, discharges into the Salt River. The Salt River also receives discharge from Pond Creek near its confluence with the Ohio River. In the Louisville Metro area, there are eleven small watersheds that feed into the Ohio River Basin. The watersheds are geographically shown below in Figure 2 4.

All eleven watersheds are based on the drainage systems mentioned above. In addition, Table 3-1 below provides a summary description of the general characteristics of each watershed. Each of these watersheds is discussed in detail in this Plan's Flooding section.

Figure 2-4: Louisville Metro and MSD Watersheds Map

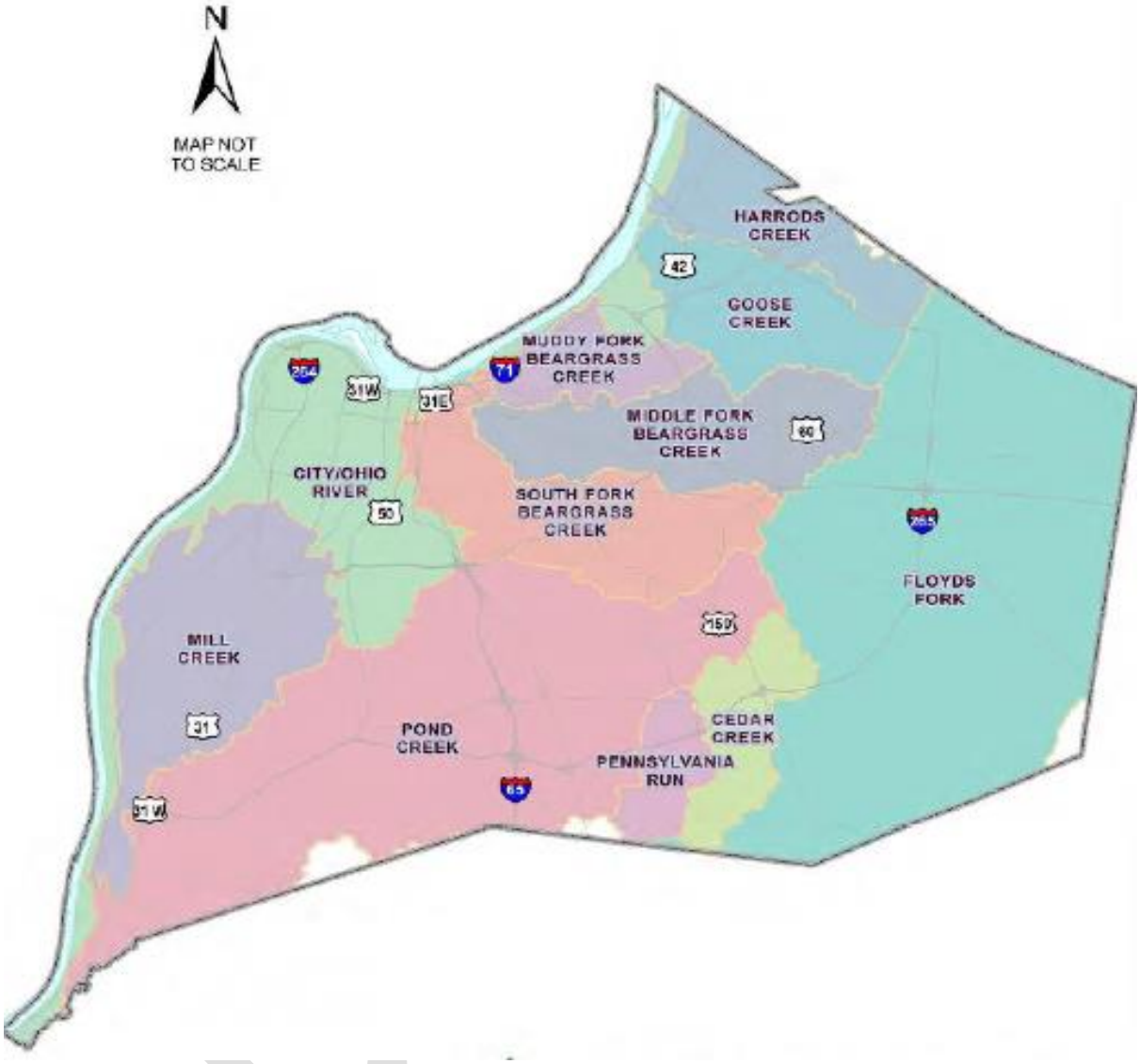


Table 2-5: Louisville Metro/MSD Watershed Characteristics

Watershed	Drainage Area (sq. miles)	Major Stream Systems
Cedar Creek	11.23	Cedar Creek
Floyds Fork	103.9 (Jefferson Co) 284 (Total)	Floyds Fork Chenoweth Run Pope Lick
Harrods Creek	15.3 (Jefferson Co) 92 (Total)	Harrods Creek Wolf Pen Branch South Fork Harrods South Fork Hite
Goose Creek	18.6 (Jefferson Co) 30.2 (Total)	Goose Creek
Middle Fork Beargrass Creek	25.1	Middle Fork Weicher Creek
Mill Creek	34.2	Mill Creek Upper Mill Creek Big Run Cane Run Black Pond Creek
Muddy Fork Beargrass Creek	8.8	Muddy Fork
Ohio Rive/City	39.8 (Jefferson Co) 91,170 (Total a Jefferson Co)	Combined Sewer System
Pennsylvania Run(1)	7.0	Pennsylvania Run
Pond Creek	89.3 (Jefferson Co) 126 (Total)	Pond Creek Northern Ditch Southern Ditch Fern Creek
South Fork Beargrass Creek	27.1	South Fork Buechel Branch

3 Planning Process

Louisville Metro Emergency Services is the entity responsible for maintaining ownership and leading development of the Plan. The planning process for the 2022 Plan update began in 2016. Throughout the course of the last 6 years, Louisville Metro, the Commonwealth of Kentucky, and private interest groups conducted activities related to hazard mitigation. In late 2021, Louisville Metro Emergency Services secured the services of AECOM to assist with plan development. AECOM is considered an industry expert in mitigation planning.

The planning process used to update the Plan entailed the development of individual scopes of work to complete plan elements. These scopes of work included tasks with associated timeframes and milestones.

Using a plan development process focused on individual plan elements ensured that the greatest opportunities for collaboration were made available to federal, state, local, and non-governmental partners. Rather than approaching all partners with an entire plan, using individual plan elements allowed for focused initiatives that were of particular interest to those involved. For consistency, a cutoff date was established for the availability of data: September 1, 2022. Data sets, such as the U.S. Census or new disaster declarations, available after this date were noted for incorporation into future plan updates.

The process to develop the 2022 Plan began in late 2021. Although the Covid-19 pandemic that ravaged the nation and the state was almost 2 years in, the Omicron variant of late 2021 and early 2022 created additional challenges to in-person meetings. Therefore, the planning team was forced to create new and unique opportunities for outreach and engagement that went beyond the traditional in-person meetings and briefings. This allowed Louisville Metro to engage stakeholders in a virtual manner, expanding the reach of the information and integrating ideas and thoughts from sectors of the public not typically present during a traditional plan update process. The centerpiece of this effort was the Louisville Metro Hazard Mitigation Plan Update Virtual Room, as discussed below under “Information Distribution.”

Traditional outreach and coordination initiatives were also performed continuously throughout the plan development process, although they also occurred via virtual methods such as Microsoft Teams or Zoom. These initiatives ranged from the development and dissemination of Hazard Mitigation Plan Guidance to the strengthening and expansion of local partnerships, resulting in collaborative and meaningful mitigations strategies.

3.1 Planning Teams and Stakeholders

A critical task at the beginning of the planning process is to assemble a planning team of representatives from Louisville Metro and partner organization. These planning partners and stakeholders have the expertise to develop the plan, and their organizations have the authority to implement the mitigation strategy developed through the planning process. Presented below are key competences of the planning team and stakeholders responsible for developing and reviewing drafts of the plan, creating the mitigation strategy, and submitting the final plan for local adoption:

Local Community Planners: These individuals, mainly from partner Louisville Metro agencies, helped the planning team understand past, current, and future community development trends,

the policies or activities that affect development, and the relationship between hazards and development.

Emergency Managers: First responders to disasters who have information on past occurrences and existing preparedness measures and have a direct line of communication with Kentucky Emergency Management (KYEM) and the State Hazard Mitigation Officer (SHMO).

GIS Specialists: Individuals that analyzed and mapped data to support the planning process and communicated complex information, such as the locations of assets at risk in threat- or hazard-prone areas and estimated damage for a particular disaster scenarios.

Public Works/Engineering Staff: Individuals that helped identify current or projected problems for the community's infrastructure that are addressed through capital improvements supported by the mitigation plan.

Elected and Executive Officials: Mindful of the community as a whole, these officials had the ability to communicate how the mitigation plan supports other social, economic, or environmental goals for the community.

Floodplain Administrators: Provided information on Louisville Metro's flood hazard maps, floodplain ordinance, repetitive loss properties, and actions to continue compliance with the National Flood Insurance Program and reduce flood losses.

State and Federal Partners: Provided available data, understand how to identify and leverage resources across agencies, and identified state and federal programs with complementary missions.

3.1.1 Project Leadership Team

The Project Leadership Team was made up of Louisville Metro staff and a consultant team of AECOM. The Project Leadership Team was tasked with day-to-day responsibilities for developing the Plan. Additionally, the Project Leadership Team was responsible for coordination and communication among federal, state, local, and private stakeholders. Project Leadership Team members are listed in Table 3-1 below.

Table 3-1: Louisville Metro Hazard Mitigation Plan Project Leadership Team

Name	Title
Jim Bottom	Emergency Services Supervisor
Jim McKinney (since retired)	Emergency Services Supervisor
Amy Rose	Emergency Services Coordinator
Ed Koubek	AECOM
Lael Holton	AECOM
Josh Hunn	AECOM
Katelyn Henry	AECOM

3.1.2 Steering Committee

The Louisville Metro Steering Committee was tasked with guiding the overall plan update process. Members of the Steering Committee were selected to represent a cross-section of views and interests within the planning area. Through this inclusion of diverse interests, the Steering Committee sought to enhance the robustness of the planning effort and to build support for hazard mitigation activities across stakeholder groups. Final decisions or recommendations on the plan update were be made by the Steering Committee based on general consensus. The Louisville Metro Hazard Mitigation Plan Steering Committee is presented in Table 3-2 below.

Table 3-2: Louisville Metro Hazard Mitigation Plan Steering Committee

Name	Organization	Title
Jim McKinney*	Emergency Services	Emergency Services Supervisor
Jim Bottom	Emergency Services, LEPC	Emergency Services Supervisor
Amy Rose	Emergency Services	Emergency Services Coordinator
Lori Rafferty	MSD	MS4/Floodplain Program Manager
Meghan Brown	MSD	Emergency Preparedness and Operational Resiliency Administrator - Operations
Stephanie Laughlin	MSD	Infrastructure Planning Program Manager
Sumedha Rao	Advanced Planning and Sustainability	Sustainability Coordinator
Ed Koubek	AECOM	Sr. Advisor
Lael Holton	AECOM	Mitigation Subject Mater Expert
Josh Hunn	AECOM	Project Manager

**- Jim McKinney has retired*

3.1.3 Stakeholders

A stakeholder is a representative of an agency, organization, jurisdiction, or other entity that has a role in Louisville Metro's hazard mitigation process. Stakeholders or a sub-set of active stakeholders formed the planning team for the planning process, and their participation improved the plan. Stakeholders for this effort comprised a broad group of local agency partners and natural hazard Subject Matter Experts (SMEs) that encompasses a whole community approach. The stakeholders listed in Table 3-3 below contributed to local mitigation programs and the integrated planning process through a variety of means, including their defined capabilities, ownership of critical facilities, provision of data and information for the risk assessment, participation in the planning process, and their ongoing review and comment on Plan drafts throughout the update.

Table 3-3: Louisville Metro Hazard Mitigation Plan Community Stakeholders

Name	Louisville Metro Organization	Title
Sumedha Rao	Advanced Planning and Sustainability	Sustainability Coordinator
Rachael Hamilton	Air Pollution Control District	Director

Name	Louisville Metro Organization	Title
Michelle King	Air Pollution Control District	Director of Program Planning & Executive Administrator
Keith Talley	Community Building	Chief
Kelly Jones	Emergency Services	Deputy Director
Mellone Long	Center for Neighborhoods	Director
Ben Anderson	Codes and Regulations	Application Development Supervisor Office of Civic Innovation and Technology
Jeff O'Brien	Develop Louisville	Director
Jim McKinney	Emergency Services Emergency Management Agency	Emergency Services Supervisor
Jim Bottom	Emergency Services, LEPC	Emergency Services Supervisor
Amy Rose	Emergency Services	Emergency Services Coordinator
Chris Perkins	Jefferson County Public Schools	Security Specialist
Stan Mullen	Jefferson County Public Schools	Executive Administrator of Security
Dave Self	Jefferson County Public Schools	Security Specialist
Bill Dieruf	Jeffersontown	Mayor
Matt Meunier	Jeffersontown	Director of Community Development/ Assistant to the Mayor
James McCloud	Kentucky DEP – Division of Waste Mgmt	Environmental Inspector
Matt Crawford	Kentucky Geological Survey	Geologist
Danielle Story	KIPDA	Community Planning and Development Representative
Amanda Hunter	KY Department for Public Health	Regional Resilience & Response Coordinator at Kentucky Department for Public Health
Geni Jo Brawner	KYEM	State Hazard Mitigation Officer
Jim Garrett	KYEM	KYEM Volunteer Coordination Program
Jess Hamner	LOJIC	LOJIC Solutions Analyst III
Curt Bynum	LOJIC	Director
Chester Hicks	Louisville Downtown Partnership	Director
Chip Jones	Louisville Gas & Electric	Business Continuity Program Coordinator | Corporate Security and Business Continuity
Jeremy Smith	Louisville Metro Police	Security Officer
Eric Culver	Louisville Metro Police	Sargent
Bradley Hart	Louisville Water Company	Safety, Security, & Emergency Preparedness
Dan Maloney	Louisville Zoo	Director
Jonathan Jones	Louisville Metro Fire	Fire Chief

Name	Louisville Metro Organization	Title
Matt Swain	Louisville Metro Housing Authority	OSHA/Security & Investigations, Manager
Lisa O'Sanka	Louisville Metro Housing Authority	Director
Brent Hagan	Lyndon	Mayor
David James	Metro Council	Council President
Mark Fox	Metro Council	Public Safety Chair
James Peden	Metro Council	Public Safety Vice Chair
Chris Seidt	Metro IT	Director Office of Civic Innovation & Technology
Jason Canuel	Metro Parks	Assistant Director
Stephanie Laughlin	MSD	Infrastructure Planning Program Manager
Meghan Brown	MSD	Emergency Preparedness and Operational Resiliency Administrator - Operations
Lori Rafferty	MSD	MS4/Floodplain Program Manager
Mike Kochasic	NWS	Warning Coordination Meteorologist
John Gordon	NWS	Meteorologist-in-Charge,
Joseph Haberman	Planning & Design	Manager
Dr. Sarah Moyer	Public Health and Wellness	Director
Paul Kern	Public Health and Wellness	Public Health Preparedness Administrator
Dirk Gowin	Public Works	Engineer
Jason W. Brandt	Public Works	Emergency Management Operations Chief
Vanessa D. Burns	Public Works	Director
Colleen Younger	PVA	Property Valuation Administrator
Tameka Laird	Resilience & Community Services	Director
Beverly Chester-Burton	Shively	Mayor
Jack Ruf	St. Matthews	Planning and Zoning Office
Rick Tonini	St. Matthews	Mayor
Jason Meiman	Suburban Fire	Chief
Aida Copic	TARC	Director of Planning ·
Carrie Butler	TARC	Executive Director
Gary Lewis	University of Louisville PD	Assistant Vice President for Operations / Chief of Police
Mindy Christian	University of Louisville EM	Emergency Coordinator
Nick Grinstead	University of Kentucky Martin School of Public Policy and Administration	Planning Grants Manager/Program Coordinator Hazard Mitigation Grants Program Office
Brandon Brummett	USACE	Outreach Coordinator,

Name	Louisville Metro Organization	Title
Mike Griffin	USGS	Director of the Ohio-Kentucky-Indiana Water Science Center.
Jessica Wethington	Office of the Mayor, Louisville	Director of Communications
Harold Adams	MSD	Communications & Marketing Supervisor
David Kaelin	Soil and Water Conservation District	Conservation District Supervisors
Geri Johnson	Soil and Water Conservation District	Conservation District Supervisors
Josh Dickerson	Flood Control - MSD	Flood Protection Project Administrator/Engineer

3.2 Meetings and Coordination

Meetings and coordination were an integral part of the planning process for continued progress on the Plan update. Between 2021 and 2022, the Project Leadership Team, Steering Committee, and plan stakeholders conducted a variety of meetings and inter-jurisdictional coordination. These efforts are described below.

3.2.1 Project Leadership Team Meetings

Following the Project Leadership Team Kickoff Meeting in December 2021, the Project Leadership Team met regularly (via virtual platforms), utilizing video conference calls and webinars. During these meetings, topics such as progress, updates, data needs/requests, and project timelines were discussed for each phase of the planning process. These meetings were critical in continually advancing the planning process and allowing for consistent communication regarding Plan progress and needs.

3.2.2 Steering Committee Meetings

The Louisville Metro Hazard Mitigation Plan Steering Committee was responsible for the high-level decision-making and steering of the Plan update process, including cross-sector coordination and guidance. Members met on a quarterly basis, starting the planning process with a virtual (due to the Covid-19 pandemic**)** Kickoff Meeting on January 24, 2022. The virtual kickoff meeting discussed the high-level strategy for each phase of the planning process, with more focus on methodology and data needs for the Hazard Identifications and Risk Assessment (HIRA) update. The meetings also served to review, rank, and prioritize the Mitigation Actions.

3.2.3 Individual Meetings

Stakeholders contributed specific data for the risk assessment and mitigation strategies, and individual meetings were held with them. For example, the Kentucky Geological Society contributed data related to earthquakes, landslides, and karst/sinkholes. Louisville Office of Metro Sustainability contributed data and recommendations from the Urban Tree Canopy and Urban Heat Island studies. The National Weather Service contributed data related to severe storms, tornadoes, severe winter storms, and hail. MSD contributed updated floodplain maps and stormwater data. In addition, various other stakeholders were tapped for information related to

their field of specialty. These meetings were instrumental in determining both what has affected the Louisville Metro area, and what can be done to mitigate against future occurrences.

3.2.4 Outreach Meetings

Four outreach meetings were held for this Plan update. The first focused on HIRA data and reviewing changes to the state's Vulnerability Assessment and identification of state critical facilities. The remaining meetings were used to solicit input regarding HIRA and Mitigation Strategies for inclusion in this update. Mitigation Strategies meetings were held to answer three main questions:

1. What long-term outcomes does Louisville Metro want to achieve?
2. What specific actions will Louisville Metro take to reduce risk to hazards?
3. How will identified mitigation actions be prioritized and implemented?

A summary of these meetings is provided below in Table 3-4.

Table 3-4: 2022 Louisville Metro Mitigation Strategy Meetings

Date	Number of Attendees	Major Topics
February	44	Kick-Off / Introduction
March	38	Hazard Identification and Risk Assessment
September 13, 2022	52	Mitigation Strategies – Concepts
September 28, 2022		Mitigation Strategies – Reviews

The outreach meetings provided participants information on the availability of new data, risk products, and technical assistance opportunities. Each meeting was held virtually in an MS Teams environment and facilitated by AECOM and Louisville Metro ES. Members of the Steering Committee and Planning Team attended each meeting.

Copies of presentations associated with Project Kick-off/Introduction, Hazard Identification and Risk Assessment, and Mitigation Strategies for both Concept and Reviews are presented in Appendix A.

3.2.5 Public Participation

As with previous years, Louisville Metro's planning process provided an opportunity for the public to comment on the plan during its formation. Unlike other years, the Covid-19 pandemic made in person meetings not possible. Because of this, public participation was driven by virtual tools, including social media, zoom calls, and a public survey housed within the Louisville Metro Virtual Room. Questions included in the 2-minute survey included:

1. Have you ever experienced or been impacted by a natural disaster in your current community?
2. In your opinion, what are the top three hazards facing our community?

3. How concerned are you about the possibility of your community being affected by a natural disaster?
4. In your household, has anyone done any of the following disaster preparedness activities?
5. Are there any other comments you would like to include regarding Louisville Metro's Hazard Mitigation Planning Strategies and hazards possibly affecting your local community

For each question, respondents were given a series of possible responses. Answers were collected and analyzed to provide additional viewpoints towards community preparedness and mitigation. Over 100 responses were received.

Not surprisingly, responses identified several major themes:

- Over three out of four respondents indicated that they had been affected by a natural disaster in some way.
- Cyber-attacks, Flooding, Sever Thunderstorms and Tornadoes were the most cited as hazards likely to affect the Louisville Metro community.
- Landslides, Karst and Sinkholes and Wildfires were identified as the least likely to affect the community.
- A majority of respondents indicated that they are "Very Worried" about the possibility of their community being affected by a natural disaster, while less than one in ten indicated that were not at all worried.
- While about one in three respondents indicated that they both "talked about what to do during a emergency or natural disaster" and "made and emergency kit or assembled emergency supplies," about the same number indicated that they "have not done anything in particular" when it comes to mitigating against disasters.
- Respondent comments generally focused on climate change and the need to be better prepared.

Results of the Virtual Room survey are presented in Appendix C.

3.2.6 Additional Public and Stakeholder Meetings

Throughout the 2022 planning cycle, Louisville Metro stakeholders, including the public were invited to participate in numerous additional meetings to discuss hazards, mitigation efforts, and future strategies. In addition, since the completion of the last Plan update, Louisville Metro led or participated in numerous meetings, forums, and workshops focused on mitigation and hazard risk reduction. Many of these sessions focused on providing information and assistance to stakeholders that needed assistance in the development of mitigation plans or projects. These engagements included training seminars, mitigation workshops, and grant application informational updates, as well as issue-focused presentations, and are provided as part of Louisville Metro's commitment to improving the capability of stakeholders.

A listing of individual public and stakeholder meetings, to include topics discussed and desired outcomes is provided in Appendix B.

3.3 Information Distribution

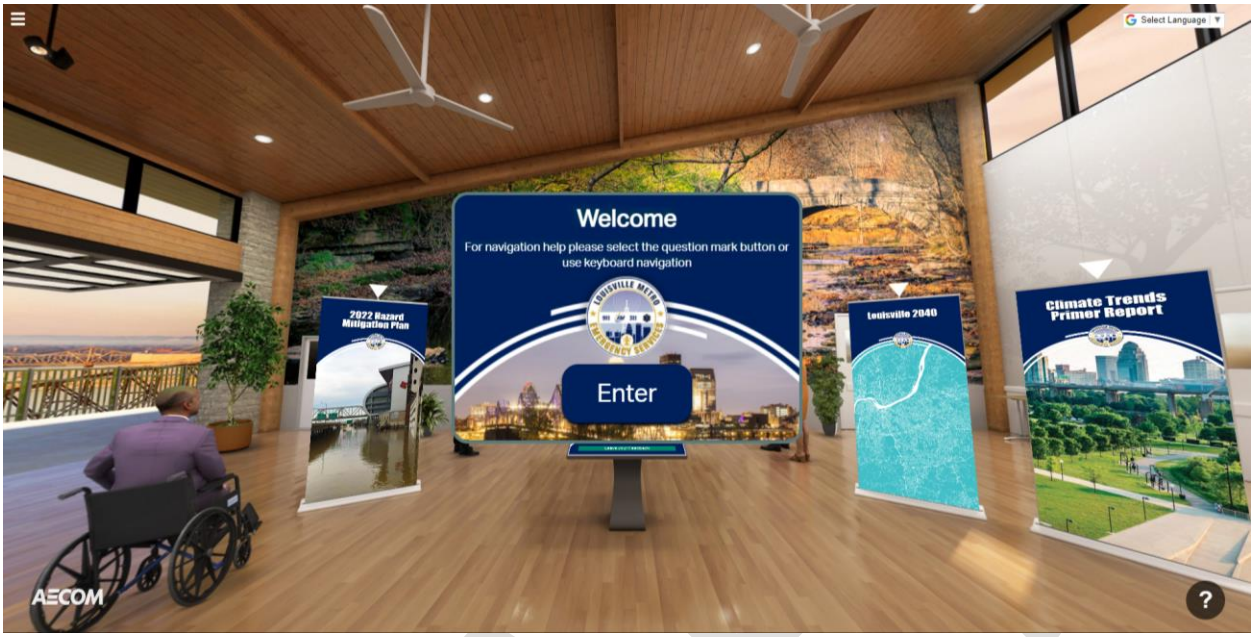
As mentioned above, the challenges presented by the pandemic required the state to develop alternative methods for engagement and information distribution. Louisville Metro used traditional methods of soliciting input, such as one-on-one meetings with stakeholders, email requests for information/data calls, as well as other less traditional methods such as conducting online polls during virtual meetings. One of the new resources leveraged this year was the development of the Louisville Metro Hazard Mitigation Plan Update Virtual Room (Louisville Metro Virtual Room). The Louisville Metro Virtual Room is a virtual engagement tool that provides an immersive, interactive experience for stakeholders to access Plan materials and provide feedback.

Information presented in this virtual room included a detailed analysis of hazards, threats, maps, and public documents published by various Louisville Metro agencies and partners that address topics covered in Plan development. Meeting and presentation recordings are also available on the virtual room, providing unique and continuous access for interested stakeholders and the public. Finally, a Survey instrument, designed to allow users to identify problem areas in their community and report them to the Plan custodians. Information from this survey will be useful to Louisville Metro Emergency Services in identifying areas in need of hazard mitigation, and crafting a response. Finally, the virtual room included a "comment box" to solicit feedback from visitors that could be included in future updates of the Plan. Questions prompted users to review the information presented and to provide additional information that they felt was missing from the draft of the Plan sections. The Louisville Metro Virtual Room can be accessed at:

https://aecomviz.com/LouisvilleMetroUpdate/

As of the submission to FEMA, Louisville Metro's Virtual Room had over 100 unique visitors with over 400 views of the page. The survey in the room is currently live and and will be so throughout the next five years. Figure 3-1 below is a snapshot of the Louisville Metro Plan Update Virtual Room.

Figure 3-1: Louisville Metro Plan Update Virtual Room



https://aecomviz.com/LouisvilleMetroUpdate/

3.4 Integration with State Planning Efforts

The Commonwealth of Kentucky's Enhanced Hazard Mitigation Plan was adopted in 2018. The theme of the 2018 update was administrative integration. State and local hazard mitigation planning has always valued and needed broad participation by stakeholders, formal and informal networks created and maintained, and open channels of communication. The enhanced hazard mitigation plan identified the following natural hazards:

- Flooding
- Drought
- Earthquakes
- Landslides
- Karst/Sinkholes
- Mine Subsidence
- Severe Winter Storms
- Tornadoes and Severe Thunderstorm Wind
- Extreme Temperatures
- Wildfires

Each of the above hazards, with the exception of Mine Subsidence, are also included as hazards in the Louisville Metro update. Each hazard profile was reviewed to ensure concurrence with current planning efforts.

Finally, to assess the risk from the above identified hazards, the state plan relied on the following Commonwealth's experts:

- Kentucky Division of Water conducted the flooding risk assessment, analyzed Severe Repetitive-Loss and Repetitive-Loss properties, and assessed dam safety.
- Kentucky Division of Water's Drought Monitoring Center conducted the drought risk assessment.
- Kentucky Geological Survey (KGS) conducted the earthquakes, landslides, karst and sinkholes, and mine subsidence risk assessments.
- The National Weather Service (NWS) provided expertise and documentation regarding tornadoes and severe thunderstorm wind, severe winter storms, and extreme temperatures.
- Kentucky Division of Forestry (KDF) provided data and expertise toward assessing the risk from wildfires.

During the update of this plan, each of the above were contacted to provide information on hazards potentially affecting the Louisville Metro area. The Kentucky Division of Water was contacted to provide information on larger, statewide mitigation efforts, even though MSD is responsible for flooding issues within the Louisville Metro area.

3.5 Integration of Existing Local Plans, Policies, and Programs

The following local plans and programs were examined and integrated into Louisville Metro's hazard mitigation planning process and 2022 update. It should be noted that additional plans, policies, and programs were also sourced; however, if they were not updated within the past 5 years, they are not specifically referenced in Table 3-5. Many of these plans, specifically those published by MSD and the Office of Advanced Planning and Sustainability also relied on the 2016 Hazard Mitigation Plan to develop their findings, conclusions and recommendations.

Table 3-5: Existing Plans, Policies and Programs Reviewed

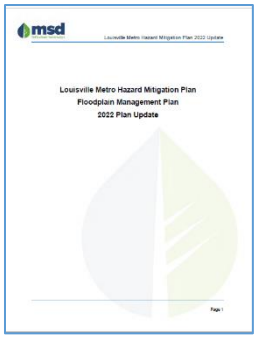
Plan/Program	Type	Owner	Status
Floodplain Management Plan	Addendum to the Louisville Metro Hazard Mitigation Plan	Louisville and Jefferson County Metropolitan Sewer District	Active 2022
Plan 2040	Comprehensive Plan	Louisville Metro, Louisville Forward	Active Adopted 1.1.2019
Floodplain Management Ordinance	Land development regulation	Louisville and Jefferson County Metropolitan Sewer District	Active Amended 8.25.2017
Prepare Louisville - Building a Climate Resilient City for All	Plan to determine the risks climate change poses and the steps that can be taken to increase resilience	Office of Advanced Planning and Sustainability	Active April 2020

Plan/Program	Type	Owner	Status
Greenhouse Gas Emissions Reduction Plan	Framework for achieving climate action goals that Louisville Metro committed to under the Global Covenant of Mayors for Climate & Energy on Earth Day 2016.	Office of Advanced Planning and Sustainability	Active April 2020
Urban Heat Management Study	Study to enhance livability, health, and sustainability in the Louisville Metro region.	Office of Advanced Planning and Sustainability	Active April 2016
Tree Canopy Assessment	Provides planning of green infrastructure through tree canopy mapping and analytics	Office of Advanced Planning and Sustainability	Active October 11, 2021
Sustain Louisville	Comprehensive sustainability plan	Office of Advanced Planning and Sustainability	Active 2013
Louisville Metro Climate Hazard Identification	A Climate Change Addendum to the 2016 Louisville Hazard Mitigation Plan	Office of Advanced Planning and Sustainability	Published 6.30.2019
Climate Trends Primer	Assessment and conclusions	Office of Advanced Planning and Sustainability	Published 5.1.2019
Watershed Master Plan	Promotion of stormwater drainage management practices	Louisville and Jefferson County Metropolitan Sewer District	Active July 2022
Program for Public Information Plan	Plan of outreach efforts made in Louisville Metro related to flood and water quality topics	Louisville and Jefferson County Metropolitan Sewer District	Active 2021 Update
Emergency Preparedness and Operational Resiliency Program	Emergency Operations Plan	Louisville and Jefferson County Metropolitan Sewer District	Active 2022
20-Year Comprehensive Facility Plan	Critical Repair and Reinvestment Plan	Louisville and Jefferson County Metropolitan Sewer District	Active June 2017
MSD IT and LOJIC Information Technology Resilience and Cybersecurity Program	Resiliency and preparedness program	Louisville and Jefferson County Metropolitan Sewer District	Active 2022

Plan/Program	Type	Owner	Status
Emergency Operations Plan 2021 – 2022	Policy and basic plan	Department of Public Health and Wellness	April 29, 2022
Karst Ordinance	Land development regulation	Louisville Metro, Louisville Forward	Active Adopted 3.1.2006
Steep Slopes Ordinance	Land development regulation	Louisville Metro, Louisville Forward	Active Adopted 3.1.2006
Erosion Prevention Sediment Control Ordinance	Land development regulation	Louisville Metro, Louisville Forward	Active Adopted 11.21.2000
Hazardous Materials Ordinance	County ordinance	Louisville Metro	Active Amended 7.2.2007
Move Louisville	Long range strategic multimodal transportation plan	Louisville Metro, Louisville Forward	Active Updated 12.1.21
Louisville/ Jefferson County Emergency Operation Plan	Emergency Operations Plan	Louisville Metro, Emergency Services	Active Updated 2020
Louisville Metro Government Continuity of Operation Plan	Continuity of Operations plan	Louisville Metro, Emergency Services	Active Updated 2018
KIPDA Regional Hazard Mitigation Plan	Hazard mitigation plan	KIPDA	Active Updated 2021
KIPDA Regional Climate Change Report	Climate change impacts	KIPDA	June/August 2020
Silver Jackets	Coordination/Collaboration Program	MSD	In Progress

The most common themes in these plans and programs are related to hazard mitigation, land use ordinances, floodplains, climate change, and emergency management. Many address Louisville Metro's susceptibility to climate change, including flooding concerns due to increased storm frequency and severity. A description of each plan, policy, or program reviewed is presented below. Where applicable, a statement is presented to show how this hazard mitigation plan will integrated into future planning efforts.

Metropolitan Sewer District Floodplain Management Plan



The purpose of this document is to update the flood and dam and levee portions of the existing Louisville Metro Hazard Mitigation Plan. The update includes revised maps showing risk and vulnerabilities, as well as including narratives on 19 flood projects and 13 dam and levee failure projects. The projects were developed through the planning process to address flood-related needs in the Louisville Metro area. The Plan includes project descriptions, proposed schedules, contacts and partners, benefit-cost prioritization, budget considerations, and project updates. The project updates were determined based on input from the lead implementers for each project. Several of the projects have been completed since the plan was created, such as updating the Floodplain Ordinance, while others have been put on hold. Many projects are on-going and/or continue to be implemented, such as the public outreach related to flooding and the floodplain buyout program. For example, Louisville Metro was awarded five new flood acquisition grants in 2021, and continues to apply for new grant opportunities annually.

This plan ties directly into the Hazard Mitigation Plan by providing detailed, recent information on flooding risks and vulnerabilities within the Louisville Metro area, as well as providing information on mitigation projects currently being performed or under consideration. Information contained in this plan has been used in the formulation of this plan. In addition, annual Metropolitan Sewer District Floodplain Management Planning efforts will use the Hazard Mitigation Plan as a baseline for its upcoming projects and strategies.

Louisville Metro Plan 2040

Plan 2040 builds on recent initiatives like Vision Louisville, Sustain Louisville, and Move Louisville to make Louisville a more connected, competitive, creative, and compassionate place to live, work, and create. Plan 2040 provides land use vision to both grow and maintain the beauty and urban fabric of Louisville using five guiding principles—connected, healthy, authentic, sustainable and equitable—to strategically manage all the benefits and challenges that come from adding more people.

This plan was used in calculating future growth trends and in determining potential future vulnerabilities.

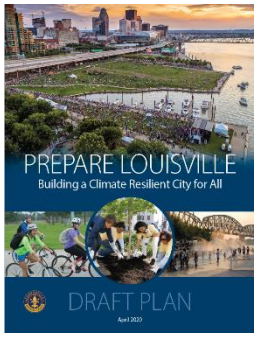
Louisville Metro Floodplain Management Ordinance

Louisville Metro participates in the NFIP so that community members can purchase flood insurance to protect themselves from flood losses while making the community eligible to receive federal disaster assistance. To participate in the NFIP, the community is required to adopt and enforce a floodplain ordinance.

Louisville Metro's Floodplain Management Ordinance, adopted in 2006 and amended in 2017, outlines specific development standards for areas within the floodplain. The purpose of the ordinance is to maximize the wise and safe use of the flood-prone areas of Jefferson County and to ensure that flood levels are not increased, and to minimize public and private losses from flooding.

This ordinance was used to supplement the Mitigation Strategies section.

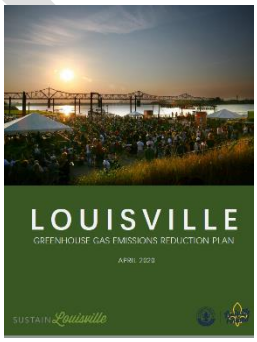
Prepare Louisville – Building a Climate Resilient City for All



Prepare Louisville was developed to identify a roadmap towards minimizing Louisville's contribution to climate change and increase resilience to extreme weather events and other climate impacts. This plan helps fulfill the commitment made through the Global Covenant of Mayors for Louisville to uphold the Paris Agreement by reducing emissions 80 percent by 2050, and take steps to protect community members and businesses from changing climate conditions. This plan was issued in 2020, and according to Advanced Planning representatives, is already slightly out of date with key metrics. This plan will be updated as needed through 2050, or until plan goals are met.

This plan was used to supplement the Mitigation Strategies section. In addition, as the Prepare Louisville – Building a Climate Resilient City for All plan is updated, it will rely on information contained in the Hazard Mitigation Plan, specifically information on Mitigation Strategies and Future Conditions.

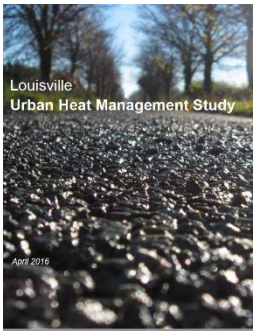
Greenhouse Gas Emissions Reduction Plan



Louisville's Greenhouse Gas Emissions Reduction Plan (ERP) establishes a framework for achieving the climate action goals that Louisville Metro committed to under the Global Covenant of Mayors for Climate & Energy on Earth Day 2016. As the first part of this commitment, Louisville Metro updated its community-wide greenhouse gas (GHG) inventory in 2016 to describe the current sources of GHG emissions generated within its political boundaries. As the second part of the commitment, Louisville Metro joined cities across the globe in setting a target to reduce its community-wide GHG emissions by 80% by 2050. This target was chosen in December 2018, because it aligned with the Paris Agreement and the scientific consensus of what was required to avoid the most damaging effects of climate change at that time. The ERP builds on a history of past work completed by Louisville Metro to understand the level of GHG emissions generated in our community.

This plan was used to supplement the Mitigation Strategies section.

Urban Heat Management Study

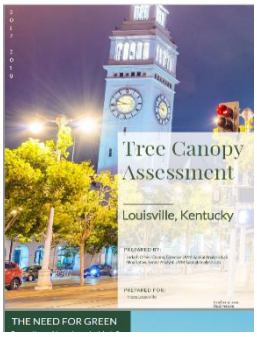


Commissioned by the Louisville Metro Office of Sustainability, this study was the first comprehensive heat management assessment undertaken by a major U.S. city, and constitutes one component of a broader effort to enhance livability, health, and sustainability in the Louisville Metro region. This report assesses the extent to which Louisville Metro is warming due to urban development and deforestation, estimates the extent to which rising temperatures are impacting public health, and presents a series of neighborhood-based recommendations for moderating the pace of warming.

The study provides an overview of the science of the urban heat island phenomenon, its implications for human health, and how urban temperatures can be moderated through urban design and other regional strategies. It also presents a methodology for estimating the potential benefits of specific heat management strategies for lowering temperatures across Louisville, and lowering the risk of heat of illness during periods of extreme heat. The report presents the results of a heat management assessment, and includes neighborhood-specific findings on the potential for lessened heat risk through the adoption of cool materials, vegetative, and energy efficiency strategies. Finally, the report presents a set of metro-wide and neighborhood-level recommendations for managing Louisville's rising heat risk.

This plan was used to supplement the Extreme Heat Mitigation Strategies section. In addition, this Hazard Mitigation Plan will support future visions of the Urban Heat Management Study by providing information on extreme heat history and potential mitigation strategies.

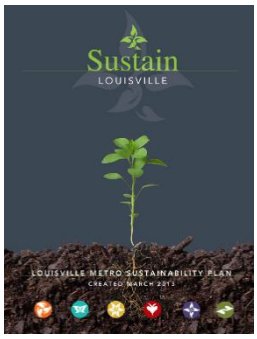
Tree Canopy Assessment



This study assessed tree canopy for Louisville over the 2012-2019 time period. Tree Canopy Assessment protocols are helping Louisville Metro better understand their green infrastructure through tree canopy mapping and analytics. Tree canopy is defined as the layer of leaves, branches, and stems that provide tree coverage of the ground when viewed from above. When integrated with other data, such as land use or demographic variables, this assessment provides vital information to help Louisville Metro and its residents chart a greener future.

This plan was used to supplement the Mitigation Strategies section.

Sustain Louisville



Sustain Louisville is the city's first sustainability plan. Sustain Louisville is a vital element for ensuring an environmentally sound, vibrant, and prosperous future for Louisville and its citizens. The plan was prepared by the Office of Sustainability with the input of city government employees and community stakeholders. Sustain Louisville is intended to be a living document that celebrates our strengths and identifies goals for future success. As the city makes progress toward meeting Sustain Louisville's goals, or as priorities change, the plan will evolve and remain fluid. Implementation of the initiatives and progress toward achieving Sustain Louisville's goals will be reported to the community on an annual basis.

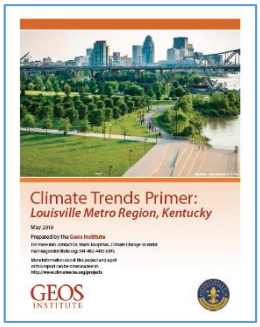
This plan was used to supplement the Mitigation Strategies section. In addition, this Hazard Mitigation Plan will support future visions of the Sustain Louisville plan by providing information on hazard identification and potential mitigation strategies.

Louisville Metro Government Office of Sustainability and Office of Advanced Planning Climate Hazard Identification

This assessment combined the best available information on climate change trends and projections, as well as research into potential changes in hazards in response to those trends and projections. The assessment covered all 13 of the hazards identified in the 2016 plan, in addition to air quality. Report findings indicate that of the 13 original hazards, 10 are expected to worsen with climate change, 1 may potentially lessen over longer time frames (Severe Winter Weather), and 2 are not associated with substantial climate change responses, although they remain significant hazards to the region (earthquakes and hazardous material releases.

This plan was used in developing future conditions in the Risk Assessment section. In addition, this Hazard Mitigation Plan will form the baseline for identifying hazards to be included in Climate Hazard Identification future versions.

Louisville Metro Government Office of Sustainability and Office of Advanced Planning Climate Trends Primer



The Climate Change Primer provides information on the expected trends and impacts expected with climate change specific to Louisville and the 12-county region surrounding the Metro area. Understanding climate change trends and impacts is the first step in identifying climate-related risks and vulnerabilities. The next step will be to develop strategies that build overall resilience for both people and natural resources of the region.

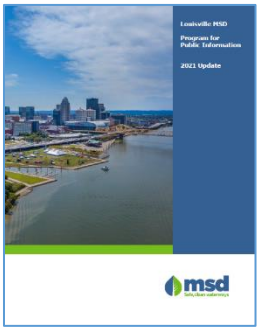
This plan was used in developing future conditions in the Risk Assessment section. In addition, this Hazard Mitigation Plan will from the baseline for identifying hazards to be included in future versions of the *Climate Trends Primer.*

Metropolitan Sewer District Watershed Master Plan

The Watershed Master Plan (WMP) is intended to compile related reference and data documents. It is a process that MSD can use to guide present and future regional management of stormwater drainage. In doing so, stormwater drainage facilities (e.g., storm sewers, detention basins, and post-construction water quality practices) will be employed within a comprehensive planning context. It should be emphasized that the WMP is not a flood study or a floodplain management program. The primary objective for the WMP is the promotion of stormwater drainage management practices in the context of a regional program; however, this plan was prepared in coordination with the floodplain management plan, which is part of the Louisville Metro Hazard Mitigation Plan.

This plan was used in coordination with the Floodplain Management Plan to identify key actions/mitigation projects that are associated with each of the 11 watersheds identified within the Louisville Metro area. In addition, MSD will likely reference the 2022 Hazard Mitigation Plan in future versions of their Watershed Master Plan, specifically as it deals with mitigation strategies associated with flooding and dam/levee failures.

Metropolitan Sewer District Program for Public Information Plan



This document is the 2021 Update of the Program for Public Information Plan (PPI) that was originally completed for Louisville Metro, Kentucky in 2014. This update includes information about outreach efforts being made in Louisville Metro related to flood and water quality topics. It also includes information on MSD actions to reduce and mitigate against flood risk.

This plan was used to identify the various methods of outreach conducted by MSD to promote flood mitigation activities in the Louisville Metro area. Specific activities referenced included newsletters, social media outlets, presentations, brochures, and even newspaper advertisements.

Metropolitan Sewer District Emergency Preparedness and Operational Resiliency (EPOR) Program

The EPOR Program develops resilient business practices to perform mission-critical functions and return to "normal" service post emergencies. Bolstering emergency preparedness through incident command structure-based planning, trainings and exercises, and after-action reporting, the program complements existing safety, security, planning, and grant pursuits.

This plan was used in formulating mitigation strategies. In addition, MSD will likely reference the Hazard Mitigation Plan to identify actions needed to reduce risks and increase system resiliency.

Metropolitan Sewer District 20-Year Comprehensive Facility Plan

The Blueprint 2025 Integrated Strategic Business Plan is a guide for achieving MSD's mission through aligning staff and management goals with organizational values. Critical success factors will measure impact to the community while providing quality wastewater, stormwater, and flood protection services.

This plan was used in formulating mitigation strategies. In addition, this Hazard Mitigation Plan will support future visions of the 20-Year Comprehensive Facility Plan by providing information on hazard identification and potential longer-term mitigation strategies.

Metropolitan Sewer District Information Technology and LOJIC Information Technology Resilience and Cybersecurity Program

The MSD IT and LOJIC information Technology Resilience and Cybersecurity Program includes a comprehensive list of policies, plans, programs, and training intended to protect MSD IT and LOJIC systems against cybersecurity attacks and disasters (natural or man-made). This Program—administered by chartered IT Steering and Information Security Steering Committees—includes MSD's Information Security Policy and Procedures, Information Security Program, Disaster Recovery Plan, and Business Continuity Plan. Specific internal initiatives are intended to maintain or improve system resiliency, application and infrastructure architecture design, application security design, and testing.

This plan was used to develop future conditions in the Risk Assessment section, and to identify future mitigation strategies.

Department of Public Health and Wellness, Emergency Operations Plan

This EOP and its subsequent annexes address how Louisville Metro Public Health and Wellness will continue to provide critical public health services before, during, and after an event. An all-hazards approach to planning is primarily used throughout this plan, with recommended incident-specific response plans that build upon and complement the basic plan, are outlined in the annexes.

This plan was used to develop mitigation strategies associated with Public Health and Wellness programs. In addition, this Hazard Mitigation Plan will support future visions of this plan by providing information on public health emergencies and potential mitigation strategies.

Metropolitan Sewer District Public Health and Safety

Louisville's Metropolitan Sewer District (MSD) and Louisville Metro Public Health and Wellness have partnered with researchers from the University of Louisville's Envirome Institute to learn how sewage may indicate community health risk by collecting samples from sewers at sites across Louisville, looking for SARS-CoV-2, the virus that causes Covid-19. Together with county-level clinical data, sewers provide a better picture to understand infection rate changes in large population centers of Louisville.

This plan was used to develop information on Public Health Emergencies in the Risk Assessment section. In addition, this Hazard Mitigation Plan will support future visions of this plan by providing information on potential mitigation strategies associated with public health emergencies.

Louisville Metro Karst Ordinance

The purpose of this part is to guide development in karst terrain areas consistent with Cornerstone 2020 Comprehensive Plan guidelines, to protect natural areas and features, and to locate development, where possible, in areas that do not have severe environmental limitations. The intent of this part is to regulate karst terrain development to protect the public health, safety, and welfare by regulating the development and use of environmentally constrained lands to

proceed in a manner that promotes safe and appropriate construction, stormwater management, and groundwater quality.

This ordinance was used to develop information on Karst conditions in the Risk Assessment section. It is likely that as the Louisville Metro Karst Ordinance is revised, the Hazard Mitigation Plan will be referenced due to its detailed information on past Karst occurrences and associated mitigation strategies.

Louisville Metro Steep Slopes Ordinance

The purpose of this part is to guide development in steeply sloped or unstable hillside areas consistent with Cornerstone 2020 Comprehensive Plan guidelines, to protect natural areas and features, and to locate development, where possible, in areas that do not have severe environmental limitations.

This ordinance was used to develop information on landslide conditions in the Risk Assessment section. It is likely that as the Louisville Metro Karst Ordinance is revised, the Hazard Mitigation Plan will be referenced due to its detailed information on past Karst occurrences and associated mitigation strategies.

Louisville Metro Hazardous Materials Ordinance

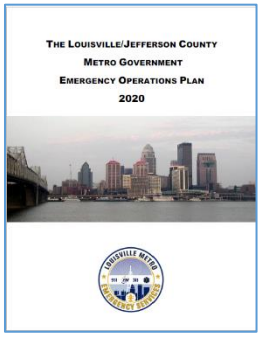
The purpose of this chapter is for the protection of public health and safety in Louisville Metro, through prevention and control of hazardous materials incidents and releases, and to require the timely reporting of releases thereto.

This ordinance was used to develop information on Hazardous Material regulations in the Risk Assessment section.

Move Louisville

Move Louisville is a long-range strategic multi-modal transportation plan. Move Louisville was in progress at the time of the 2016 hazard mitigation plan update, and was finalized in 2021. It outlines strategic planning efforts that could be impacted by future hazards.

Louisville/ Jefferson County Emergency Operation Plan

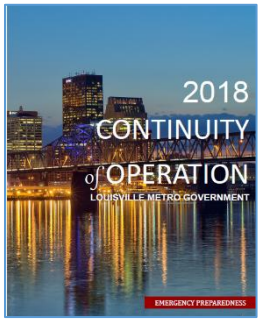


Louisville Metro Emergency Services leads emergency planning activities and develops the basic planning policies, guidelines, and Emergency Operations Plan (EOP). The EOP is updated in accordance with KRS Chapter 39, KAR 109, and guidelines from the Kentucky Division of Emergency Management. The EOP is adopted by resolution of the Louisville Metro Government Metro Council. The EOP outlines primary organizational structure, roles, and responsibilities of partner agencies. The plan is supported by All-Hazards Mitigation Strategies, Standard Operating Procedures (SOPs), and independent agency plans, and the State EOP. The EOP is updated as changes occur or according to state requirements. It provides direction and control during any large-scale disaster, to include preparedness, response, recovery, and mitigation.

This plan was used in formulating Consequence Analysis tables. In addition, this Hazard Mitigation Plan will support future visions of the Louisville/ Jefferson County Emergency

Operation Plan by providing information on the various hazards likely to occur in the Louisville Metro area so that planners can build in potential response actions if/when they happen.

Louisville Metro Government Continuity of Operation Plan



This document outlines a multi-agency concept of operations for the coordination of resources at different emergency response levels to ensure the continuity of essential services. It is critical that services such as 9-1-1 call-taking, and public safety dispatching for police, fire, and Emergency Management Services (EMS) continue without interruption.

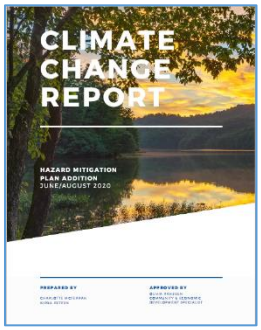
This plan was used in formulating Consequence Analysis tables. In addition, this Hazard Mitigation Plan will support future visions of the Louisville Metro Government Continuity of Operation Plan by providing information on the various hazards likely to occur in the Louisville Metro area so that planners can build in potential response actions if/when they happen.

KIPDA Regional Hazard Mitigation Plan

This plan serves as a regional hazard mitigation plan for surrounding counties to include Trimble, Henry, Oldham, Shelby, Spencer, and Bullitt in Kentucky. This plan covers each of the Kentucky counties in the Kentuckiana Metropolitan Statistical area, and each borders Jefferson County. Hazards covered include Dam Failure, Drought, Earthquake, Extreme Cold, Extreme Heat, Flooding, Hail, Karst Sinkholes, Landslides, Severe Storm and Severe Winter Storm. These hazards align closely with the Louisville Metro Hazard Mitigation Plan (HMP).

This plan was used to supplement hazard data used in the risk assessment portion of the plan. In addition, this Hazard Mitigation Plan will support future KIPDA Regional Hazard Mitigation Planning efforts by providing information on the various hazards likely to occur in the Louisville Metro area and the strategies in place to address. These likely will be similar to those encountered by KIPDA.

KIPDA Regional Climate Change Report



This plan, like the Louisville Metro Government Office of Sustainability and Office of Advanced Planning Climate Trends Primer, takes the standard model for identifying hazard mitigation risk and revises predictions based on a changing climate. With more recent research on climate change, it is evident that the likelihood of hazards occurring will not remain the same, making historical data unreliable. Although hazards are influenced in the same ways that they were fifty years ago, influencing factors themselves are undergoing changes due to climate change. Therefore, climate change needs to be taken into consideration when discussing hazard mitigation because it is causing the likelihood of hazards occurring to change. This report provides a summary and analysis of the most relevant climate change research that applies to the Kentuckiana region, as well as recommendations for what to consider in terms of hazard mitigation.

This plan was used in a similar manor to other climate change reports. It was reviewed to provide information on future conditions in the Risk Assessment section. In addition, this Hazard Mitigation Plan will support future KIPDA Climate Change Report efforts by providing

information on how climate change is being addressed in the Louisville Metro area. These affects likely will be similar to those encountered by KIPDA.

Silver Jackets

Silver Jackets is a national effort led by the US Army Corps of Engineers that facilitates collaborative flood risk reduction efforts between federal, state, and local agencies. The Kentucky Silver Jackets includes participants with mission areas of floodplain management, natural hazards mitigation, emergency management, natural resources management, and conservation. Kentucky's approach to Silver Jackets highlights agency priorities and facilitated discussions on potential collaborative efforts. Since 2012, the Kentucky team is responsible for multiple initiatives and projects that have enhanced flood risk awareness and reduction efforts in the Commonwealth.

Kentucky Association of Mitigation Managers

The Kentucky Association of Mitigation Managers (KAMM) website[14] was visited frequently during the performance of this project to access natural hazard mitigation and management information in Kentucky. Members of KAMM represent local, state, and federal officials, floodplain coordinators, planning and zoning officials, engineers, surveyors, GIS specialists, hydrologists, public safety and emergency managers, all of whom share mitigation best practices on their website.

3.6 Additional Mitigation and Outreach Activities

Louisville Metro Emergency Services will continue to be the monitoring and implementation body for the 2022 Plan, as well as the workgroup to support and inform future Plan updates. Following the adoption of the 2022 Plan, members of the Steering Committee will meet periodically throughout the year to discuss mitigation activities, align projects, and seek opportunities to partner and conduct an annual review of the Plan.

As identified in the new Mitigation Actions, Louisville Metro Emergency Services and MSD are implementing regular reviews of local mitigation activities. Both Emergency Services and MSD will track program implementation and submit the data annually to the Plan custodian as required. This report will detail progress toward key mitigation goals and objectives highlighted in the Plan. This process will also allow for timely updates to plan strategies, programs, and hazard analyses. Among the benefits for this report are improved interagency program coordination, as well as regular progress numbers.

In addition to the meetings and events discussed above, Emergency Services and MSD representatives have participated in additional mitigation and outreach activities, including:

- Conducting project kickoff meetings to provide technical assistance for the successful project implementation and grants management of FEMA HMA awards.

[14] https://www.kymitigation.org/about-kamm/

- Participating in local outreach events to build public awareness of natural hazards risk and mitigation efforts.
- Participating in local hazard mitigation planning efforts, including regional efforts.
- Participating in state and national mitigation conferences and workshops to understand the plethora of federal grant programs (BRIC, FMA, HMGP, etc.)
- Working with federal and regional partners in Region 4 to develop mitigation strategies and an "integrating green infrastructure into hazard mitigation plan (HMP)" pilot workshop.

3.7 CRS Integration

Community Rating System (CRS) and Flood Mitigation Act (FMA) planning requirements were integrated into the hazard mitigation planning process to ensure coordination and leverage funding opportunities. In addition to the DMA 2000 Planning Requirements, the CRS 10-step planning and floodplain management requirements were used to guide the Louisville Metro planning process, with a particular focus on flooding and repetitive loss. The CRS 10-step planning process is consistent with the multi-hazard planning regulations under 44 CFR Part 201.

Table 3-6: CRS Ten Step Planning Process

Step #		Disaster Mitigation Act of 2000 Planning Requirements
1.	Organize	Planning Process
2.	Involve the Public	
3.	Coordinate	
4.	Assess the Hazard	Risk Assessment
5.	Assess the Problem	
6.	Set Goals	Mitigation Strategy
7.	Review Possible Activities	
8.	Draft Action Plan	
9.	Adopt Plan	Plan Adoption
10.	Implement, Evaluate, & Revise	Plan Review, Evaluation, & Implementation

The NFIP's CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.

As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

- Reduce flood damage to insurable property.
- Strengthen and support the insurance aspects of the NFIP.
- Encourage a comprehensive approach to floodplain management.

Currently, Louisville Metro is a Class 3 in the CRS program[15], saving the community approximately $2 million each year. Louisville Metro earns this rating by engaging in many floodplain management activities, such as providing flood information, preserving open space in the floodplain, maintaining the drainage system, and outreach.

As a Class 3 community, Louisville-Jefferson County is among the top 18 Community Rating System communities in the country for greatest insurance premium discounts:

3.8 Incorporating Equity in Mitigation

Although there is no one-size-fits-all definition, equity can generally be understood as policies, practices, interactions, cultures, and resources that are responsive to all people. Equity is achieved not only when everyone is provided full access to information and assistance, but when we intervene to ensure that all are provided with the resources necessary to meaningfully participate, make progress, and benefit from hazard mitigation. As human beings, we each have unique needs that must be met to allow our meaningful participation. To realize this vision, we must work in partnership with the "Whole Community."

Inclusive processes take time, but when we work collaboratively with diverse populations and stakeholders, we will arrive at more effective outcomes. Each person and community has its own definition of what it takes to achieve equity, and the definitions are often informed by personal and local goals. One way to measure equity is through better outcomes, such as an easier long-term recovery or a disaster that does not disproportionately affect our most vulnerable residents. We can also measure equity successes in our mitigation initiatives by seeing that:

- At-risk risk populations lend expertise and have agency in the hazard mitigation process.
- Barriers to participating in mitigation activities are removed, and training, language access, transportation, meals, and/or childcare are provided.
- Investment takes place in traditionally underserved communities.
- Race is no longer a determining factor of risk.
- Indicators of social vulnerability and environmental burden are assessed alongside hazards in mitigation plans and are used to target outreach or risk reduction projects.
- State and local governments include equity as a factor for prioritizing projects and applying their administrative and hazard mitigation plans.
- Cost share is reduced for small or under-resourced communities.
- Resources are provided to build local capacity and capability for grant application processing and administration.
- An impact assessment is completed before a mitigation project to ensure that it helps, and does not negatively impact at-risk populations.

[15] https://www.kymitigation.org/crs-program-in-kentucky/

- Those engaged in mitigation activities are representative of the Whole Community.

These approaches are reflected in this Hazard Mitigation Plan update, and will be considered when planning future Louisville Metro mitigation projects. The ranking criteria for projects, described in the Hazard Mitigation Strategy section of this Plan, provide the basis for project submissions to FEMA's Building Resilient Infrastructure and Communities (BRIC) grant program. Equity considerations were applied when developing these strategies.

4 Hazard Identifications and Risk Assessment (HIRA) Overview

The purpose of the HIRA is to identify natural, technological, and human-caused hazards, and to evaluate the risk they pose to Louisville Metro, the health and safety of its residents, visitors, property, environment, and economy. A vulnerability and risk assessment is a decision support tool for determining the need for and prioritization of mitigation measures to protect assets, processes, and people. Although availability of resources limits the ability and extent risks are reduced, vulnerability and risk assessments can help ensure that the available resources and actions taken are justified and implemented based on the threat, vulnerability, and risk.

The 2022 Louisville Metro Hazard Mitigation Plan assesses community's risks and vulnerabilities though a standard process widely accepted as appropriate for planning purposes.

This section is to be used as the starting point for developing overall mitigation strategies. The risk assessment section uses best available data through various points in 2022. This includes the first-hand knowledge of individual stakeholders, local, state, and national datasets, commonly available internet search functions, and the use of Geographic Information System (GIS). GIS provides the capabilities to perform an accurate risk assessment, and to indicate specific spatial areas of vulnerability to each identified hazard.

The risk assessment provides the factual basis for activities proposed in the strategy that will reduce losses from identified hazards. Risk assessments allow for a connection between the community's vulnerability and the hazard mitigation actions. In other words, it provides sufficient information to enable Louisville Metro to identify and prioritize appropriate hazard mitigation strategies and actions.

This section of the Plan follows the "Local Mitigation Plan Review Tool" section "Hazard Identification and Risk Assessment" Element B. The requirements for this section are described in Table 4-1 below:

Table 4-1:

Element	Requirement
B1. Does the Plan include a description of the type, location and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii) **Intent:** To understand the potential and chronic hazards affecting the natural hazards the planning area in order to identify which hazard risks are most significant and which jurisdictions or locations are most adversely affected.	✓ The plan must include a description of the natural hazards that can affect the jurisdiction(s) in the planning area. A natural hazard is a source of harm or difficulty created by a meteorological, environmental, or geological event. The plan must address natural hazards. Manmade or human-caused hazards may be included in the document, but these are not reviewed to meet the requirements for natural hazards. In addition, FEMA will not require the removal of this extra information prior to plan approval. ✓ The plan must provide the rationale for the omission of any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area. ✓ The description, or profile, must include information on location, extent, previous occurrences, and future probability for each hazard. Previous occurrences and future probability are addressed

	in sub-element B2. The information does not necessarily need to be described or presented separately for location, extent, previous occurrences, and future probability. For example, for some hazards, one map with explanatory text could provide information on location, extent, and future probability. *Location* means the geographic areas in the planning area that are affected by the hazard. For many hazards, maps are the best way to illustrate location. However, location may be described in other formats. For example, if a geographically-specific location cannot be identified for a hazard, such as tornados, the plan may state that the entire planning area is equally at risk to that hazard. *Extent* means the strength or magnitude of the hazard. For example, extent could be described in terms of the specific measurement of an occurrence on a scientific scale (for example, Enhanced Fujita Scale, Saffir-Simpson Hurricane Scale, Richter Scale, flood depth grids) and/or other hazard factors, such as duration and speed of onset. Extent is not the same as impacts, which are described in sub-element B3. ✓ For participating jurisdictions in a multi-jurisdictional plan, the plan must describe any hazards that are unique and/or varied from those affecting the overall planning area.
B2. . Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i) **Intent:** To understand potential impacts to the community based on information on the hazard events that have occurred in the past and the likelihood they will occur in the future.	✓ The plan must include the history of previous hazard events for each of the identified hazards. ✓ The plan must include the probability of future events for each identified hazard. *Probability* means the likelihood of the hazard occurring and may be defined in terms of general descriptors (for example, unlikely, likely, highly likely), historical frequencies, statistical probabilities (for example: 1% chance of occurrence in any given year), and/or hazard probability maps. If general descriptors are used, then they must be defined in the plan. For example, "highly likely" could be defined as equals near 100% chance of occurrence next year or happens every year ✓ Plan updates must include hazard events that have occurred since the last plan was developed.
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii) **Intent:** For each jurisdiction to consider their community as a whole and analyze the potential impacts of future hazard events and the vulnerabilities that could be reduced through hazard mitigation actions.	✓ For each participating jurisdiction, the plan must describe the potential impacts of each of the identified hazards on the community. *Impact* means the consequence or effect of the hazard on the community and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have value to the community. For example, impacts could be described by referencing historical disaster impacts and/or an estimate of potential future losses (such as percent damage of total exposure). ✓ The plan must provide an overall summary of each jurisdiction's vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other

	community assets as defined by the community that are susceptible to damage and loss from hazard events. A plan will meet this sub-element by addressing the requirements described in §201.6(c)(2)(ii)(A-C). Vulnerable assets and potential losses is more than a list of the total exposure of population, structures, and critical facilities in the planning area. An example of an overall summary is a list of key issues or problem statements that clearly describes the community's greatest vulnerabilities and that will be addressed in the mitigation strategy.
B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods? 44 CFR 201.6(c)(2)(ii) **Intent:** To inform hazard mitigation actions for properties that have suffered repetitive damage due to flooding, particularly problem areas that may not be apparent on floodplain maps. Information on repetitive loss properties helps inform FEMA hazard mitigation assistance programs under the National Flood Insurance Act.	a. The plan must describe the types (residential, commercial, institutional, etc.) and estimate the numbers of repetitive loss properties located in identified flood hazard areas. **Repetitive loss properties** are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. **Severe repetitive loss properties** are residential properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building. Use of flood insurance claim and disaster assistance information is subject to The Privacy Act of 1974, as amended, which prohibits public release of the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance. However, maps showing general areas where claims have been paid can be made public. If a plan includes the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance, the plan cannot be approved until this Privacy Act covered information is removed from the plan.

To complete the elements required for the Risk Assessment section, the Project Team decided to use a similar methodology established in other Kentucky-based Hazard Mitigation Plans. This included breaking this section into four basic areas of examination:

1. Identifying and Defining Hazards
2. Profiling Hazards
3. Assessing Vulnerabilities
4. Projecting Future effects based on climate change

Each identified hazard was developed with one continuous Risk Assessment overview. This provides an independent review of each hazard following the basic four sections described above (Defining, Profiling, Assessing Vulnerability, and Projecting). In addition, it allows the end users the ability to review all facets of each hazard's complete Risk Assessment within one section.

Throughout the risk assessment, GIS spatial data provide the baseline for the risk assessments developed for the Plan. GIS provides the architecture to facilitate an inventory of assets and hazards, as well as providing the platform to calculate a geographic-based risk assessment. The maps developed through GIS production are used whenever possible to convey where spatially defined risks and vulnerable areas are located; therefore, it should be considered for a mitigation opportunity to make the community more resilient.

The maps and data layers created from this production provide a visual tool for analysis as well as the capability to use this information in GIS to identify very specific areas of unmet need and high risk. Creating these data in a GIS layer format extends the usage of the data by allowing other interested parties to add these data layers into their own GIS mapping environments. Finally, the information developed throughout this section was guided and developed using the best available data.

To capture changes in development, updated infrastructure, population, and building data were included in the risk assessment. For infrastructure and buildings, the new data incorporated updated LOJIC information. To identify changes in population geography, new population and social vulnerability numbers were taken from the 2020 U.S. Census and the latest Centers for Disease Control's Agency for Toxic Substances and Disease Registry (CDC/ATSDR) Social Vulnerability Index from 2018. ATSDR's Geospatial Research, Analysis & Services Program (GRASP) created databases to help emergency response planners and public health officials identify and map communities that will most likely need support before, during, and after a hazardous event.

The CDC/ATSDR SVI uses U.S. Census data to determine the social vulnerability of every census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. The CDC/ATSDR SVI ranks each tract on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes. Maps of the four themes are shown in Figure 4-1 below. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. Possible scores range from 0 (lowest vulnerability) to 1 (highest vulnerability).

Jefferson County, Kentucky's 2018 Overall SVI Score is 0.57. A score of 0.57 indicates a moderate to high level of vulnerability. A percentile ranking represents the proportion of census tracts that are equal to or lower than a tract of interest in terms of social vulnerability. A CDC/ATSDR SVI ranking of 0.57 signifies that 57% of tracts in the nation are less vulnerable than Jefferson County, and that 43% of tracts in the nation are more vulnerable.

The maps below further showcase Louisville Metro's SVI. As the maps show, social vulnerabilities are not uniform throughout Louisville Metro's footprint. Areas to the east and northeast have significantly lower social vulnerabilities than downtown Louisville and areas to the west and south.

Figure 4-1: Louisville Metro SVI Maps

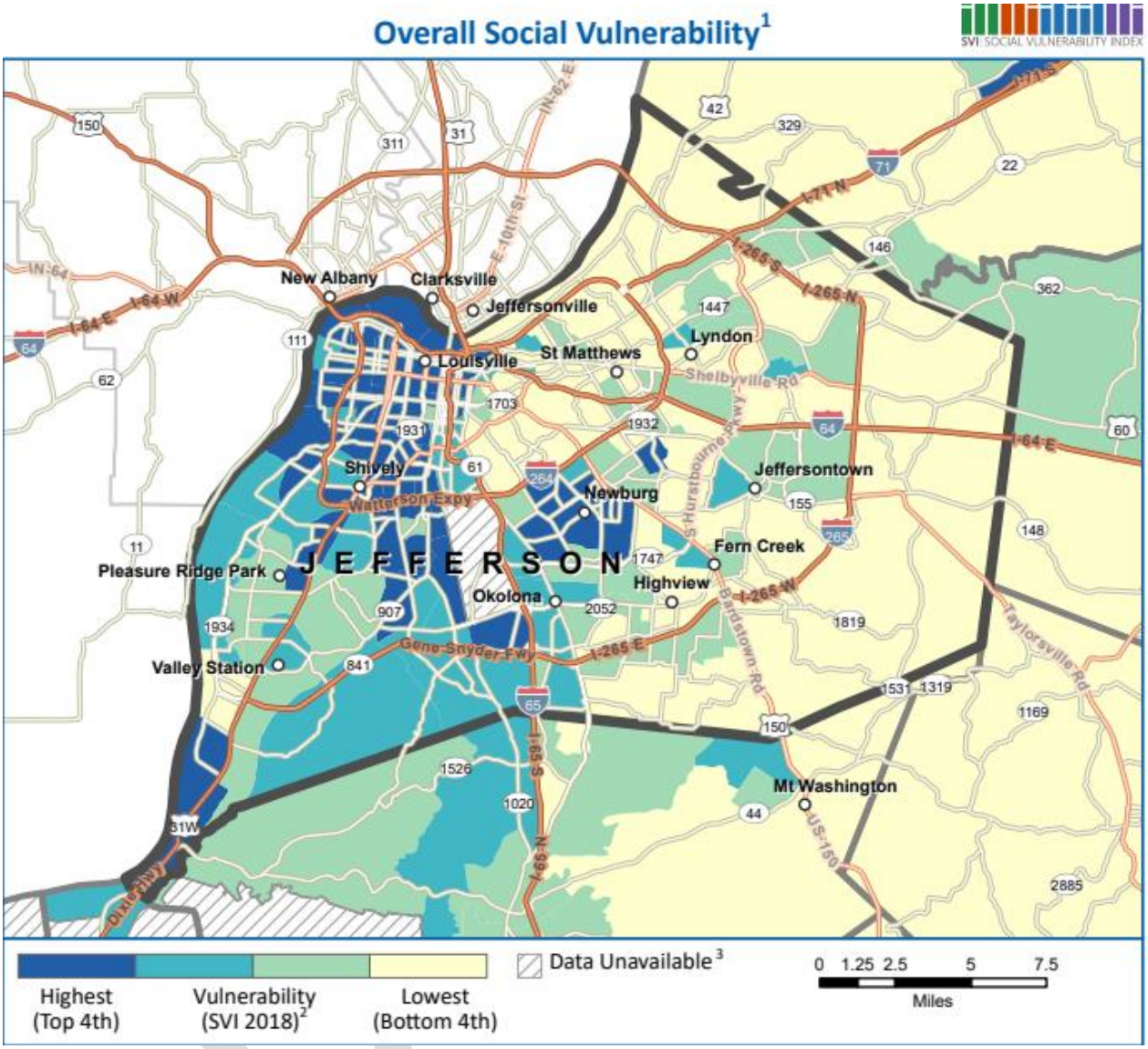
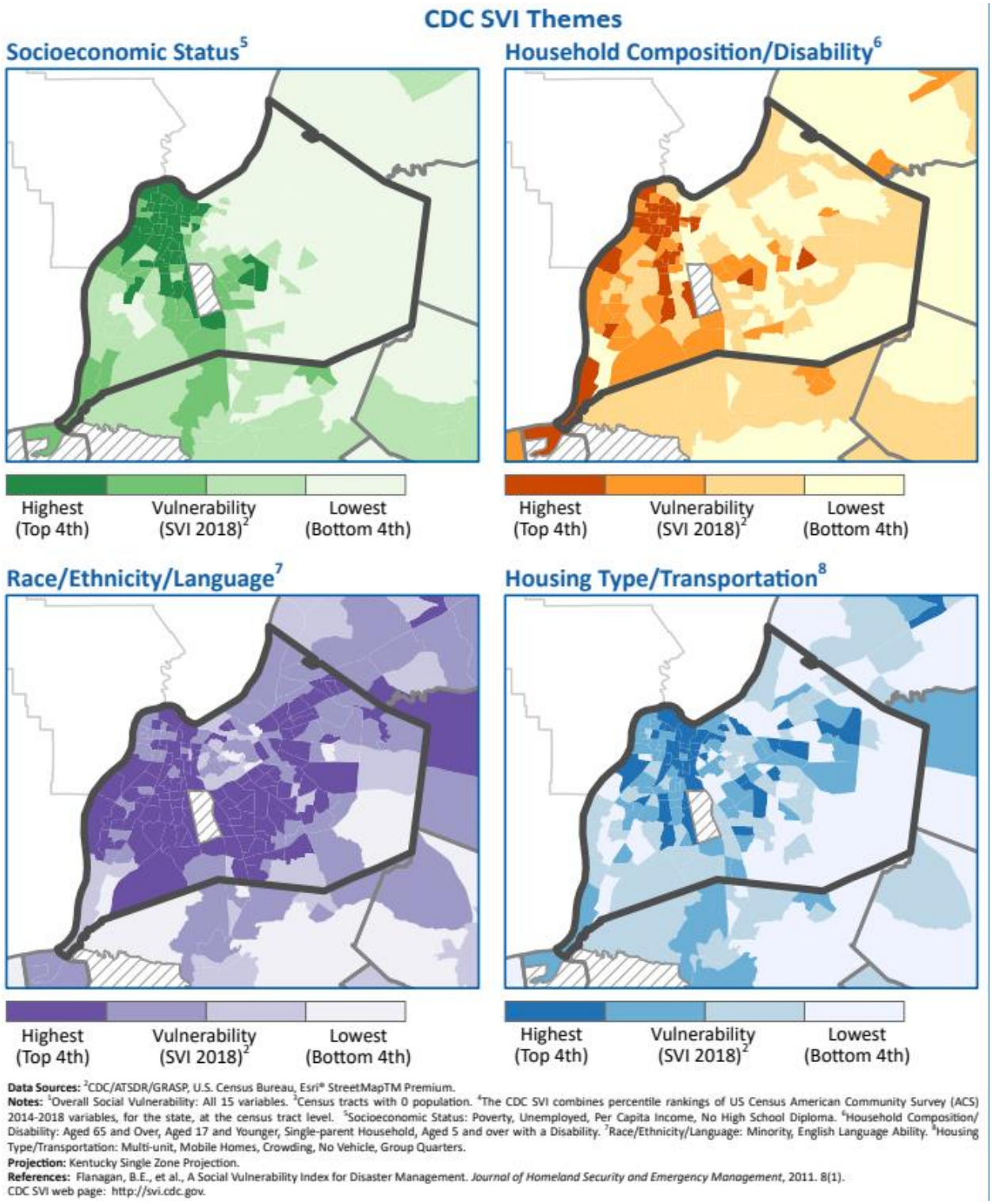


Figure 4-1: Louisville Metro SVI Maps (cont'd)



Data Sources: [2]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.
Notes: [1]Overall Social Vulnerability: All 15 variables. [3]Census tracts with 0 population. [4]The CDC SVI combines percentile rankings of US Census American Community Survey (ACS) 2014-2018 variables, for the state, at the census tract level. [5]Socioeconomic Status: Poverty, Unemployed, Per Capita Income, No High School Diploma. [6]Household Composition/ Disability: Aged 65 and Over, Aged 17 and Younger, Single-parent Household, Aged 5 and over with a Disability. [7]Race/Ethnicity/Language: Minority, English Language Ability. [8]Housing Type/Transportation: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters.
Projection: Kentucky Single Zone Projection.
References: Flanagan, B.E., et al., A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 2011. 8(1).
CDC SVI web page: http://svi.cdc.gov.

4.1 Identifying and Defining Hazards: Overview

This section provides a complete overview and definition of each likely hazard that could potentially affect the Louisville Metro area. A complete understanding of these hazards better prepares decision makers, local agencies, and residents on the causes of, potential damages contributed to, and possible scenarios of each hazard identified in the Plan.

It should be noted that there are many more hazards that could potentially affect the Louisville Metro area that are not included in the Plan. This includes events such as falling meteorites/asteroids, volcanic eruptions, and insect invasions, just to name a few. These were not profiled due to their extremely low probability of occurrence.

The plan includes hazards where there is a historical record of damage caused to people and property, or where the potential for such damage exists in the area. Due to the Louisville Metro's climate, geology, and geographical setting, the community is vulnerable to a wide array of hazards that threaten life and property. In addition, the Project Team conducted a survey with stakeholders to determine what hazards they believe are most likely to affect the Louisville Metro area.

Armed with this data, along with research of historic impacts, occurrences, dollar losses to date, review of the past State and Local Hazard Mitigation Plans, and discussions with key agencies and stakeholders, 16 hazards are assessed in the 2022 Louisville Metro Hazard Mitigation Plan. All but three of these hazards were included in the 2016 Hazard Mitigation Plan. Of these 16, 12 are considered "natural hazards" and are a source of harm or difficulty created by a meteorological, environmental, or geological event.

The Plan also includes three new hazards—civil unrest, cyber incidents, and public health emergencies—that are being addressed for the first time. These three join Hazardous Materials Release as the four manmade or human-caused hazards identified. Louisville Metro understands that FEMA will not review these in the plan approval process; however, Louisville Metro stakeholders identified these as risks to the local community and each has a long and significant history affecting the Louisville Metro area.

The 16 hazards included in the Louisville Metro l2022 Hazard Mitigation Plan, along with information on hazards included in the 2018 Kentucky Hazard Mitigation Plan, are presented below. It should be noted that Hailstorms and Severe Weather are addressed separately in the Louisville Metro plan, while they are addressed together in the state plan under "Tornadoes and Severe Thunderstorms and Wind."

Table 4-2: Louisville Metro/Commonwealth of Kentucky Hazard Crosswalk

2022 Louisville Metro Hazard Mitigation Plan Hazards	Included in 2018 Kentucky Hazard Mitigation Plan	Natural Hazard	Man-made/Non-natural hazard
Civil Unrest			X
Cyber incidents			X
Dam/ Level Failures	X	X	
Droughts	X	X	
Earthquakes	X	X	
Extreme Heat	X	X	
Hail		X	
Floods	X	X	
Hazardous Material Releases			X
Karst and Sinkholes	X	X	
Landslides	X	X	
Public Health Emergencies			X
Severe Winter Weather	X	X	
Severe Storms		X	
Tornadoes	X	X	
Wildfires	X	X	

Finally, to gain a better understanding of how the local community views hazard potential in the Louisville Metro area, the Planning Team conducted a simple Hazard Ranking exercise with plan stakeholders to determine which hazards are viewed as posing the highest risk to the community. Almost every stakeholder agreed that flooding was the biggest hazard facing the Louisville Metro community. This was followed by tornados and severe winter and summer storms. Cyber-attacks were also discussed as having a high potential risk, as was civil unrest and Public Health Emergencies. Each of these hazards has affected the Louisville Metro area within the past 2 years, and in the case of Public Health Emergencies, is still effecting the region through Covid-19. Because of this, recency bias—the tendency to place too much emphasis on experiences that are freshest in memory—may be a reason. The results of this process are found in Table 4-3 below.

Table 4-3: Louisville Metro Hazard Ranking

RANK	HAZARD
1	Flooding
2	Tornados

RANK	HAZARD
3	Winter Storms
4	Severe Storms
5	Cyber-Attacks
6	Public Health Emergencies
7	Hazardous Material Releases
8	Civil Unrest
9	Extreme Heat
10	Dam/Levee Failure
11	Earthquakes
12	Hail storms
13	Drought
14	Karst
15	Landslide
16	Wildfire

4.2 Profiling Hazards: Overview

As noted in the last section, due to Louisville's geology, climate, and geographical setting, the Louisville Metro area is vulnerable to a wide array of natural hazards that threaten life and property. The Profiling Hazards section profiles those hazards previously identified as affecting Louisville (see section titled "Identifying Hazards").

The Louisville Metro Hazard Profiles have been created using the best available data from a variety of resources, including but not limited to FEMA, the National Centers for Environmental Information (NCEI), formerly the National Climatic Data Center (NCDC), National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), LOJIC, the U.S. Army Corps of Engineers: Louisville District, Kentucky Office of Geographical Information, Kentucky Geological Survey (KGS), the CDC, the Kentucky State Climatology Center, Midwestern Regional Climate Center (MRCC), FEMA Hazard Mapping website, FEMA Data Visualization Tool, local agencies and newspaper articles, previously prepared Hazard Mitigation Plans (including those of nearby jurisdictions), and the approved 2018 Kentucky Enhanced State Hazard Mitigation Plan.

In addition to these sources, public input was a valuable local resource throughout the planning process. Stakeholder members attended steering committee/stakeholder meetings, completed a hazard identification and ranking exercise, and discussed information gathered from the sources listed above, as well as their own general knowledge. Steering committee members discussed particular issues such as past events and significant occurrences that did not warrant a declared disaster, and how those events impacted the Louisville Metro community.

4.2.1 Kentucky's Declarations

The profile section provides the historical context for identifying the hazards, and a good indicator of hazards affecting a community is to review a presidential declaration table. Using data obtained from the recently developed (2020) FEMA Data Visualization Tool, the table below identifies the 86 Presidentially Declared Disasters that have occurred in Kentucky since 1953[16] by type, and also identifies the 18 Presidentially Declared Disasters that have included the Louisville/Jefferson County. As the table shows, since 2016, the Covid-19 pandemic has been the only incident to warrant Presidentially Declared Disaster designation (EM-3469-KY and DR-4497-KY). The Incident Period for this disaster began on January 20, 2020, and is ongoing.

Table 4-4: Kentucky and Louisville Metro Presidentially Declared Disasters Since 1957

Rank	Number of KY Declarations	Hazard Type	Number of Louisville Metro Declarations	Dates	Declaration Title	Disaster Number
1	32	Severe Storms	6	1997	Severe Storm, Flooding and Tornadoes	1163
				2003	Severe Storms, Flooding, Mud and Rock Slides and Tornadoes	11471
				2004	Severe Storms, Tornadoes, Flooding and Mudslides	1523
				2008	Severe Wind Storm associated with tropical Depression Ike	1802
				2009	Severe Storm, Straight-Line Winds and Flooding	1855
				2011	Severe Storms, Tornadoes and Flooding	1976
2	26	Flood	4	1978	Severe Storm, Flooding	568
				1989	Severe Storm, Flooding	821
				2015	Severe Storms, Tornadoes, Flooding, Landslides, And Mudslides	4217
				2018	Severe Storms, Tornadoes, Flooding, Landslides, And Mudslides	4361
3	8	Fire	0	NA	NA	NA

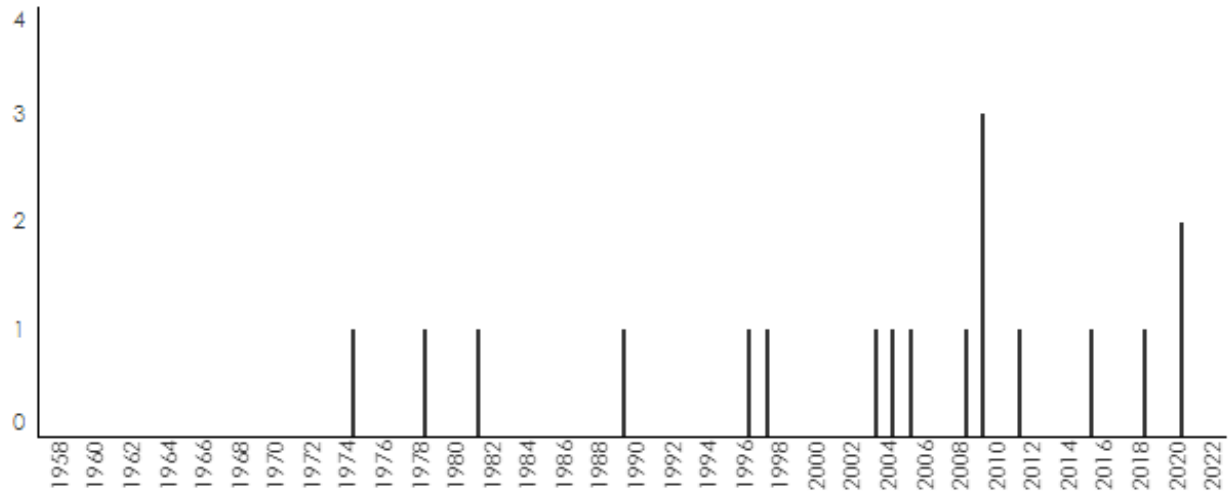
[16] https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Rank	Number of KY Declarations	Hazard Type	Number of Louisville Metro Declarations	Dates	Declaration Title	Disaster Number
4	7	Tornado	1	1974	Tornadoes	420
5	5	Snow	1	1996	Blizzard	1089
6	3	Severe Ice Storm	2	2009	Severe Winter Storm	3302
				2009	Severe Winter Storm and Flooding	1818
7	2	Biological	2	2020	Covid-19	3469
				2020	Covid-19 Pandemic	4497
8	1	Hurricane	1	2005	Hurricane Katrina	3231
9	1	High Winds	0	NA	NA	NA
10	1	Toxic Substance	1	1981	Sewer Explosion, Toxic Waste	636

Severe storms rank as the number 1 reason for Kentucky receiving Presidentially Declared Disaster designations, followed by flooding, fires, and tornadoes. It should be noted that for certain events, such as flooding, multiple hazards are listed as having affected an area.

Figure 4-2 below showcases the years that disasters have occurred in Louisville Metro area. As the data show, there were only six declared disasters prior to 2000, while there have been 12 since. This indicates that the frequency of disasters is increasing.

Figure 4-2: Presidentially-Declared Disasters in Louisville Metro Area by Year



4.2.2 Loss Matrix Tables

The Loss Matrix tables below provide quantitative data that portray which hazards have the potential to cause the most devastation, based on frequencies and damage numbers where available. The data used also help prioritize which hazards should receive the most consideration when justifying potential mitigation projects. These loss and occurrence data are then used to calculate a basic loss estimation model for each hazard, based on the number of events divided by the total number of damages. As always, these data can be improved, and Louisville Metro is dedicated to keeping better loss information to improve the results of this model.

The source of loss data for the Climate Loss Matrix was the National Centers for Environmental Information (NCEI) Storm Events Database, which provides a consistent and single source of data, even if limited at times.

Geologic loss data were obtained from the USGS, the Kentucky Department of Water, and the Kentucky Geological Survey.

Loss estimates for Cyber, Civil Unrest, Hazmat Releases, and Public Health Emergencies were obtained from Louisville Fire and various government agency and private-sector estimates.

Table 4-5: Louisville Metro Loss Matrix Climate Hazards

Hazard	Start Range	End Range	Range (Yrs.)	Total # Events	Total Losses	Probability (% chance per year)	Average Consequences	Deaths	Injuries
Drought	1950	2021	71	0	$0	<1%	$0	0	0
Extreme Heat	2011	2022	11	3	$0	27%	$0	2	0
Hail	1961	2021	60	90	$20,017,000	100%	$222,411	0	0
Flooding	1996	2021	25	114	$253,036,000	100%	$1,983,583	2	0
Severe Storm	1957	2021	59	321	$4,327,000	100%	$13,4808	3	11
Severe Winter Storm	1996	2021	25	39	$255,000	100%	$3,889	5	0
Tornado	1964	2022	58	24	$6,205,000	42%	$258,542	3	227
Wildfire	2001	2022	20	0	$0	<1%	$0	0	0

Data based on NCEI Storm Events Database

Table 4-5 provides a snapshot of the damages associated with each climate hazard. Flooding has displayed the most potential to do damage to Louisville Metro, with Severe Storms (to include Heavy Rain, High Winds, Lightening, Storm Winds and Thunderstorm Winds) being the most frequent occurrence. It is important to note that hazards without damage records due to underdeveloped record keeping (i.e., Drought, Wildfire) should still be considered a risk to Louisville Metro.

Table 4-6: Louisville Metro Loss Matrix Geologic Hazards

Hazard	Start Range	End Range	Range (Yrs.)	Frequency	Total Losses	Probability (% chance per year)	Average Consequences	Deaths	Injuries
Dam/Levee Failure	1973	2022	42	1	$0	2%	None	0	0
Earthquake (>5.0)	1950	2022	72	8	$0	11%	None	0	0
Karst/ Sinkhole *	1950	2022	1	443	N/A	N/A	None	0	0
Landslides	1950	2022	72	5	$0	6%	None	0	0

Occurrences are recorded sinkholes.

Table 4-6 provides a snapshot of the damages associated with each geologic hazard. Karst/Sinkholes were the most frequent occurrence, while the remaining three hazards—Dam/Levee Failures, Earthquakes, and Landslides—had almost no significant occurrences over

the past 71 years. However, it is important to note that many geologic hazards either have a very low probability (but if/when they occur, can result in severe damage and high costs), or happen in rural areas and never get reported (Karst).

Table 4-7: Louisville Metro Loss Matrix Non-Natural Hazards

Hazard	Start Range	End Range	Range (Yrs.)	Frequency	Total Losses	Probability (% chance per year)	Average Consequences	Deaths	Injuries
Civil Unrest	1960	2022	62	2 major events	$200M	4%	$100M	5	10+
Cyber incidents	2000	2022	22	100+ day 8 major events/day	$100M +	100%	$2.07M	0	0
HAZ/MAT	2010	2022	6	1,000+/year	N/A	100%	~$2,000	0	0
Public Health Emergencies	2000	2022	22	5+	$1B+	45%	$200M	2,467	269,102

The Non-Natural Hazards Loss Matrix table provides a snapshot of the damages associated with non-natural hazards. These data make two things abundantly clear: cyber-attacks are the most frequent occurrence, while public health emergencies, to include the Covid-19 pandemic, are the single hazard that has had the biggest impact, both financially and on public health, in the history of Louisville Metro area.

5 Hazard Profiles

To streamline the dissemination of hazard information, the Project Team developed a common format in the profile section to display multiple layers of information, including information on previous occurrences, probabilities, types, locations, and information on extent. To provide the end users with a snapshot of each hazard and how it has impacted Louisville Metro, the Project Team again used a "Profile Risk Table" for each hazard. This table provides a general overview and summary of and how a hazard may affect the community. Table 5-1 describes the "Profile Risk Table" along with an explanation of each data element.

Table 5-1: Profile Risk Table [Specific Hazard]

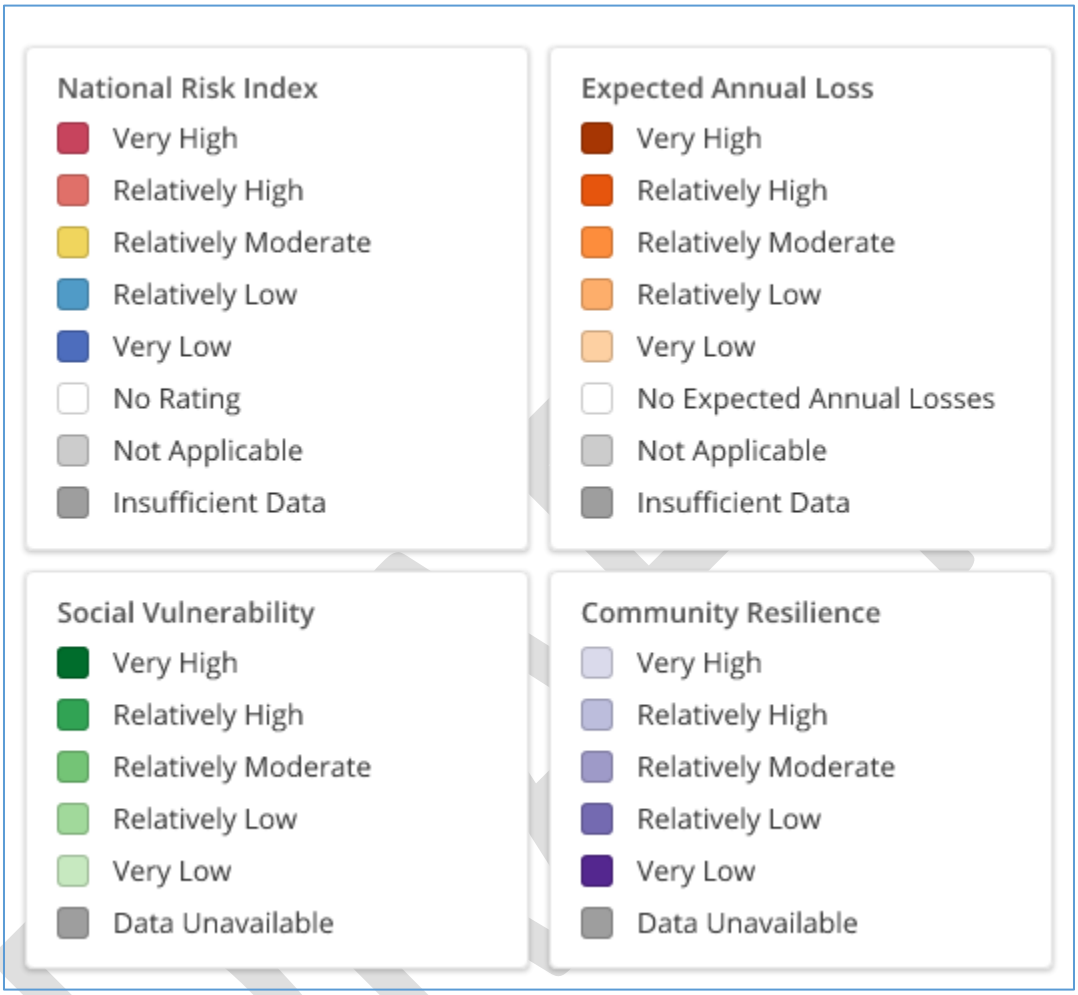
Period of occurrence:	When does this hazard typically occur?
Number of events:	Number of recorded events
Probability of events:	Probability of the event occurring, calculated using occurrence data • Rare - Hazard event is not likely to occur within 100 years (>1% chance of occurrence in any given year) • Occasionally – Hazard event is likely to occur within 100 years (1% chance of occurrence in any given year) • Frequent - Hazard event is likely to occur within 25 years (>4% chance of occurrence in any given year) • Annually – Hazard event likely to occur every year
FEMA Risk Rating	Information obtained from FEMA's 2021 National Risk Index[17]
Warning time:	Average/Typical warning time for this type of hazard
Potential of injury or death:	The potential this hazard could cause injury or death (high, medium, low) based on past occurrences both in Louisville and other similar jurisdictions.
Possible Extent:	Description of how bad could it be/worst case scenario.

The FEMA National Risk Index provides relative Risk Index scores and ratings based on data for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience. Separate scores and ratings are also provided for each component: Expected Annual Loss, Social Vulnerability, and Community Resilience. For the Risk Index and Expected Annual Loss, scores and ratings can be viewed as a composite score for all hazards or individually for each hazard type. It should be noted that only natural hazards are assessed in the National Risk Index.

The National Risk Rating's community score describes a relative position among all other communities at the same level for a given component. All scores are constrained to range of 0 (lowest possible value) to 100 (highest possible value). And for every score there is a qualitative

[17] https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf

rating that describes the nature of a community's score in comparison to all other communities at the same level, ranging from "Very Low" to "Very High" as depicted in the graphic below.



A full National Risk Register Community Profile for Jefferson County is included as Appendix D.

To further provide end users with information on each hazard and potential impacts on the Louisville Metro area, the Project Team developed a "Consequence Analysis" Table for each hazard. The consequence analysis is completed to better understand and outline the impacts that a hazard event would have on the public; responders; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; local economic conditions; and the overall public confidence in Louisville Metro governance should a hazard event occur. Table 5-2 describes information found in the "Consequence Analysis" table along with an explanation of each data element.

Table 5-2: Consequence Analysis [Specific Hazard]

Subject	Impacts
Health and Safety of the Public	Describes how the general public can be impacted and the risks associated with the specific hazard.
Health and Safety of Responders	Describes the impact the hazard will have on the first responder community to include response times and general health and safety concerns
Vulnerable populations	Describes if a hazard can disproportionally impact vulnerable populations, identifies those populations, and provides information on likely outcomes.
Continuity of Operations (including delivery of services)	Describes how a hazard could prevent Louisville Metro government employees, systems or infrastructure from either reporting to, or completing their essential functions.
Property, Facilities, and Infrastructure	Describes how a hazard could impact Louisville Metro area private property, government facilities and/or infrastructure.
Environment	Describes how a hazard could adversely affect the Louisville Metro area environment.
Economic Conditions	Describes the potential for economic losses due to hazard impacting the Louisville Metro area. Provides a general range of loss where appropriate.
Public Confidence in Louisville Metro Governance	Provides a general opinion based on past occurrences, both locally and nationally, of how the public will view the Louisville Metro government if preparedness, response and recovery actions associated with a specific hazard fall short of expectations.

Within each hazards profile section, the following elements will be found:

- A "Profile Risk" table that summarizes the overall risk.
- A "Consequence Analysis" table" that summarizes the potential impacts to various segments of the Louisville Metro community.
- A listing of previous significant occurrences on each identified hazard and a brief description of known events—occurring both in the Louisville Metro area or elsewhere if appropriate.

Understanding risk and each hazard's potential effect on Louisville Metro is imperative to the mitigation strategy, and provides the information needed to understand the overall risk to the community.

Assessing Vulnerability: Overview

The Assessing Vulnerability section uses best available data and modeling techniques from national, state, and local data sources. The model used for the Louisville Metro plan follows the State's Vulnerability Assessment Model, and the 2005, 2011 and 2016 Louisville Metro Hazard Mitigation Plan.

This model is very flexible and can be adjusted to fit the data needs of particular organizations. The model provides an understanding of relative risk and vulnerabilities from hazards across the community. Uncertainties are inherent in any vulnerability/risk assessment, 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, loss data or economic parameters).

The Louisville Metro Vulnerability Assessment incorporates multiple models that have been developed and data resources, and assimilates them into a specific model for this Plan. FEMA requires state and local partners to assess the jurisdiction's overall vulnerability to population, property, infrastructure, and critical facilities. The project team, using the best available data and methods, assessed the vulnerability and risks surrounding the Louisville Metro community.

One of the most important steps in creating a vulnerability assessment model in GIS is to define the geographic unit of measurement. Through the creation of previous Louisville Metro Hazard Mitigation Plans, the risk assessment model has become more granular.

The geographic unit of measure for this plan is a 100-meter (M) grid derived from the Military Grid Reference System (MGRS). The MGRS was chosen based on the equal area distribution of each grid cell, and the fact that the military-based grid system can also be used during response and recovery efforts. This model allows the end user to extrapolate hazard and exposure data into geographically equally sized areas. The Grid-Level Risk Assessment Model specifically provides the following improvements:

1. Equal area calculations based on each unit being equally sized
2. Allows better comparisons between planning areas in different parts of the County
3. Improved visual interpretations of risk and vulnerability
4. Potential for better policy decisions and dollar allocation
5. Granular data enhance the potential usage for other planning processes
6. Military grid provides enhanced usage during response and recovery

The Grid-Level Risk Assessment methodology provides enhanced data and more refined information for policy and decision making. There is a total of 103,920 individual grids across the county. The main goal of this model is to supply mapping that can be easily informed with a variety of data resources and inputs, while also allowing for providing a model that demonstrates equivalent comparisons across the area of assessment. Using the 100M grid cell model allows the data to be influenced by a variety of data resources, and provides 100M grids to assess each hazard equally across the entire planning area.

Models

There are multiple models that attempt to determine hazard vulnerability. The models used for this plan relies heavily on GIS spatial analyses and provides the user with several layers of integrated information that can be used individually to display different planning scenarios, such as densities of populations, buildings, and socially vulnerable populations.

To calculate vulnerability for the Louisville Metro area, various models were used, including the previously deployed "Hazard Vulnerability Score" methodology. As mentioned, to facilitate data

collection and analysis, data was collected at the 1M grid level. This approach enabled the creation of a Hazard Vulnerability view for hazard at the 1M grid spatial level.

Critical facilities were key in determining overall vulnerability. Critical facility locations were obtained from LOJIC and include the following types and numbers:

Table 5-3: Critical Facility Types and Numbers Within the Louisville Metro Area

Critical Facility Types	No. of Critical Facilities	Critical Facility Types	# of Critical Facilities
Colleges	26	Manufacturing Facilities	95
Convention Centers	2	Municipal Office Buildings	29
Daycares	699	Museums	9
Detention Centers	11	Nursing Homes	64
Emergency Operations Centers	1	Post Offices	32
EMS Sites	124	Religious Facilities	13
Groceries	812	Schools	247
Health Clinics	15	Shelters	79
Hospitals	24	Major Shopping Centers	26
Hotels	116	Theaters and Sports Facilities	16
Libraries	19		

Finally, critical infrastructure was identified and mapped to include the following:

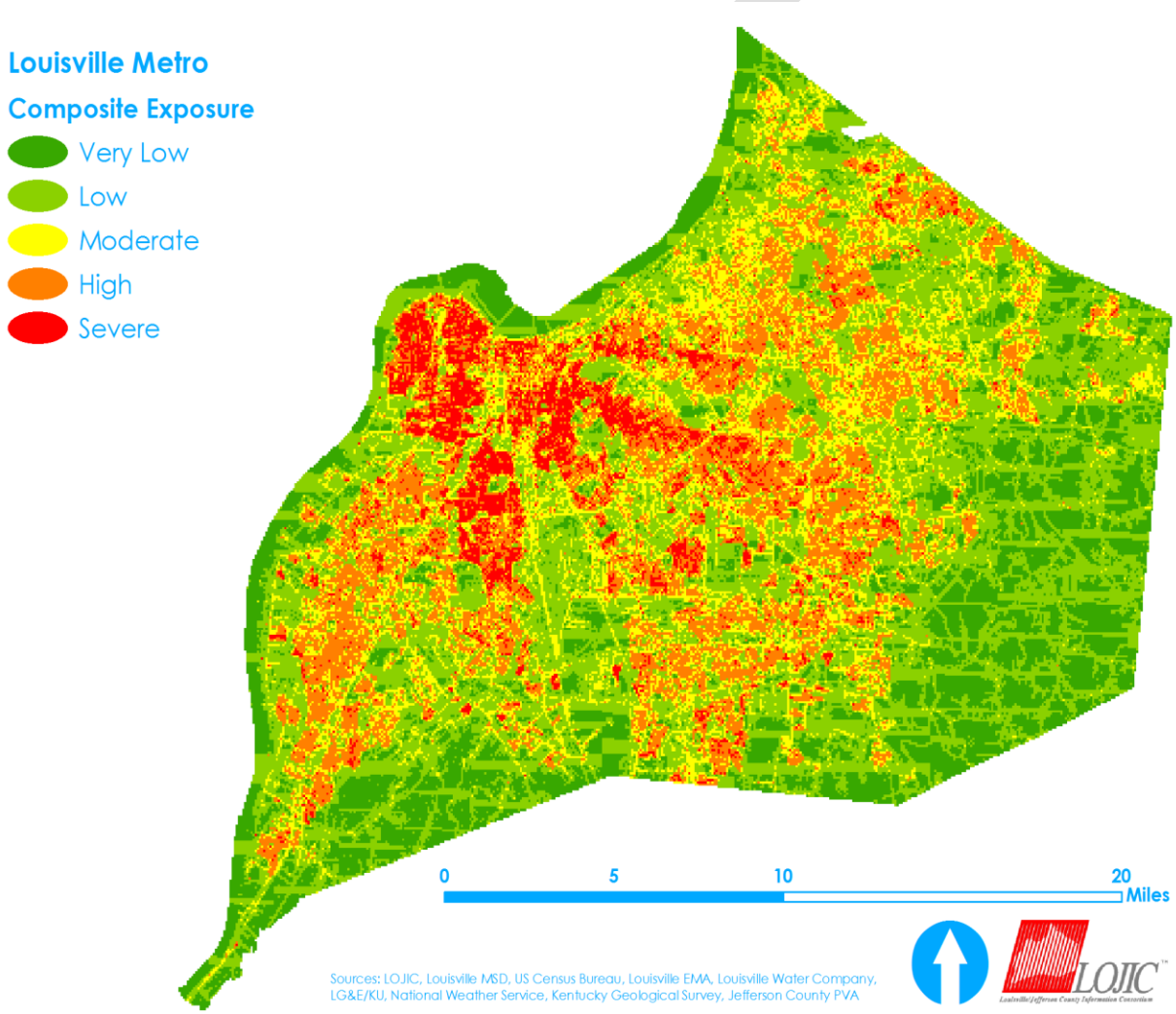
Table 5-4: Louisville Metro Critical Infrastructure Categories

Airports	Gas Storage Facilities	Sewer Treatment Plants
Bridges	Generation Facilities	Sirens
Bus Depots	LGE Facilities	Tunnels
Drainage Lines	MSD Facilities	Viaducts
Drainage Pump Stations	Ports	Water Company Facilities
Electrical Lines	Rail Lines	Water Pressure Stations
Electrical Towers	Roads	Water Storage Tanks
Flood Pump Stations	Sewer Lines	Water Supply Lines
Gas Lines	Sewer Pump Stations	-

Exposure

To finalize vulnerability, critical facility and infrastructure data was overlain by hazard-specific risk maps. This allows emergency managers and the stakeholder community to comprehend where high concentrations of need could arise during and/or before a disaster. These data layers can also be used individually for multiple planning purposes. Figure 5-1 represents the composite Exposure for the Louisville Metro area. This map shows the areas with the greatest vulnerability considering all hazards identified in this plan.

Figure 5-1: Composite Exposure Map for the Louisville Metro Area



The Hazard Vulnerability Composite Exposure map appears to contain some bias toward the more populated areas in the county, to include the City o Louisville . This is due to a correlation between density of population and density of infrastructure, properties, and critical facilities. This resulted in densely populated areas having greater exposure in general. The goal of this

model was to assess the most vulnerable areas throughout Louisville Metro. Given the most populated areas have the most at risk, this model achieves this goal.

Finally, throughout the next sections, where each of the 16 hazards are described in detail, additional information on vulnerability and how it is being calculated, is presented.

5.1 Civil Unrest

Civil unrest, also known as civil disorder and civil disturbances, can range from minor to significant events that can disrupt the functioning of a community for a few days, weeks, or months. Title 18 of the United States Code defines civil disorder, and lists the crimes associated with civil disorder. In Section 231 of Chapter 12, defines civil disorder as:

> *"Any public disturbance involving acts of violence by assemblages of three or more persons, which causes an immediate danger of or results in damage or injury to the property or person of any other individual…(a)(1)…use, application or making of any firearm, or explosive or incendiary device, or technique capable of causing injury or death to persons…or…(a)(2)…transports or manufactures for transportation in commerce any firearm, or explosive or incendiary device, knowing or having reason to know or intending that the same will be used unlawfully in furtherance of a civil disorder…or…(a)(3)…commit any act to obstruct, impede, or interfere with any fireman or law enforcement officer lawfully engaged in the lawful performance of official duties incident to and during the commission of a civil disorder…"*[18]

Civil unrest can arise from many situations, and be triggered by a specific issue or by a combination of causes. Instances of police violence have often been a scenario trigger for civil unrest. Although demonstrations and protests can occur throughout the Louisville Metro area, these actions often involve free speech rights in public places, and do not evolve into chaos or violence. Historically, civil unrest within Louisville Metro has centered in the downtown Louisville area. For planning purposes, civil unrest is most likely to occur in areas with numerous government buildings, schools/universities, city council meetings, state/city parks, and in the downtown core.

Civil unrest differs from Civil disobedience. The term civil disobedience, in contrast, is a non-violent form of protest or resistance to obeying certain laws, demands, and commands of a government or of an occupying power. Civil disobedience is sometimes equated with protests or non-violent resistance. Acts of civil disobedience can start peacefully, but can lead to violence. In this context, civil disorder arising from civil disobedience in which participants turn violent and antagonistic toward public safety and civil authority is unlawful.

The lines between civil unrest and civil disobedience and simple protest/demonstrations are often blurred, and encompass a wide range of actions: from peaceful to violent, from legal to illegal, and from spontaneous to highly planned. Further, while a group of people may organize and bring attention to a specific cause through peaceful protest/demonstrations, a smaller, separate group may engage in illegal tactics.

Because civil unrest may result from many situations and encompass a broad spectrum of actions, the severity of such disturbances often reflects the degree of public displeasure or

18 https://www.law.cornell.edu/uscode/text/18/232

expression of discontent. As the last few years have shown, civil unrest in both the Louisville Metro area and throughout the United States can be both a driver for change, and a dangerous condition that can become increasingly chaotic and volatile.

Laws have evolved that govern civil unrest and peacefully resolve conflict. In the United States, gathering in a crowd is constitutionally protected under "the right of the people to peacefully assemble." However, assemblies that are not peaceable are generally not protected. The laws that deal with disruptive conduct are generally grouped into offenses that disturb the public peace. They range from misdemeanors, such as blocking sidewalks or challenging another to fight, to felonies, such as looting and rioting.

5.1.1 Hazard Profile and Consequence Analysis

Table 5-1 below represents the typical hazard profile associated with civil unrest.

Table 5-1: Profile Risk Table Civil Unrest

Period of occurrence:	Anytime; however, actions are typically in "reaction" to a specific event.
Number of events:	10+ over last 50 years (many are small and go unreported)
Probability of events:	Frequent - Hazard event is likely to occur within 25 years (>4% chance of occurrence in any given year)
FEMA Risk Rating/Score:	Not applicable
Warning time:	None to days
Potential of injury or death:	High. During the recent Breonna Taylor protests, at least three people were killed with many others injured.
Possible Extent:	The magnitude or severity of a civil unrest situation coincides with the level of public outrage. They can take the form of small gatherings or large groups blocking access to buildings or disrupting normal activities. Civil unrest situations can also be peaceful sit-ins or a full scale riot. The circumstances surrounding civil unrest may be spontaneous or may result from escalating tensions. Civil unrest can erupt anywhere but the most likely locations are those areas with large population groupings or gatherings. Sites that are attractive for political rallies should be viewed as potential locations for the epicenter of civil disorder events. Disruption of critical infrastructure may occur during very severe civil unrest events. Public services such as water, power, communication, and transportation may be temporarily unavailable. Civil Unrest can also occur in proximity to locations where a 'trigger event' occurred The Louisville downtown area is the most likely place where civil unrest will occur. Other locations are unlikely to be as affected as those in the central business district. Civil unrest can last anywhere from one day to months and costs for city agencies tasked with response, monitoring, protection and clean up can easily exceed $100,000 even for small events. Although insurance may cover private businesses and homes for losses emanating from civil unrest, this is typically not the case for public facilities.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and Plan stakeholders, specifically those associated with the Louisville Metro Police and Fire departments, Louisville Metro EMS, the Department of Public Works, and the Mayor's Office, has been performed to better understand and outline the impacts that extended periods of civil unrest would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in the table below.

Table 5-2: Consequence Analysis Civil Unrest

Subject	Impacts
Health and Safety of the Public	All Louisville Metro area residents can be impacted by civil unrest, though those who live or work in downtown Louisville tend to be more exposed and impacted by civil unrest incidents.
Health and Safety of Responders	First responders are often on the front line of events. Responders can be targeted, causing injury to personnel, damage to facilities, and the loss of equipment. Responders are often injured during major civil unrest incidents and, even when events are brought under control, may be seen as an enemy of the community causing long-term trust issues.
Vulnerable populations	Ethnic minority and immigrant communities are historically the centers for civil unrest events.
Continuity of Operations (including delivery of services)	Major incidents can bring government services to a standstill. In the Louisville Metro area, with the majority of government offices located in the central downtown area, a major incident in this area could prevent employees from getting to work or home. Furthermore, government buildings are often targeted and can be damaged or destroyed.
Property, Facilities, and Infrastructure	Civil unrest incidents often target government organizations or visible images of the government such as first responder vehicles, city halls, courts, and businesses such as banks and retail stores. Businesses in downtown areas or along transportation routes are often targeted during looting or may be targeted for political or other reasons such as ownership ethnicity or their association with an industry being targeted by the manifestation (banks, oil company offices, etc.). Much of the impact from civil unrest is to property, secondary only to economic impacts. According to Axios, protests that took place in 140 U.S. cities after the death of George Floyd resulted in at least $2 billion of paid insurance claims — eclipsing the record set in Los Angeles in 1992 after the acquittal of the police officers who brutalized Rodney King[19]. The costs to public entities were likely much larger.

[19] https://www.axios.com/2020/09/16/riots-cost-property-damage

Subject	Impacts
Environment	Typically, civil unrest will have a minimum impact on the environment unless, hazard material facilities such as petroleum or chemical facilities are targeted in arson fires or vandalism. The impact on the environment in such cases could be significant.
Economic Conditions	Economic impacts caused by loss of business, destruction of businesses, and business interruption can exceed the property damage dollar figures by multiple factors. Lost sales and uninsured losses can permanently destroy small businesses. Areas can also become perceived as unsafe or unwelcoming for business, further hurting the economy. Finally, financial outlays related to unanticipated civil unrest can create unanticipated budget issues.
Public Confidence in Louisville Metro Governance	Major incidents can cause long-term damage to public confidence in local government or, especially, Louisville Metro public safety elements. This can cause either alienation or, when response is proactive, help rebuild confidence and trust. The general public expects a quick restoration of order and protection of property while activists may demand accountability from officials and safety for peaceful demonstrators.

5.1.2 Significant Louisville Metro Civil Unrest Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to civil unrest. That said, Louisville has a long history of civil disobedience that has spanned generations.

During the civil rights movement, Louisville was a regular stop for the Rev. Dr. Martin Luther King Jr., whose brother served as a pastor in the city. There were sit-ins, pickets, and marches that led to landmark victories: it was the first major city in the South to pass local civil rights and fair housing ordinances, and it was the rare Southern city to peacefully integrate its schools after the Brown v. Board of Education ruling. The 1970s brought a violent clash over the use of bussing to integrate schools. In the 1980s, there was so much labor unrest that Louisville became known as Strike City. And although these events were important in their own right, three major events have shaped Louisville as a city of protest.

Bloody Monday 1855: Bloody Monday was a series of riots on August 6, 1855, in Louisville, an election day, when Protestant mobs attacked Irish and German Catholic neighborhoods. These riots grew out of the bitter rivalry between the Democrats and the Nativist Know-Nothing Party. Multiple street fights raged, leaving twenty-two people dead, scores injured, and much property destroyed by fire. Five people were later indicted, but none were convicted, and the victims were not compensated. This was one of the largest riots in the United States at the time.

Louisville Riots of 1968: As in many other cities around the country, there was unrest and riots, partially in response to the assassination of Martin Luther King Jr. On May 27, a group of approximately 400 people gathered at 28th and Greenwood Streets, in the Parkland neighborhood. The intersection, and Parkland in general, had recently become an important location for Louisville's black community, because the local NAACP branch had moved its office there. The crowd was protesting against the possible reinstatement of a white officer who

had been suspended for beating a black man some weeks earlier. Several community leaders arrived and told the crowd that no decision had been reached, and alluded to disturbances in the future if the officer was reinstated. By 8:30, the crowd began to disperse.

However, rumors were spread that Student Nonviolent Coordinating Committee speaker Stokely Carmichael's plane to Louisville was being intentionally delayed. After bottles were thrown by the crowd, the crowd became unruly and police were called. However, the small and unprepared police response simply upset the crowd more, which continued to grow. The police, including a captain who was hit in the face by a bottle, retreated, leaving behind a patrol car, which was turned over and burned. By midnight, rioters had looted stores as far east as Fourth Street, overturned cars, and started fires.

Within an hour, Mayor Kenneth A. Schmied requested 700 Kentucky National Guard troops and established a citywide curfew. Violence and vandalism continued to rage the next day, but had subdued somewhat by May 29. Business owners began to return, although troops remained until June 4. Police made 472 arrests related to the riots. Two teenage rioters had died, and over $200,000 in damage had been done.

The disturbances had a longer-lasting effect. Many local business owners quickly pulled out or were forced, by the threat of racial violence, to leave Parkland and surrounding areas. Many residents also left the West End, which has since lagged behind the greater Louisville area in terms of development and economic activity.

Breonna Taylor Riots 2020-2021: In one of the longest sustained protests in Louisville's 242-year history, marchers took to the streets over a one-year period to rally for justice in the shootings by authorities of Breonna Taylor on March 13, 2020, and David McAtee on June 1 of the same year. These protests and demonstrations were part of the nationwide reaction to the murder of George Floyd, an African American man who was killed in police custody on

Protestors in Louisville after Breonna Taylor Shooting
Courtesy: New York Times

May 25, 2020.

On May 26, multiple protesters, including friends and family of Taylor, protested outside Louisville Mayor Greg Fischer's office, and demanded the three officers be arrested and charged with murder. On May 28, 500 to 600 demonstrators marched in Downtown Louisville. The protests continued into the early morning of May 29, when seven people were shot; one was in critical condition.

Daily protests in downtown Louisville continued, and on June 1, 2020, David McAtee, a 53-year-old African-American man, was fatally shot by the Kentucky Army National Guard in Louisville while protesting. According to officials, the police and soldiers were fired upon by McAtee, and two Louisville officers and two National Guardsmen returned fire. McAtee was killed by a shot fired from a guardsman. The body cams of the police involved were deactivated

during the shooting, in violation of department policy. Hours later, police chief Steve Conrad was fired by Louisville Mayor Greg Fischer.

On June 27, Steven Lopez was arrested after firing shots on the crowd of protesters gathered at Louisville's Jefferson Square Park, killing one and injuring another. Lopez had previously taken part in the Breonna Taylor protests, but later got into arguments with other Jefferson Park protesters, which resulted in at least three reported physical confrontations. Lopez was also among a group of 17 Louisville protesters who had been arrested on June 17 for inciting a riot, disorderly conduct, harassment, and possession of drug paraphernalia.

On July 4, over 100 people participated in the Youth March for Freedom in downtown Louisville. The participants stopped at historical civil rights sites, and speakers called for the end of racial injustice and told the stories of the people affiliated with the sites. On July 14, the national social justice organization Until Freedom organized a march of over 100 people to Attorney General Cameron's house, where protesters occupied his lawn, demanding charges against the officers involved in the killing.

By mid-July, there had been about 50 days of protests. According to LMPD, 435 protesters had been arrested. On July 24, protesters marched into the NuLu area of Louisville, blocked the 600 block of E. Market Street with metal barricades, and set up long metal tables for an impromptu block party to highlight demands for NuLu business owners, including hiring a more proportionate number of black workers. Police cleared the street and arrested 76 protesters who refused to leave.

On July 25, 300 members of the Atlanta-based black militia NFAC marched to Louisville's Metro Hall, with the street lined with local protesters. NFAC founder John "Grandmaster Jay" Johnson gave a speech calling on officials to speed up and be more transparent about the investigation into Taylor's death.

On September 23, the night after the grand jury verdict was announced, protesters gathered in the Jefferson Square Park area of Louisville as well as many other U.S. cities, including Los Angeles, Dallas, Minneapolis, New York, Chicago, Atlanta, Cincinnati, Denver, Nashville, Philadelphia, Seattle, San Diego, Las Vegas, and Portland. The previous day, a state of emergency had been declared in Louisville in anticipation of the verdict announcement. In Louisville, two LMPD officers were shot during the protest, and one suspect was kept in custody.

Finally, on and around the March anniversary of the killing, hundreds of people gathered for protests and civil unrest in cities across the United States, including Louisville.

5.1.3 Assessing Vulnerability

Although the probability of future civil unrest incidents is difficult to predict, given past occurrences, and the significance of Louisville Metro and its communities in past occurrences, civil unrest incidents are likely to occur in the future. As discussed in the Location section above, areas that are important to Louisville Metro government, the state, region, and even the United States may be targets for civil unrest. These areas include universities, landmarks, correctional facilities, major industrial facilities, and others similar in nature.

Civil unrest can result in numerous secondary hazards. Depending on the size and scope of the incident, civil unrest may lead to widespread urban fire, utility failure, transportation interruption, and environmental hazards. The most significant impact of civil unrest is the secondary hazard of interruption of continuity of government, which can also lead to several of the aforementioned secondary hazards. The extent of secondary hazards will vary significantly based on the extent and nature of the civil unrest.

It is difficult to estimate potential losses associated with civil disorder. These incidents often target government organizations or visible images of the government such as police vehicles, city halls, or court facilities. Businesses such as banks, businesses in the downtown Louisville area or along major transportation routes, and other "high-profile" commercial establishments are often targeted during looting, or may be targeted for political or other reasons, or because they are associated with an industry being targeted by those upset.

5.1.4 Climate Assessment

Because civil unrest is a short-term, human-caused hazard, no climate change impacts are associated with the hazard. However, according to a July 2022 article in "Nature Communications" researchers said, "climate change highlights the importance of understanding the complex relationships between natural and social systems, especially when evaluating the role of climate change in exacerbating internal political tensions and factionalism.[20] And although more research is needed, correlations are beginning to form regarding increased heat and drought conditions with increased civil unrest.

[20] https://www.nature.com/articles/s41467-022-31522-x

5.2 Cyber Incidents

Information technology has become embedded in the ways we conduct business, work, and live. In a government context, technology is fundamental to public services such as providing healthcare, public transportation, law enforcement, citizen engagement, public utilities, and supporting tax and rate payers. Any disruption to these services can have a significant negative impact on a community and its residents.

A cyber incident is defined by the Department of Homeland Security (DHS) in the 2016 National Cyber Incident Response Plan as:

> *"An event occurring on or conducted through a computer network that actually or imminently jeopardizes the confidentiality, integrity or availability of computers, information on communication systems or networks, physical or virtual infrastructure controlled by computers or information systems, or information resident thereon*[21]*.*

Confidentiality refers to the ability to preserve authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information.

Integrity speaks to guarding against improper information modification or destruction and ensuring information non-repudiation and authenticity. Data Integrity relates to ensuring data has not been altered in an unauthorized manner and covers data in storage, during processing, and while in transit. System Integrity covers the quality that a system has when it performs its intended function in an unimpaired manner, free from unauthorized manipulation of the system, whether intentional or accidental. And finally, availability refers to the ability to ensure timely and reliable access to and use of information.

The nature of cyber incidents (also called cyber-attacks) differs from other natural hazards and even man-made events because it often lacks physical presence or evidence. Cyber incidents can go on for years without being detected. And with each passing day, the costs and damage to a community increase. The Ponemon Institute's 2022 Cost of a Data Breach Report[22] indicated the following related to cyber incidents:

- Average total cost of a data breach – $4.35M
- Average cost of a data breach in the Public Section – $2.07M

[21] https://www.cisa.gov/uscert/sites/default/files/ncirp/National_Cyber_Incident_Response_Plan.pdf

[22] https://www.ibm.com/downloads/cas/3R8N1DZJ

- Percentage of organizations that have had more than one data breach – 83%
- Frequency of breaches caused by stolen or compromised credentials – 19%
- Share of breaches that occurred in the cloud – 45%
- Number of breaches occurred because of a compromise at a business partner – 19%
- Average time to identify a data breach 2021 – 277 days
- Average time to contain a data breach once identified 2021 – 70 days

Wherever information technologies exist and are used, cyber incidents can occur. As Louisville Metro becomes more and more dependent on its IT infrastructure, it also becomes more vulnerable to IT-related disruptions. Most cyber incidents can be categorized as malicious attacks, human errors, or as system glitches.

Cyber incidents based on actors with malicious intent can be driven by criminal motives for profit, extortion, and theft; or to damage, destroy, or interfere with infrastructure systems. Organizations worldwide experience malicious attacks on a daily basis, and Louisville Metro is no different. According to interviews with Louisville Metro Information Technology representatives, Louisville Metro faces numerous daily cyber incidents, with at least two per day being elevated to "major" status and requiring more investigation. Human error and system glitches are the main reason for allowing system intrusion.

Common Types of Cyber Incidents

Cyber incidents can occur at any time, with or without pervious warnings. Cyber incidents based on an actor's malicious intent can be driven by criminal motives for profit, extortion, and theft; or to damage, destroy, or interfere with infrastructure systems. Cyber incidents due to human errors or system glitches can occur because of negligence, lack of policy and/or process, unclear roles and responsibilities, insufficient training, misconfigurations, etc. Listed below are the most common types of cyber incidents:

- *Advanced Persistent Threat (APT):* An attack in which the attacker gains access to a network and remains undetected. APT attacks are designed to steal data instead of cause damage.
- *Adware:* A form of software that displays advertising content in a manner that is potentially unexpected and unwanted by users, which may also include various user-tracking functions (similar to spyware).
- *Denial-of-Service Attack (DoS):* Attacks that focus on disrupting service to a network in which attackers send high volumes of data until the network becomes overloaded and can no longer function.
- *Drive-by Downloads:* Malware is downloaded unknowingly by the victims when they visit an infected site.

- *Electro Magnetic Pulse (EMP):* Intense burst of electromagnetic energy resulting from natural (e.g., solar storms or space weather) or man-made (e.g., nuclear or pulse-power device) which can temporarily affect or permanently damage electronic equipment.
- *Malvertising:* Malware downloaded when the victim clicks on an affected ad.
- *Malware:* Software that can destroy data, affect computer performance, cause a crash, or even allow spammers to send email through an account.
- *Man-in-the-Middle (MITM):* Attacks mirror victims and endpoints for online information exchange. In this type of attack, the MITM communicates with the victim who believes is interacting with the legitimate endpoint website. The MITM is also communicating with the actual endpoint website by impersonating the victim. As the process goes through, the MITM obtains entered and received information from both the victim and endpoint.
- *Password Attacks:* Third-party attempts to crack a user's password and subsequently gain access to a system. Password attacks do not typically require malware, but rather stem from software applications on the attacker's system. These applications may use a variety of methods to gain access, including generating large numbers of generated guesses, or dictionary attacks, in which passwords are systematically tested against all of the words in a dictionary. Due to users reusing the same password for different systems, a password attack targeting an unrelated system can give the attacker access to a more sought-after system.
- *Pharming:* Arranging for a web's site traffic to be redirected to a different, fraudulent site, either through a vulnerability in an agency's server software or through the use of malware on a user's computer system.
- *Phishing:* Malicious email messages that ask users to click a link or download a program. Phishing attacks may appear as legitimate emails from trusted third parties.
- *Physical damage:* Intentional or unintentional damage to physical infrastructure such as data center, hardware, and power grids.
- *Ransomware:* Malware that locks a person's keyboard or computer to prevent them from accessing data until you pay a ransom, usually in Bitcoin. A popular variation of this is ransom crypto ware, which corrupts files using a private key that only the attacker possesses.
- *Social Engineering:* In the context of cyber-security, this refers to an effort to psychologically manipulate a person, especially through misrepresentation or deception, to gain access to information. The manipulation often relies on the trusting nature of most individuals, or makes use of many people's natural reluctance to offend others or appear too mistrustful. The ruse may involve creating impressions that make things appear more benevolent, trustworthy, and reliable than they actually are. Some schemes are very complex and involve several stages of manipulation over a substantial period of time.
- *Social Engineered Trojans:* Programs designed to mimic legitimate processes (e.g., updating software, running fake antivirus software) with the end goal of human

interaction–caused infection. When the victim runs the fake process, the Trojan is installed on the system.

- *Spear Phishing:* A form of phishing that targets a specific individual, company, or agency, usually relying on an accumulation of information to make subsequent ruses more effective when further probing the target, until a successful security breach finally becomes possible.
- *Spoofing:* Attempting to gain access to a system by posing as an authorized user, synonymous with impersonating, masquerading, or mimicking. Attempting to fool a network user into believing that a particular site was reached, when actually the user has been led to access a false site that has been designed to appear authentic, usually for the purpose of gaining valuable information, tricking the user into downloading harmful software, or providing funds to the fraudsters.
- *Spyware:* Software that allows others to gain private information about a user, without that person's knowledge or consent, such as passwords, credit card numbers, social security numbers, or account information.
- *Structured Query Language injection (SQLi):* Attackers use malicious SQL code for backend database manipulation to access information that was not intended to be displayed.
- *Virus:* A program or code that attaches itself to a legitimate, executable program, and then reproduces itself when that program is run.
- *Worm:* A self-contained program (or set of programs) that is able to spread copies of itself to other computer systems, usually through network connections of email attachments.

5.2.1 Hazard Profile and Consequence Analysis

Table 5-3 below represents the typical hazard profile associated with Cyber incidents.

Table 5-3: Profile Risk Table Cyber Incident

Period of occurrence:	Anytime
Number of events:	Thousands per month according to Louisville IT
Probability of events:	Frequent - Cyber incidents are likely to occur within 25 years (>4% chance of occurrence in any given year)
FEMA Risk Rating/Score:	Not applicable
Warning time:	None
Potential of injury or death:	Low. However, if critical infrastructure is affected long term (power is out for weeks, water is contaminated), the potential for injury or death increases significantly.
Possible Extent:	Cyber incidents can affect any vulnerable computer system. And since almost all computers in the Louisville Metro government use a Windows operating system, it

	is reasonable to conclude that every computer has the potential to be compromised. In this event, a majority of Louisville Metro services could become crippled, leading to delays in services and in some extreme cases, property loss, injuries and even death.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, including representatives with Louisville Metro Information Technology, has been performed to better understand and outline the potential impacts that cyber incidents would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in

Table 5-4:

Table 5-4: Consequence Analysis Cyber Incident

Subject	Impacts
Health and Safety of the Public	Anyone who is present in the Louisville Metro area during a cyber-incident can be impacted. Effects on residents may include delayed services such as transportation, impaired or cancelled healthcare services, decreased or no availability of public services, information, and financial loss and exposed or lost information.
Health and Safety of Responders	Emergency responders may not be able to access their mission critical systems, experience delays or performance issues. If data confidentiality is lost the public may lose their trust in organization and/or system. If data integrity is lost it may put patients and first responders at risk. Louisville Metro may experience a prolonged incident response if the disruption is long lasting, complex and exhausting internal resources.
Vulnerable populations	Individuals who have a direct dependency on Louisville Metro for health and safety reasons are vulnerable to cyber incidents impacting their needed services. Other vulnerable populations include individuals and organizations who depend on an income from Louisville Metro if payments can't be processed, who are dependent on critical public services or Louisville Metro-provided transportation.
Continuity of Operations (including delivery of services)	Minor cyber incidents which are identified early and are recoverable may have little to no impact on daily operations before being fully contained. However, a significant incident impacting one or more Louisville Metro departments or private businesses that contract to the government can severely affect Louisville Metro's capability to perform critical operations.
Property, Facilities, and Infrastructure	Cyber incidents can cause physical damage if property such as devices, infrastructure, or end consumers are affected by the disruption. An incident including utilities, life support devices, transportation or telecommunications may lead to extensive property damages. *Energy* – Almost all Louisville Metro services and those of other businesses within the area have a direct dependency to energy. A cyber incident impacting the power system can therefore have a secondary effect on the

Subject	Impacts
	Louisville Metro area as other critical systems without backup power will quickly fail. *Water/Wastewater* – Both Louisville Water and MSD facilities and infrastructure are vulnerable to cyber incidents on their SCADA systems, which can result in the release of hazardous material and malfunctioning systems. Such scenarios can result in environmental impact and create health and safety risks in the region. *Transportation* – Transportation systems are vulnerable to attacks on their SCADA systems, which may result in trains and vehicles not operating as planned, airport functionality issues, delays, cancellations which can result in a secondary economic impact in the region due to loss of productive if people can't access public transportation to and from work. *Communications* – The Louisville Metro area relies on different types of technology-based communications methods such as its website, VOIP and email to conduct its daily operations. A cyber incident impacting the VOIP or email system would quickly result in a loss of productivity, a negative consumer experience and could potentially halter or delay operations.
Environment	The loss of control or availability of SCADA systems could potentially impact the environment in the region if, for example, it causes the release of hazardous materials or improper disposal of waste water.
Economic Conditions	The financial impact of a cyber-incident ranges from little or minimal to significant depending upon duration, scale, affected systems, devices and users. A significant, extended cyber incident affecting most or all of Louisville Metro operations would likely impact the local and possibly regional economy for some time. An incident of that magnitude would likely create significant, potentially long-term or ongoing challenges Organizations who experience cyber incidents which lead to data breaches of sensitive or confidential information can be subjects to legal fines and financial penalties if, for example, Personal Identifiable Information (PII), including social security numbers, credit card information or driver's license information is breached. Organizations who fail to meet regulatory and contractual obligations due to a cyber-incident may have significant cost for legal fees, settlements and fines. If Louisville Metro is held in a Ransomware attack, the cost to either pay the ransom or defend against future attacks could run into the tens of millions of dollars.
Possible Extent:	Louisville Metro has identified a number of essential services which are critical to support life, health, safety and legal requirements in the region, to include critical SCADA systems, critical facilities, critical devices, and communication systems. Cities of similar size to Louisville have paid ransomware costs into the tens of millions of US Dollars to reclaim access to their vital records.
Public Confidence in Louisville Metro Governance	Recent cyber-incidents involving government agencies such as the ransomware attack on the City of Atlanta shows that such large scale disruption generate national media interest; jeopardizes perceptions of effective operations, question executive priorities, and decrease general public confidence in the government's ability to protect their vital information.

5.2.2 Significant Louisville Metro Cyber Incident Occurrences

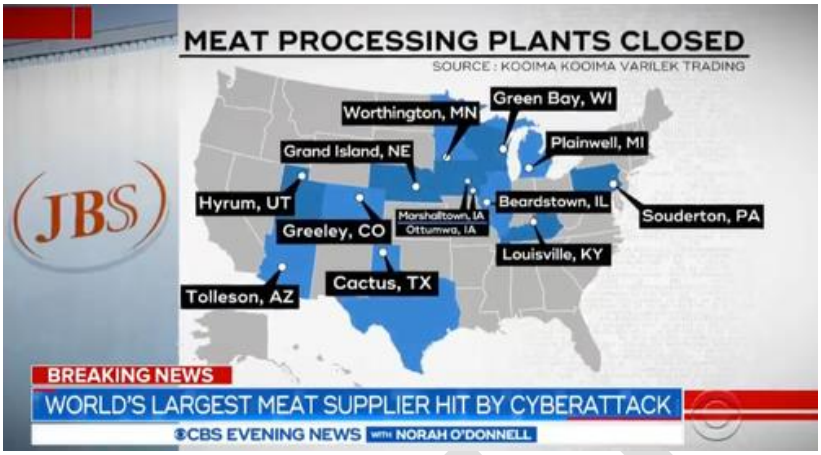
According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to cyber incidents.

Cyber incidents occur daily across the globe. The quantity of information being stolen by malicious attackers, destroyed, or exposed as a result of a human error or made unavailable due to a system glitch is growing each year. As noted previously, Louisville Metro is the recipient of a constant variety of attacks ranging from scans for weaknesses in our defenses, malware, phishing, and internet-based attacks, to insider threats. Although Louisville Metro has not been identified as a target of any successful attacks, there have been several high-profile incidents in the Louisville Metro area, as well as with cities similar in size to Louisville. Select events are described below:

Louisville Zoo. Louisville, KY – Cyber Attack 2022: A ransomware attack occurred recently to the company that sends emails for the Louisville Zoo, according to zoo officials. Officials said that names, email addresses, physical addresses, membership numbers, and membership levels were acquired by an unauthorized party as a result of the software attack. They did not say when exactly the software attack occurred.

Becker Law Firm. Louisville, KY-Ransomware Attack 2022: In a cyber-attack on one of Louisville's best-known law firms, extortionists gave Becker Law Office just one day to respond to their ransom request, or else they would release files allegedly stolen from the firm.

JBS Meatpacking. Louisville, KY–Ransomware Attack: On May 30, 2021, JBS S.A., a Brazil-based meat processing company, suffered a cyberattack, disabling its beef and pork slaughterhouses. The attack impacted facilities in the United States, Canada, and Australia. JBS supplies approximately one-fifth of meat globally, making it the world's largest producer of beef, chicken, and pork by sales. JBS paid the hackers an $11 million ransom. The ransom was paid in Bitcoin. JBS, which employs about 1,200 people at its Butchertown plant in Louisville, said the vast majority of its facilities were operational at the time it made the payment, but it decided to pay to avoid any unforeseen issues and ensure no data were exfiltrated. "This was a very difficult decision to make for our company and for me personally," said Andre Nogueira, the CEO of JBS USA. "However, we felt this decision to pay had to be made to prevent any potential risk for our customers."



2021 Cyber Attack on JBS Meatpacking, including Louisville Plant
Courtesy: CBS Evening News

5.2.3 Assessing Vulnerability

Regardless of the nature of the cyber incident, any area where an IT system supports Louisville Metro services can be vulnerable. The magnitude of a cyber-incident varies greatly based on the extent and duration of the impact. The extent varies based on which specific system or data are affected, possible warning time, and the ability to preempt the incident and activate a well-known and effective incident response plan. Not all IT systems used by Louisville Metro are owned or managed by the Louisville Metro. Louisville Metro relies on numerous third-party vendors and partners, who are also exposed to cyber incidents and can therefore be vulnerable to cyber incidents in other organizations. Therefore, to reduce the risk of cyber incidents, it is important to manage threats and vulnerabilities in a systematic way to include having established backup systems, current and actionable incident response, disaster recovery and continuity of operations plans, and instituting a regularly established exercise program.

All computers and computer-related equipment are vulnerable to cyber-attacks. Therefore, it is not possible to estimate potential losses associated with this hazard.

5.2.4 Climate Assessment

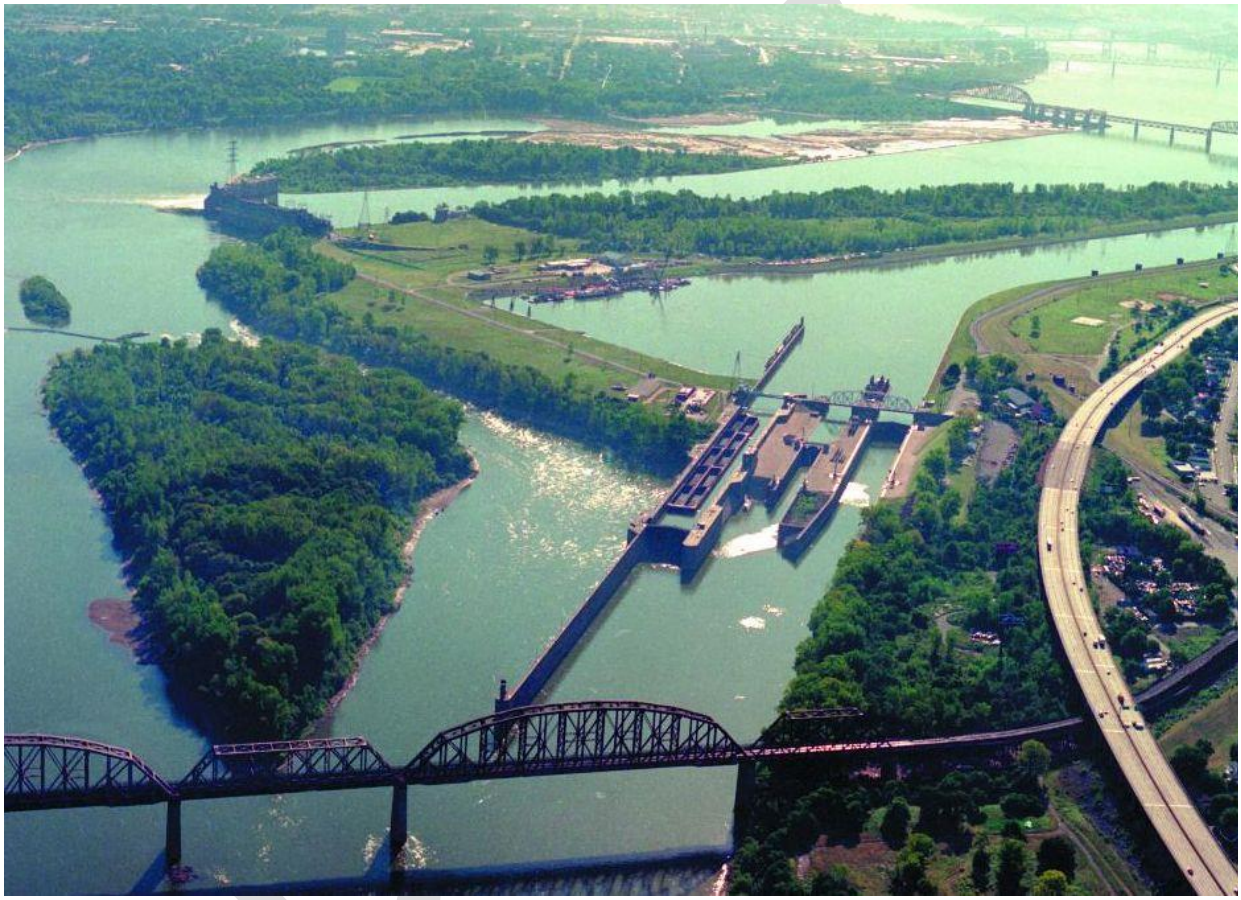
Two very real major threats that are expected to only accelerate in the future are climate change and cyber security incidents. A common characteristic between the two: lack of redundant infrastructure, whereby systems and services are no longer equipped to meet the changing demands of these threats. Furthermore, there is no accountability for both cyber security and climate change, because it is difficult to pinpoint who is accountable for climate change because everyone plays a part. Similarly, cyber space is accessible to almost everyone, making it difficult to find perpetrators of cyber-attacks.

Climate Risk

Researching the relationship between cyber incidents and climate change is currently ongoing. Although the global climate and cyber space seem worlds apart, they share many similarities. Even though the variables affecting the climate and cyber space are different, the risks associated with them are both human-caused, and can affect the same critical equities, including water, food, and energy infrastructures. Developing threat mitigation strategies that acknowledge these similarities, and encouraging cross-pollination between these key sectors, are therefore important first steps for ensuring a climate and cyber-secure future.

5.3 Dam/Levee Failure

According to the 2021 Infrastructure Report Card produced by the American Society of Civil Engineers, there are over 91,000 dams in the country that serve many purposes[23]. Although dams and levees have many benefits, they can also pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam or levee failure, the energy of the water stored behind even a small dam or levee is capable of causing loss of life and great property damage to people and infrastructure downstream.



McAlpine Locks and Dam,Louisville, KY
Source: U.S. Army Corps of Engineers

According to the U.S. Army Corps of Engineer's National Levee Database[24], the Louisville-Metro Levee System has a total length of 25.92 miles, and consists of approximately 21.0 miles

23 https://infrastructurereportcard.org/cat-item/damsinfrastructure/#:~:text=As%20of%202019%2C%20there%20are,once%2Drural%20dams%20and%20reservoirs.

[24] https://levees.sec.usace.army.mil/

of earth levee, 4.21 miles of concrete wall, and 16 pumping stations, 152 gates, and other necessary appurtenances. The project also incorporates a total 98 closures; 21 of which have been permanently sealed, and 19 of which are relatively small sandbag closures. The leveed area is estimated at approximately 76.2 square miles, and affords protection against Ohio River floods equal to the maximum of record, elevation 460.15 feet in January 1937, with a freeboard of three feet. The Louisville-Metro Levee System was federally authorized and constructed by the U.S. Army Corps of Engineers. It is now operated, maintained, and managed by MSD.

The Dam Safety and Security Act of 2002 (Public Law 107-310), signed into law on December 2, 2002, addresses safety and security for dams through the coordination by FEMA of federal programs and initiatives for dams and the transfer of federal best practices in dam security to the states. The Act of 2002 includes resources for the development and maintenance of a national dam safety information network, and the development of a strategic plan that establishes goals, priorities, and target dates to improve the safety and security of dams in the U.S.

Working under federal guidelines, the Kentucky Dam Safety program, within the Energy and Environment (EEC) Cabinet, Department for Environmental Protection (DEP), Division of Water (DOW), is responsible for the following activities in the Commonwealth:

- Inspecting existing dams
- Assessing and ranking dams based on conditions and risks
- Issuing permits for dam construction/rehabilitation
- Managing dam-related risks to minimize hazard creep
- Preparing and reviewing Emergency Action Plans (EAPs)
- Communicating dam-related risks
- Managing the State-Owned Dam Repair (SODR) program

Kentucky 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."*

The NFIP defines a levee in Title 44, Chapter 1, Section 59.1 of the Code of Federal Regulations (44 CFR 59.1) as:

> *"A man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to reduce risk from temporary flooding.*[25]*"*

The NFIP regulations define a levee system as:

> *"A flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices."*

For the purposes of this document, levees and levee systems are referred to as "levees."

Dam Classifications and Types

Since 1948, anyone in Kentucky proposing to construct a dam has been required to submit a plan to the state for review 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.

Man-made dams may be classified by the:

- Type of materials used
- Methods used in construction
- Slope or cross-section of the dam
- Way the dam resists water pressure forces
- Means for controlling seepage
- Purpose of the dam

Materials used for dam construction may include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, and/or miscellaneous materials such as plastic or rubber. The most common types of dams found in Kentucky are described below.

- *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 composed 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. These are the most prevalent dam type in the Louisville Metro area.
- *Concrete dams* may be categorized as gravity or arch dams according to the design used to resist the stress of reservoir water pressure. Concrete gravity dams use the mass weight

25 https://www.fema.gov/sites/default/files/2020-08/fema_what-is-a-levee_fact-sheet_0512.pdf

of concrete and friction to resist reservoir water pressure. A buttress dam is a specific type of gravity dam in which the large mass of concrete is reduced, and the forces are diverted to the dam foundation through vertical or sloping buttresses.

- *Coal impoundments* are defined by the Mining Safety and Health Administration (MSHA) as any structure associated with coal mining operations built to impound water and, are either at least 20 feet high, or capable of impounding at least 20 acre-feet of water. Coal impoundments store coal slurry (wastewater and impurities that result from coal washing and processing). According to the MSHA, of the 1,640 impoundments nationwide, more than 400 of those are identified as high hazard.[26]

Kentucky Dam Classification Description

Dams in Kentucky are classified by the Kentucky Division of Water as one three hazard types:[27]

- *High Hazard (C):* Structures located such that failure may cause loss of life or serious damage to houses, industrial or commercial buildings, important public utilities, main highways or major railroads.
- *Moderate Hazard (B)*: Structures located such that failure may cause significant damage to property and project operation, but loss of human life is not envisioned.
- *Low Hazard (A)*: Structures located such that failure would cause loss of the structure itself but little or no additional damage to other property.

High- and moderate-hazard dams are inspected every two years. Low-hazard dams are inspected every five years. If the structure meets all the necessary requirements as outlined in Engineering Memorandum No. 5, a Certificate of Inspection is issued to the owner. Otherwise, the owner is notified of any deficiencies. During each inspection, dams are assigned as one of the following four conditions: Satisfactory, Fair, Poor, and Unsatisfactory.

Types of Dam Failures

Hundreds of dam failures have occurred throughout U.S. history. These failures have caused immense property and environmental damages and have taken thousands of lives. As the nation's dams age and population increases, the potential for deadly dam failures grows. No one knows precisely how many dam failures have occurred in the U.S., but they have been documented in every state. From January 1, 2005 through June 2013, state dam safety programs reported 173 dam failures and 587 "incidents"— episodes that, without intervention, would likely have resulted in dam failure.[28] Unfortunately, many dam-related incidents go unreported due to various reasons, including the rural nature of many dams.

Several factors influence loss of life from dam failures, including the population at risk (PAR), the velocity and depth of the flood wave, the time of day or year the dam failure occurs, ease of

[26] https://www.msha.gov/training-education/safety-and-health-materials/safety-topic-impoundments-and-dams

[27] https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/DamSafety.aspx

[28] https://damsafety.org/dam-failures

evacuation from the inundated areas, and the timeliness of warning about the dam failure. Tools have been developed, such as Emergency Action Plans (EAPs), to communicate to dam owners, emergency management personnel, communities, and citizens the risks of dam failure, and what actions must be undertaken to protect life and property.

Most dam failures occur due to flooding events that cause overtopping of the dam. Other factors that may cause a dam to fail include:

- *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, because 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, and fly ash. 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.

Louisville Metro Dam/Levee Inventory

Per the U.S. National Inventory of Dams[29], Kentucky has approximately 1,107 dams, with almost 200 dams being identified by FEMA as High Hazard – or Class C–dams. Forty of these dams, including nine identified by FEMA as High Hazard, are in the Louisville Metro area. The list of Louisville Metro's 40 dams according to the Kentucky Division of Water (KDOW) is presented in Table 5-5 below:

Table 5-5: Active Louisville Metro Dams

Dam #	Name of Dam	Hazard Class	Owner Type	Location	Height	Area (sq. mile)
1	Tom Wallace Lake Dam	(Class C) High	MUN	Valley Station	31	2.5
2	Pine Hill Lake No 1	(Class C) High	PRI	Louisville West	27	2.8

[29] https://nid.usace.army.mil/#/

Dam #	Name of Dam	Hazard Class	Owner Type	Location	Height	Area (sq. mile)
3	Windsor Forest Dam	(Class C) High	PRI	Louisville West	29	4
4	Mitchell Hill Lake Dam	(Class C) High	PRI	Valley Station	20	1.9
5	LG&E Waste Water Dam	(Class C) High	PRI	Lanesville	12	40
6	S Fork Beargrass Creek Dry Bed Dam	(Class C) High	MUN	Jeffersontown	Unk.	13.9.
7	Roberson Run (Dry Impoundment)	(Class C) High	MUN	Louisville East	17	0
8	Whipps Mill Rd Dry Dam	(Class C) High	MUN	Anchorage	21	0
9	Norton Commons Dam	(Class C) High	PRIV	Anchorage	16	2.4
10	Waterstone Park Dam	(Class B) Moderate	PRIV	Louisville East	32	0
11	Silver Crystal Dam	(Class B) Moderate	PRIV	Brooks	15	10.2
12	Lake McNeely Dam	(Class B) Moderate	DOFW	Brooks	32	45
13	Long Run Park Lake Dam	(Class B) Moderate	MUN	Crestwood	43	27
14	Big Horn Lake Dam	(Class B) Moderate	PRI	Valley Station	28	3.7
15	Waverly Park Dam	(Class B) Moderate	PRI	Louisville West	20	4.9
16	Mirror Lake (Lower) Dam	(Class B) Moderate	PRI	Jeffersontown	28	3.7
17	Joe Guy Hagan Dam	(Class B) Moderate	PRI	Jeffersontown	28	4.5
18	LG&E Mill Creek Station Ash Dam A	(Class B) Moderate	PRI	Kosmosdale	77	56.91
19	NTS Detention Dam Section 6b	(Class B) Moderate	PRI	Jeffersontown	21	4.2
20	Polo Fields	(Class B) Moderate	PRIV	Crestwood	27	13.3

Dam #	Name of Dam	Hazard Class	Owner Type	Location	Height	Area (sq. mile)
21	AS Properties Dam No 2	(Class B) Moderate	PRIV	Jeffersontown	24	2
22	Vulcan Quarry Dam	(Class B) Moderate	MUN	Brooks	16	0
23	Riggs Lake Dam	(Class A) Low	PRI	Jeffersontown	18	8.9
24	Fern Creek Sportsman Club Dam	(Class A) Low	PRI	Waterford	25	2.8
25	Dreamland Dam	(Class A) Low	PRI	Louisville West	13	5
26	Woodhaven Country Club Dam	(Class A) Low	PRI	Louisville East	18	4.6
27	Lowry Dam	(Class A) Low	PRI	Jeffersontown	35	2
28	Wildwood Country Club Dam	(Class A) Low	PRI	Jeffersontown	18	4.6
29	Sampson Dam	(Class A) Low	PRI	Fisherville	40	7.9
30	Willow Dam	(Class A) Low	PRI	Anchorage	33	7.4
31	Putneys Pond	(Class A) Low	PRI	Anchorage	15	7.3
32	Logan Lake Dam	(Class A) Low	PRI	Fisherville	36	5.8
33	Bill Mcmahan Lake Dam	(Class A) Low	PRI	Jeffersontown	35	Unk.
34	Twin Lakes Lower Dam	(Class A) Low	PRI	Fisherville	Unk.	Unk.
35	Du Pont Fly Ash	(Class A) Low	PRI	Louisville West	18	20
36	Glenmary Dam	(Class A) Low	PRI	Mount Washington	25	4.21
37	Lake Forest Golf Course No 2	(Class A) Low	PRI	Crestwood	21	6.5
38	Lake Forest Golf Course No 1	(Class A) Low	PRIV	Crestwood	23	5
39	Springhurst Lake Dam	(Class A) Low	PRIV	Anchorage	18	5.7

Dam #	Name of Dam	Hazard Class	Owner Type	Location	Height	Area (sq. mile)
40	Gault Eastpoint Llc Dam	(Class A) Low	PRIV	Anchorage	20	5.4

5.3.1 Hazard Profile and Consequence Analysis

Table 5-6 represents the typical hazard profile associated with Dam and Levee Failures.

Table 5-6: Profile Risk Table Dam Levee Failure

Period of occurrence:	Anytime, but especially after periods of heavy rainfall.
Number of past events:	None Reported
Probability of events:	Occasionally – A dam/levee failure is likely to occur within 100 years (1% chance of occurrence in any given year)
FEMA Risk Rating/Score:	Not applicable (not rated by FEMA)
Warning time:	None to several days
Potential of injury or death:	Low. Over the last 30 years, there have been no reported deaths or injuries attributed to Dam/Levee failures. However, if historically large flooding occurs, then structures may 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 flash floods that are catastrophic to life and property because of the tremendous energy of the released water.
Possible Extent:	Flash flooding related to dam and levee failure is potentially the worst kind of flood event. A dam failure is usually the result of neglect, poor design or structural damage caused by a major event such as an earthquake. When a dam fails, an excess amount of water is suddenly let loose downstream, potentially destroying anything in its path. Levees are built for flood protection. If one fails, areas within the 100-year floodplain that were protected become vulnerable. Per the flood maps, the elevation of the majority of downtown is above 100-yr elevation and would be protected from a 100-yr flood without the flood wall. The west end and south end are the areas primarily being protected. The wall is protecting to the 1937 flood +3', which is significantly higher than the 100-yr flood. The 1937 flood was more than 9' higher than the 100-yr flood elevation, so the top of the wall is more than 12' higher than the 100-yr flood elevation.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, has been performed to better understand and outline the potential impacts that dam/levee failures would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in the table below:

Table 5-7: Consequence Analysis Dam/Levee Failure

Subject	Impacts
Health and Safety of the Public	High Hazard-classified dam failure could cause loss of life and serious damage to homes, industrial or commercial buildings, important utilities, and main highways. Moderate Hazard-failure could also cause significant damage to property, homes, highways, utilities but likely no loss of life. Low Hazard-failure would cause loss of dam, little or no damage to other structures or loss of life.
Health and Safety of Responders	Water and debris resulting from a dam or levee break have the potential to disrupt the delivery of critical Louisville Metro emergency services.
Vulnerable populations	A significant portion Louisville Metro area vulnerable population lives within mapped 100-year floodplains that is protected by the levee. These individuals would be first harmed if a levee breach occurred.
Continuity of Operations (including delivery of services)	A majority of government services buildings are located in downtown Louisville. Any topping of the levee system affecting this area would create challenges related to the delivery of government services.
Property, Facilities, and Infrastructure	Dam failures may cause flooding that is much more impactful than riverine or coastal flooding. Floodwaters from a dam failure may arrive before warning or evacuation can occur and the resulting environmental impacts can be devastating. The loss of these services has the potential to be even more pervasive than the inundation of floodwaters. The loss of recreation, in addition to the other benefits dams serve, impact the overall social, economic, and environmental resilience of communities across Louisville Metro, the Commonwealth and the nation. In the event of a levee failure, floodwaters may ultimately inundate the protected area landward of the levee. The extent of inundation is dependent on the flooding intensity. Failure of a levee during a one percent annual chance flood will inundate the approximate 100-year floodplain previously protected by the levee. Residential and commercial buildings located nearest the levee overtopping or breach location will suffer the most damage from the initial embankment failure.
Environment	The primary environmental impact from dam or levee failure is natural and manmade debris from the inundation. Silt, wood, rocks and gravel, hazardous materials, construction debris, vehicles, dead animals may be carried by inundation waters to locations that may be spawning areas for local fish, wetlands for birds and reptiles, or inhabited areas where Louisville Metro has invested heavily. While recovery and impact will vary with each inundation area, as a general rule of thumb, a breach releasing the following cubic square feet of water would result in the following: • At 17,600 cfs – 84,000 tons of debris • At 19,000 cfs – 208,000 tons of debris • At 25,000 cfs – 280,000 tons of debris 54 Isolating the potential environmental impact of dam and levee failure is obscured by the likelihood that another hazard, like an earthquake or prolonged rain resulting in widespread flooding may have triggered the failure.

Subject	Impacts
Economic Conditions	While a dam break would result in both immediate and likely recoverable (via insurance) damages, a levee failure would have long -lasting economic consequences for the Louisville area. In the highest profile levee breach event in the United States, the city of New Orleans suffered billions in economic damages, with several communities, including the Lower 9th Ward, never fully recovering.
Public Confidence in Louisville Metro Governance	A dam failure may cause the public to lose confidence in dam owners to manage local dams. Depending on the success of the response, the public may also lose confidence in first responders. And in the worst case scenario, the federal government if levee's fail.

5.3.2 Significant Louisville Metro Dam/Levee Failures Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to dam or levee failures.

Since 1973, there have been 14 dam malfunctions in Kentucky and none in the Louisville Metro area as reported to the National Performance Dam Program30. Nine of these resulted in an uncontrolled release of the associated reservoir (URR). Although these failures were significant, there has only been one reported death in the Commonwealth resulting from a dam failure. A list of known Kentucky dam failures is presented below in Table 5-8. There are no instances of levee failures occurring over the past 50 years.

Table 5-8: List of Known Kentucky Dam Malfunctions

Dam Name	Incident Date	Incident Type	Dam Type	Uncontrolled Release of Reservoir
Slaughters Lake Dam	2/25/2018	Hydrologic Event Earth	Earth	Yes - Dam breached around principal spillway pipe due to poor condition of structure and excessive erosion.
Hematite Lake Dam	6/11/1998	Not Known; Seepage; Piping	Earth	Yes - This was a low hazard dam. The dam was breached, with damage only to the earthen dam itself. Due to heavy rains, water began flowing over the emergency spillway with an approximate head of 2 to 3 feet. Failure was caused by seepage resulting in piping near or at the contact between the embankment and the south side of the sluice. The breached area was about 10 to 12 feet deep and 12 to 15 feet wide. No downstream damage.

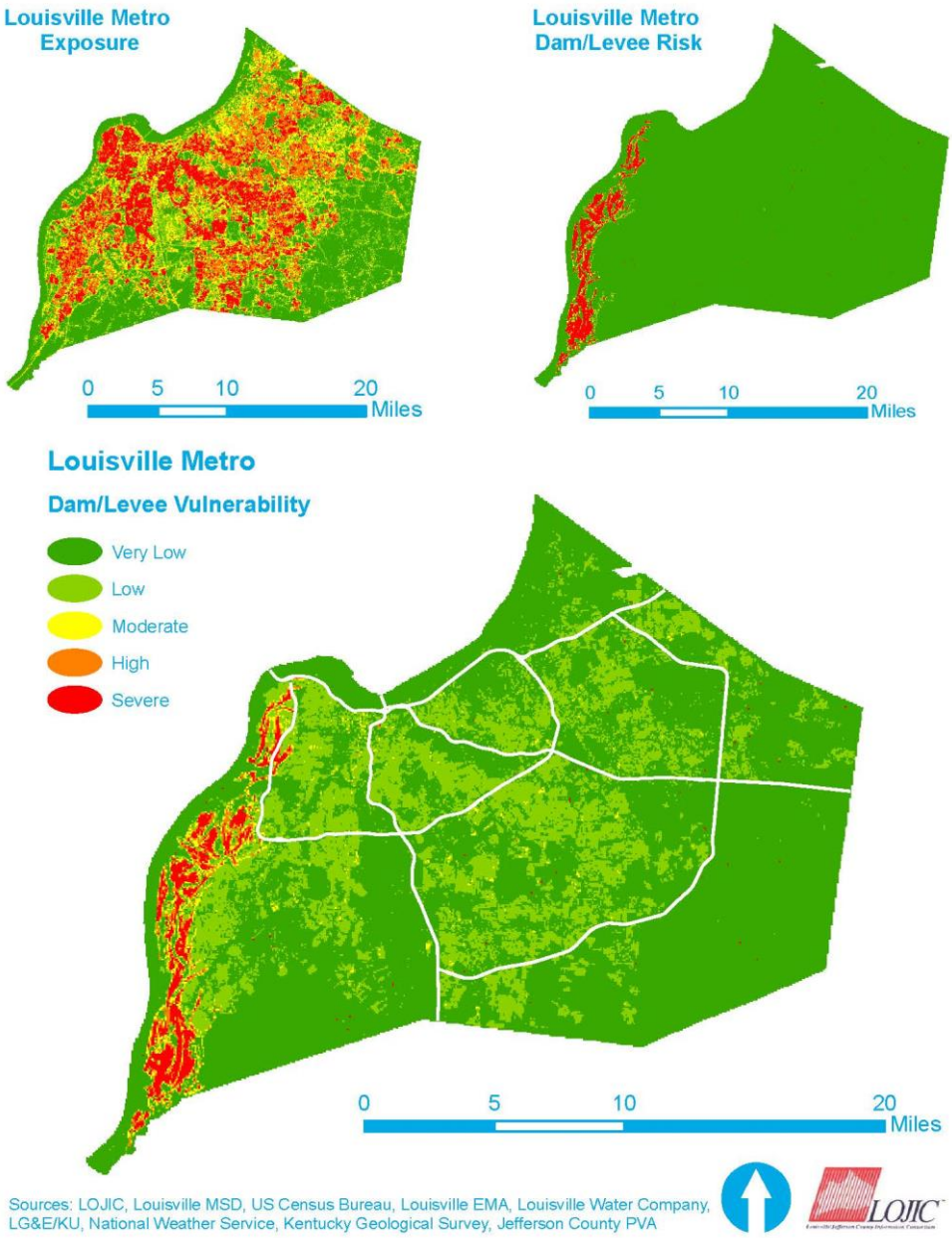
[30] http://npdp.stanford.edu/dam_incidents

Dam Name	Incident Date	Incident Type	Dam Type	Uncontrolled Release of Reservoir
Guist Creek Lake Dam	3/1/1997	Inflow Flood - Hydrologic Event	Earth	No - Inflow Flood - Hydrologic Event
Kincaid Creek Dam	3/1/1997	Inflow Flood - Hydrologic Event	Earth	No - Inflow Flood - Hydrologic Event
Mud River MPS 6a	3/1/1997	Inflow Flood - Hydrologic Event	Earth	No - Inflow Flood - Hydrologic Event
Unnamed Dam (Kys00005)	1/1/1989	Inflow Flood - Hydrologic Event	Earth	Yes - Failure of an unnamed dam. The dam was overtopped. There was moderate (unspecified) damage.
Lake Genevieve	9/5/1985	Inflow Flood - Hydrologic Event	Earth	Yes - Inflow Flood - Hydrologic Event
Lake Genevieve	1/1/1983	Piping	Earth	Yes – Piping failed resulting in an uncontrolled release
Eastover Mining Company Dam	12/18/1981	Sabotage - Other	Earth	Yes - This mine sludge pond dam collapsed, sending debris down a mountainside into Ages, Kentucky. One woman was killed, and 100 people were forced to evacuate their homes. Local residents claimed to have heard two explosions before the dam broke, making sabotage a possible cause of the failure.
Samsel	2/2/1979	Seepage	Earth	No - Leaks had developed in the dam. The dam underwent a controlled dam breach (through the use of bulldozers). Residents were evacuated.
Samsel Dam	1/1/1979	Not Known	Earth	Unknown
East Fork Pond River Frs No. 4.1	12/8/1978	Foundation Failure	Earth	Yes - Seepage through voids in the limestone of the left abutment led to the dam's failure. A local resident notified authorities on December 10, 1978 that the dam was failing. There was a complete loss of material from the top of the dam to the foundation bedrock. The breach dimension was 46 feet in height by 30 feet in width. The downstream area was open farmland, and no major damage occurred.

Dam Name	Incident Date	Incident Type	Dam Type	Uncontrolled Release of Reservoir
Camp Ernst Dam	9/15/1978	Embankment Slide	Earth	Yes - The dam failed due to sliding. No apparent damage downstream.
Caulk Lake Dam	12/16/1973	Seepage	Earth	Yes - Complete structural failure of embankment. The probable cause is thought to be the development of excessive seepage forces, as soft areas were observed prior to failure. The embankment failed to about one-half its height (about one-half of the hydraulic dam height was lost). Breach dimensions: 30 feet in depth; 120 feet across at the top, with 2:1 side slopes. The dam was rebuilt in 1974 to a much lower height. Damage was considerable (not known if damage occurred downstream), though no monetary value was set.

5.3.3 Assessing Vulnerability

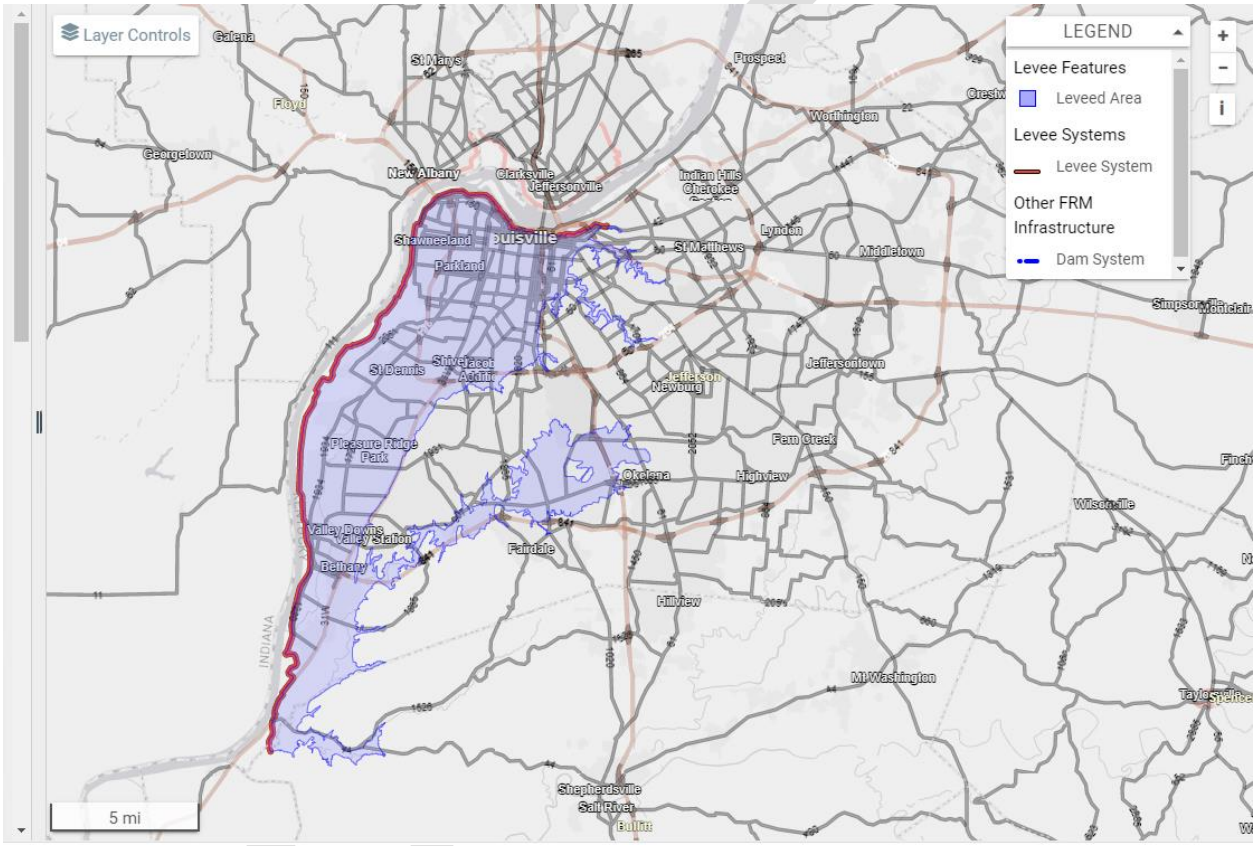
Figure 5-1: Louisville Metro Dam/Levee Vulnerability Map



To determine structures that are vulnerable and estimated to be damaged during a Dam/Levee Failure, the Hazard Boundary Overlay methodology was used. The hazard boundary used as the overlay was the Levee inundation map that was created during the update of the DFIRMs for Louisville Metro. This inundation map displays areas that would be flooded if the Levee was not in place; therefore, it was used to showcase risk in this model.

Figure 5-2 describes the area that would become inundated if the levee system failed. A listing of critical facilities and infrastructure highly vulnerable to levee and dam breaches is presented in Appendix E.

Figure 5-2. Levee Failure Inundation Map



5.3.4 Climate Assessment

Risk of dam and levee failure, due to larger and more frequent storms, as well as delayed and inadequate dam maintenance, is increasing nationwide. Throughout the Midwest, levees have been breached repeatedly as rivers reached historic flood levels. Dam and levee designs and operations were developed in part from hydrographs and historical records. If weather patterns experience significant changes over time due to the impacts of climate change, dam and levee design and operations may no longer be valid for changing conditions.

Climate Risk

Based on the best available scientific information and trends, it is likely that Louisville Metro's dams and levees will be affected by climate change. Increasing frequency and magnitude of large storms is likely to push more dams into Class C (High hazard class), thereby requiring an Emergency Plan. It can also increase the likelihood of any one dam failing, especially those already listed as Class C. Therefore, as the climate changes and more rainfall are both predicted and occurs, the risk of dam and levee failure also increases. Add in the fact that many dams are well over 75 years old and designed for a climate that no longer exists, and the risk only increases.

5.4 Drought

Kentucky is perceived as a "water-rich" state, with an average annual rainfall of 45 to 50 inches and abundant groundwater and surface water resources. However, Kentucky, likely many states, can experience extended periods of dry weather, ranging from relatively short-duration single-season events to multi-year events.

Drought is a natural and recurring climatic feature, but unlike other natural disasters, it is not a distinct event that has a clearly defined beginning and end. Rather, it is often the result of the interactions between various complex physical and social factors that are difficult to quantify or predict. Ultimately, drought is manifest as an amount or distribution of moisture that is not sufficient to meet the needs of society or the environment, and can result from both natural events that decrease supply and from human activities that increase the demand for water.

When a drought begins may be difficult to determine. A drought can be short, lasting just a few months, or persist for years before climatic conditions return to normal. Although drought conditions can occur at any time throughout the year, the most apparent time is during the summer months. High temperatures, prolonged high winds, and low relative humidity can aggravate drought conditions.

Crop failure is the most apparent effect of drought, because it has a direct impact on the economy. Due to a lack of water and moisture in the soil, during a drought, many crops will not produce normally or efficiently, and in many cases, may be lost entirely.

In addition, water shortage is a very serious effect of drought because 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 groundwater, and in extreme cases, navigable rivers have become unsafe for navigation as a result of drought.

Secondary effects of droughts include the following:

- Fire susceptibility is increased with the absence of moisture associated with a drought. Dry conditions have been known to promote the occurrence of wildfires.
- Environmental degradation in the forms of erosion and ecological damage can be seen in extreme 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 aboveground portions of the structure.

The Palmer Drought Severity Index (PDSI)[31] attempts to measure the duration and intensity of the long-term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during the current month is dependent on the current weather patterns plus the cumulative patterns of previous months. Since weather patterns can change almost literally overnight from a long-term drought pattern to a long-term wet pattern, the PDSI can respond fairly rapidly.

The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. It can be used to help delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.

Table 5-9: Palmer Drought Classifications System
Source: National Oceanic and Atmospheric Association (NOAA)

Palmer Classifications	
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Climate histories in the US generally begin around 1895. Drought is measured in the PDSI according to the level of recorded precipitation against the average, or normal, amount of precipitation for a region.

Despite all of the problems that droughts cause, drought has proven to be difficult to define. There is no universally accepted definition because drought, unlike flooding for example, is not a distinct event. Additionally, drought is often the result of many complex factors and has no well-defined start or end. The impacts of drought may again vary by affected sector, thereby making definitions of drought specific to particular situations.

The most commonly used drought definitions are based on meteorological, agricultural, hydrological, and socioeconomic effects, and are described below:

- *Meteorological drought* is defined as a period of substantially diminished precipitation duration or intensity. The commonly used definition of meteorological drought is an interval of time, generally on the order of months or years, during which

[31] https://www.drought.gov/data-maps-tools/us-gridded-palmer-drought-severity-index-pdsi-gridmet

the actual moisture supply at a given place consistently falls below the climatically appropriate moisture supply.

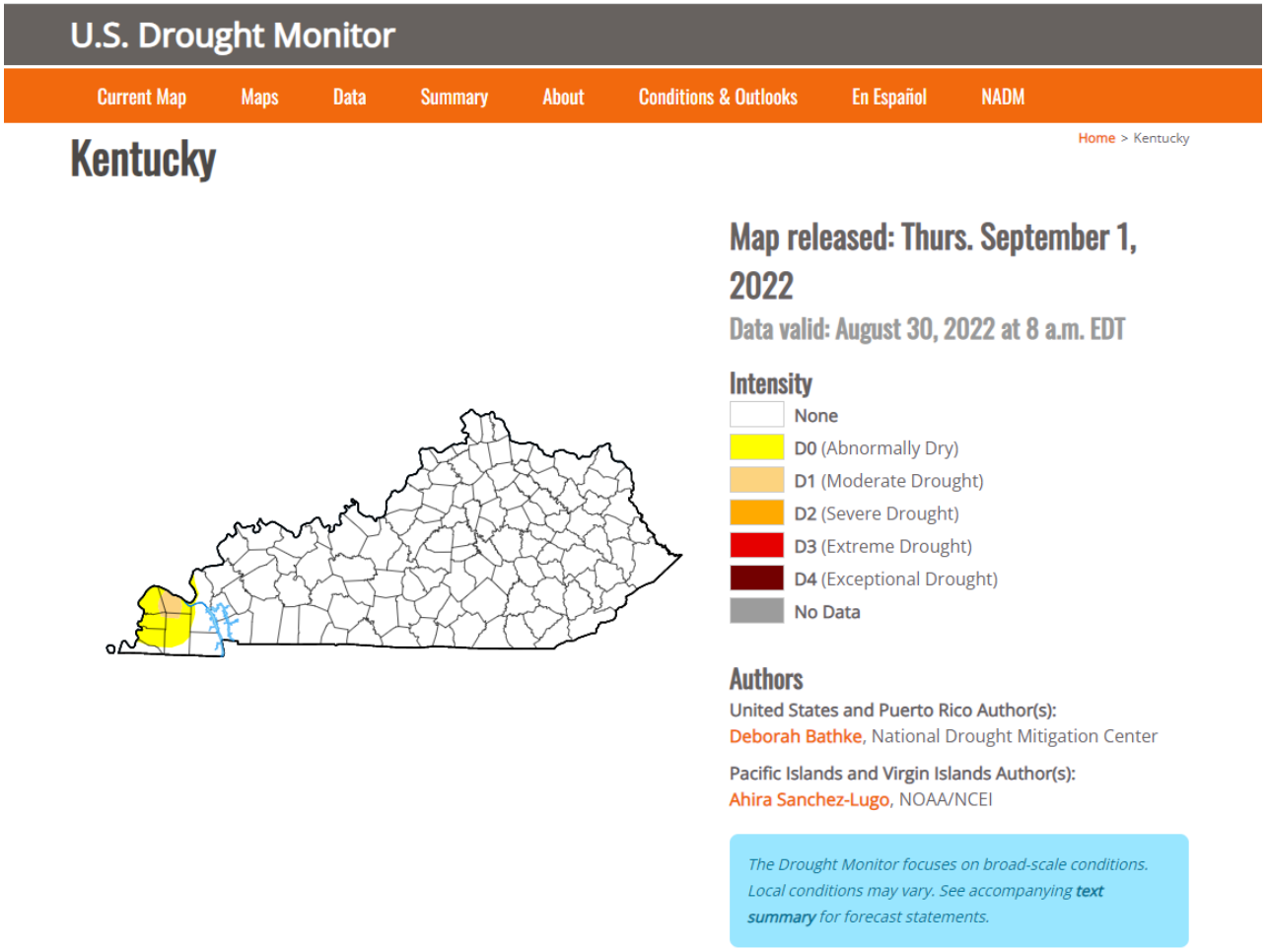
- *Agricultural drought* occurs when there is inadequate soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought usually occurs after or during meteorological drought, but before hydrological drought. It can also affect livestock and other dry-land agricultural operations.
- *Hydrological drought* refers to deficiencies in surface and subsurface water supplies. There is usually a delay between lack of rain or snow and less measurable water in streams, lakes, and reservoirs. Therefore, hydrological measurements tend to lag behind other drought indicators.
- *Socioeconomic drought* occurs when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought begins to affect the supply and demand of an economic product.

The U.S. Drought Monitor (USDM)[32] is updated each Thursday to show the location and intensity of drought across the country. A statewide map shows drought conditions across Kentucky using a five-category system, from Abnormally Dry (D0) conditions to Exceptional Drought (D4). The USDM is a joint effort of the National Drought Mitigation Center, USDA, and NOAA. Figure 5-3 includes a screenshot of the U.S. Drought Monitor.

- *D0-Abnormally Dry:* Lawns and vegetation are brown, Crops and pastures show mild stress.
- *D1-Moderate Drought:* Crops and pastures show stress; corn germination is poor. Burn bans are issued; wildfires are reported. Increased algae and fungus growth is noted.
- *D2-Severe Drought:* Hay yield is low; crop losses are reported; livestock need supplemental hay and water. Ponds, lakes, and river levels are low; boating hazards are found in lakes. Trees are distressed; leaves are wilting, pine trees are turning brown.
- *D3-Extreme Drought:* Maintaining cattle and horses is very expensive; cost of food and water is very high; producers sell livestock. Creeks and ponds are completely dry; water shortages are widespread; water restrictions begin.
- *D4-Exceptional Drought:* Hay hotline is put in place due to shortages; producers are hauling water. Water sources are extremely low.

[32] https://www.drought.gov/data-maps-tools/us-drought-monitor

Figure 5-3: U.S. Drought Monitor Screenshot



In addition to the USDM, the USGS maintains an Interactive Map: Kentucky Drought Condition Monitor[33]. This dynamic web application (Figure 5-4) provides daily updates for precipitation, streamflow, and groundwater levels for each county in Kentucky and weekly updates of crop moisture index values for each of the four climate divisions in Kentucky.

33 www.usgs.gov/tools/interactive-map-kentucky-drought-condition-monitor

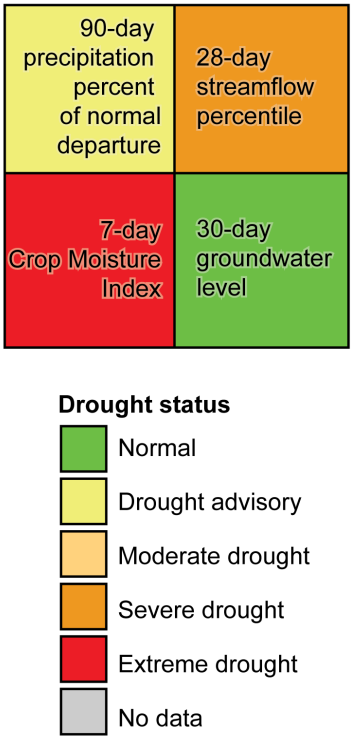
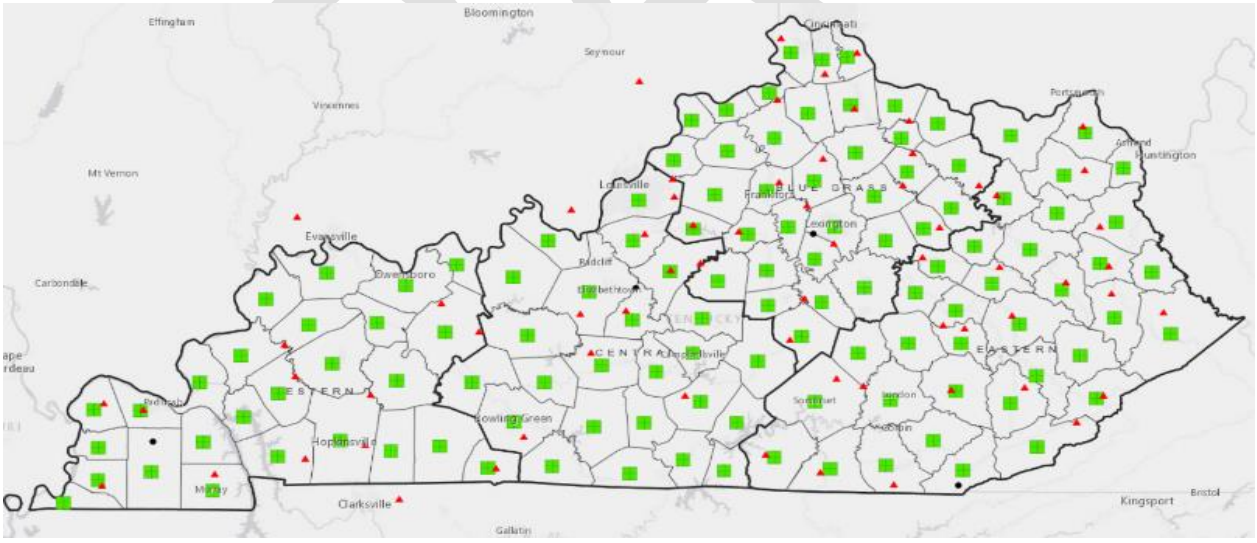


Figure 5-4: Kentucky Drought Condition Monitor

Each county has a four-panel square where each panel of the square represents a different drought indicator: The top left square represents the 90-day precipitation percent of normal departure, the top right square represents the 28-day streamflow percentile, the bottom right square represents the 30-day groundwater level percentile, and the bottom left square represents the 7-day Crop Moisture Index.

Finally, the Kentucky Division of Water continuously monitors hydrologic conditions throughout the state, including precipitation, stream flows, lake elevations, and various drought indices. This information is used to detect emerging drought conditions, to identify the locations and severity of drought, and to provide timely and appropriate public notification. For purposes of drought planning and response, the state is divided up into 15 Drought Management Regions that are based on the Area Development Districts. Each district is monitored individually to better determine which areas of the state are being impacted, and allows a more focused response to those who are being affected.



5.4.1 Hazard Profile and Consequence Analysis

The table below represents the typical hazard profile associated with droughts.

Table 5-10: Profile Risk Table Drought

Period of occurrence:	Summer months or extended periods of no precipitation.
Number of events:	For the period 1905 through the 1950s severe and extreme drought were fairly consistent in recurring about once every five years. On a statewide basis the most notable drought since the 1950s occurred from 1999 through 2001.
Probability of events:	Frequent – Drought events are likely to occur within 25 years (>4% chance of occurrence in any given year)
National Risk Rating/Score:	Very Low (Score 2.49)
Warning time:	Weeks to months
Potential of injury or death:	Low. Over the last 50 years, there have been no reported deaths or injuries attributed to drought conditions in the Louisville Metro area.
Possible Extent:	Droughts in the 1930s through the 1950s (also coinciding with the "dust bowl era) have not been eclipsed and remain benchmarks for extreme drought for purposes of planning for water resources projects. The most severe drought occurred from May 1952 until April 1957 causing a -7.79 PDSI in July of 1954.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders for the Kentucky Department of Water, has been performed to better understand and outline the potential impacts that a severe drought (USDM level D3/D4) would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-11 below.

Table 5-11: Consequence Analysis Drought

Subject	Impacts
Health and Safety of the Public	Activities that rely heavily on high water usage may be impacted significantly, including agriculture, tourism, wildlife protection, municipal water usage, commerce, recreation, electric power generation, and water quality deterioration. Droughts can lead to economic losses such as unemployment, decreased land values, and agro-business losses. Minimal risk of damage or cracking to structural foundations, due to soils can also happen in extreme cases.
Health and Safety of Responders	Little to no impact on the health and safety of first responders is anticipated due to drought conditions.
Vulnerable Populations	Any type of resource scarcity tends to affect vulnerable populations more than others. This includes water, as vulnerable populations likely have less access to alternate supplies.
Continuity of Operations (including delivery of services)	It is unlikely that drought conditions would negatively affect the ability of Louisville Metro to deliver government services.

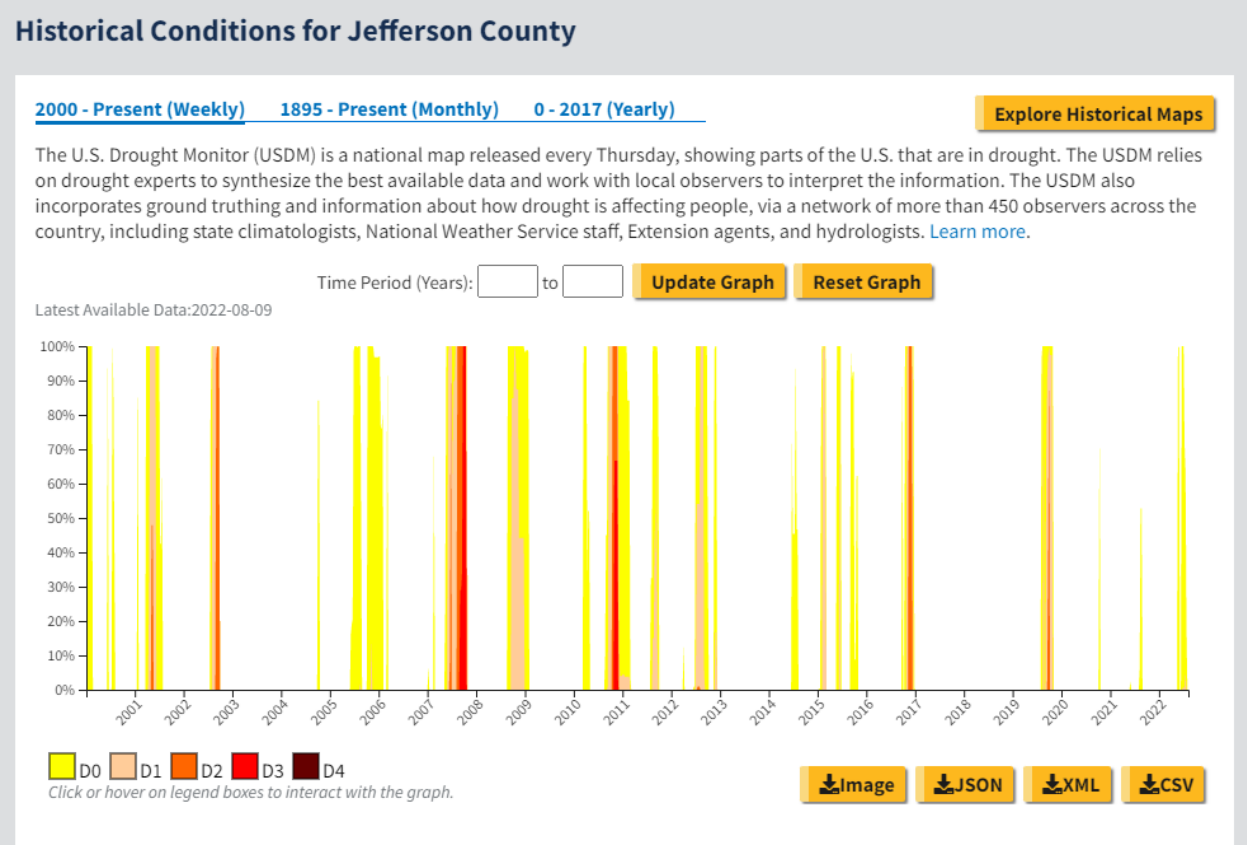
Subject	Impacts
Property, Facilities, and Infrastructure	High temperatures, prolonged high winds, and low relative humidity can aggravate drought conditions. In Louisville Metro, a secondary effect of a drought could be low river levels on the Ohio River. Low water can become unsafe for navigation in some areas. As a result, fully loaded barges may not be able to safely navigate the river, and tonnage may have to be reduced by 10 to 20 percent. Drought can impact the following: • Agriculture - irrigation and livestock needs • Drinking Water • Industrial use • Power generation • Water Quality - effluent dominated streams • Human Health Impacts - heat and airborne particulates • Environmental Damage - erosion, habitat loss • Wildfires • Structure and Infrastructure - water lines and foundations During periods of drought, 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, electric power generation, and water quality deterioration. Droughts can lead to economic losses such as unemployment, decreased land values, and Agro-business losses. In addition, there is minimal risk of damage or cracking to structural foundations, due to soils.
Environment	Prolonged drought conditions can alter the ecological balance of natural systems and harm fish, wildlife, and plant species, as well as the services that these ecosystems provide to human communities.
Economic Conditions	Droughts can have a significant economic impact on Louisville Metro agro-business owners. Prolonged periods of drought typically result in crop loss. Although Federal Crop insurance is available, many smaller farmers do not participate and those that do are not typically covered for a complete loss.
Public Confidence in Louisville Metro Governance	Although the public generally will not blame government for reduced rainfall totals and drought conditions, they will likely blame government agencies for lack of planning if a severe drought begins to affect the public's everyday lives.

5.4.2 Significant Louisville Metro Drought Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to droughts.

Based on the National Integrated Drought Information System,[34]Louisville Metro has experienced 24 droughts from 2000 through 2022. Most of these were identified as D0 events, simply just abnormally dry weeks, which is fairly common throughout the U.S. However, there have been three significant drought periods (D3 level or above) in this time span.

Figure 5-5: Historical Drought Conditions for Jefferson County



The three significant drought periods are further described below:

August–October, 2007: Drought had firmly established itself in the southeastern U.S. by late spring 2007, and began swelling northward during the early summer. By mid-June, southern Kentucky had entered a severe drought with precipitation deficits since January 1 on the order of 8 inches.

The severe drought conditions continued to spread northward, and all of central Kentucky felt the effects by the end of June. The Commonwealth issued a Water Shortage Watch for 61 central Kentucky counties. Burn bans went into effect, and the Green River Ferry in mammoth Cave National Park discontinued service because of low water levels. A few counties imposed water

[34] https://www.drought.gov/location/Louisville%2C%20Kentucky

restrictions on residents. The Tennessee Valley Authority placed a fuel surcharge of $3 to $6 per month per customer on electricity.

During August, searing heat baked Kentucky, creating significant stress on agricultural concerns and water supplies. Temperatures soaring into the 90s nearly every day and over 100 degrees on several occasions, combined with continued low overall rainfall amounts, locked the region firmly in drought. By the third week of the month, roughly the southern half of Kentucky had descended into extreme drought, with severe drought conditions crossing the Ohio River into southern Indiana. People from Logan County to Nelson County to Casey County were about 16 inches below normal for rainfall since the beginning of the year.

The number of wildfires in Kentucky increased 500% over the previous summer. In southern Kentucky, soil moisture was about half of what it should have been, and 17 counties became eligible for federal aid. The Barren River at Bowling Green was at its lowest point since the Barren River Dam was erected in 1963.

September–October, 2010: A drought declaration was issued for 50 counties under a Level 2 declaration and 35 counties under a Level 1 declaration, with agricultural disasters and wildfires becoming a major concern. Precipitation levels for September and October totaled just 1.16 inches, 4.86 inches less than normal. An excessive November rainfall total removed drought concerns.

October-November, 2016: During the moths of October and November, the Louisville Metro area received just 2.3 inches of precipitation. This level was well below normal and triggered a drought warning. Precipitation-wise, despite this drought, the year finished up very close to normal for Louisville (-1.36 inch for the year) thanks to the soaking rains the last two weeks of December. The late December rains resulted in all of Kentucky and southern Indiana being officially removed from drought status on December 27, as designated on the U.S. Drought Monitor.

As noted previously, the greatest period of drought in the Louisville Metro area was from May 1952 until April 1957. According to a USGS report (Drought of the 1950s with Special Reference),[35] this period was one of the more severe of record in the Midwest. Above-normal rainfall had encouraged rapid expansion of industry and agriculture in the Midwest during the 1940s because growing demands for water were easily met, and few supply problems arose. However, a persistent pattern of below-normal precipitation began in 1952, and except for minor interruptions, continued until early 1957. The resulting decline in water supplies caused considerable financial loss and many personal hardships. Diversion of moisture-laden airmasses away from the Midcontinent by the formation of stronger-than-normal high-pressure cells was the principal immediate cause of the drought. The rare occurrence of a succession of drought-producing meteorologic events during 1952-1956 caused critical water deficiencies in much of the Midwest and southern half of the Nation. The accumulated precipitation deficiencies during the 5-year drought period, expressed in percentage of the average precipitation for 1 year,

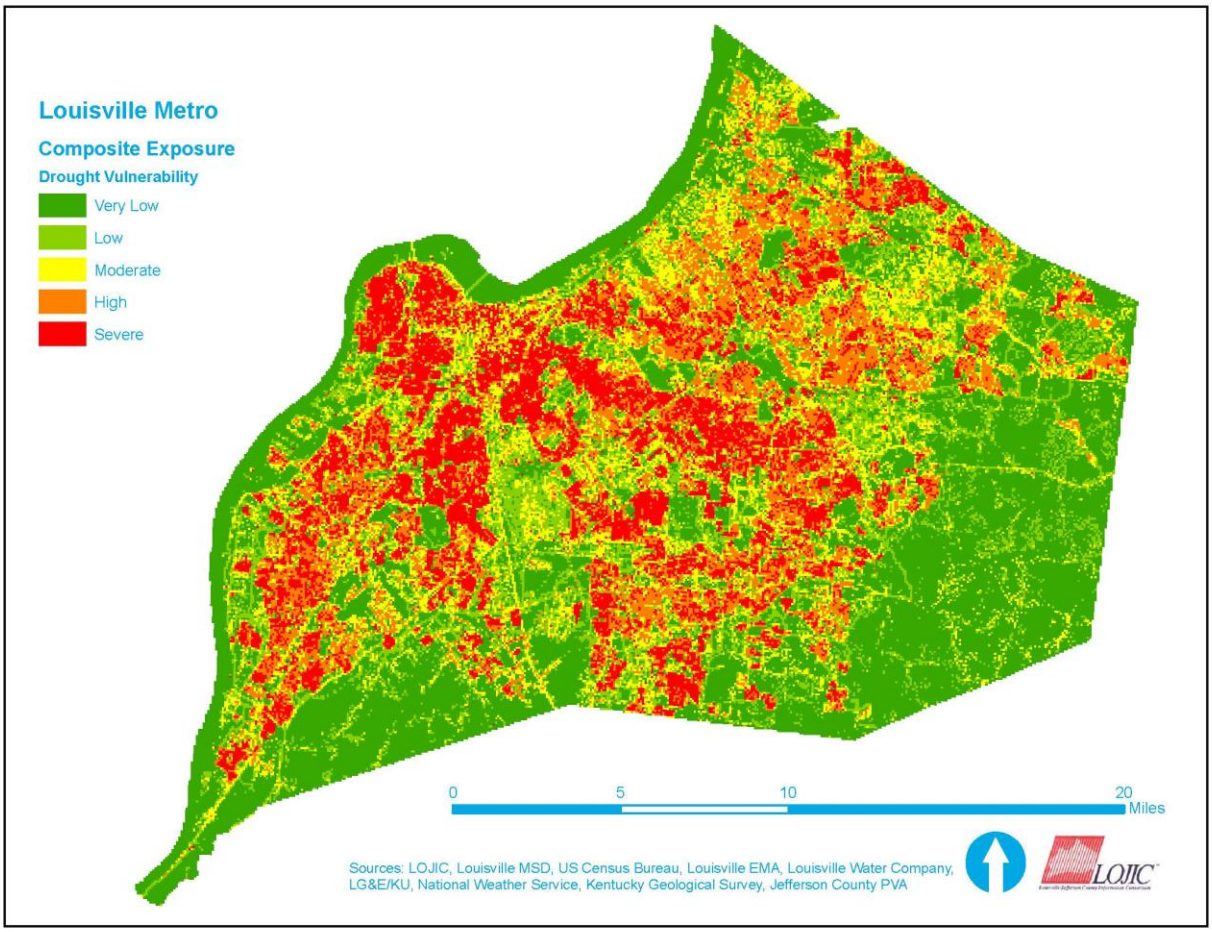
[35] https://pubs.usgs.gov/wsp/1804/report.pdf

ranged from 25 to 225 percent in much of the drought-affected area. Statistical studies of long-term precipitation records indicate that drought of equivalent severity has a recurrence interval of about 140 years in parts of the area. Groundwater levels declined steadily in much of the Midwest, with levels reduced by tens of feet in some places.

5.4.3 Assessing Vulnerability

The map below shows the drought vulnerability for the Louisville Metro area.

Figure 5-6: Louisville Metro Drought Vulnerability Map



Identifying individual structures and estimating potential losses from droughts is a challenging endeavor. Without any current spatial data that truly identifies drought hazard boundaries, it is assumed that the entire Louisville Metro area has equal vulnerability and the potential to be damaged from droughts. Therefore, to estimate which structures could be damaged from a drought it is assumed that all structures could be damaged, although this is highly unlikely.

5.4.4 Climate Assessment

Climate change increases the odds of worsening drought in many parts of the United States and the world in the decades ahead. Even in regions that may not see changes in precipitation, warmer temperatures can increase water demands and evaporation, putting greater stress on water supplies, drying out soils, and causing widespread declines in many species of trees and other plants.

Warmer temperatures can amplify the impacts of drought. Increased temperatures enhance evaporation from soils, making periodic droughts worse than they would be under cooler conditions. Droughts can persist through "positive feedback," where very dry soils and diminished plant cover can further suppress rainfall in an already dry area.

The United States is historically susceptible to drought. Paleoclimate studies show major droughts in the distant past, while some more recent dry periods are still within living memory, such as the Dust Bowl of the 1930s or the drought of the 1950s. These historic examples serve as guideposts to highlight vulnerabilities to drought as the county moves into a warmer—and in some places—drier future.

Model projections included in the Louisville Metro Climate Hazard Identification Climate Change Addendum show that overall drought stress is expected to increase in Louisville, even as average precipitation increases by 9%, on average. Because of much higher temperatures projected for the area, a modest increase in precipitation is not sufficient for offsetting higher evaporation and evapotranspiration rates.

Over time, the deficit in moisture (negative balance between the amount of precipitation and the amount of water used within the natural system) is expected to increase. With continued higher emissions, drought stress is expected to increase 14% on average by the middle of this century. By late century, drought stress is expected to increase 16% on average. If emissions are reduced, drought stress can be limited to 12 to 13%, on average, by mid- to late-century.

Some of the biggest impacts of drought are to water quality, with warmer surface waters and lower flows. These can cause challenges to the cost and implications of water treatment, as well as risk to water supplies, public health, and aquatic ecosystems. Decreases in volume can cause high temperatures and lower dissolved oxygen levels, both of which affect aquatic life. When nutrient loading is added to the mix, harmful algal blooms can further threaten waterways and water supplies.

Climate Risk

Based on the best available scientific information and trends, it is highly likely that drought risk will worsen in Louisville, driven primarily by increasing temperatures, and also if precipitation increases. The geographic distribution of this risk is not expected to change with climate change, but the severity could increase. This risk could be lessened if GHG emissions are reduced.

5.5 Earthquakes

According to the USGS, an earthquake is what happens when two blocks of the earth suddenly slip past one another. The surface where they slip is called the fault or fault plane. The location below the earth's surface where the earthquake starts is called the hypocenter, and the location directly above it on the surface of the earth is called the epicenter.[36]

Sometimes an earthquake has foreshocks. These are smaller earthquakes that happen in the same place as the larger earthquake that follows. Scientists cannot tell that an earthquake is a foreshock until the larger earthquake happens. The largest, main earthquake is called the mainshock. Mainshocks always have aftershocks that follow. These are smaller earthquakes that occur afterwards in the same place as the mainshock. Depending on the size of the mainshock, aftershocks can continue for weeks, months, and even years after the mainshock.

Earthquakes can affect hundreds of thousands of square kilometers; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area. Ground shaking from earthquakes can collapse buildings and bridges, disrupt gas, electric, and phone service, and sometimes trigger landslides, avalanches, flash floods, fires, and destructive ocean waves (tsunamis). During an earthquake, 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. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends on the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Earthquake Types

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, which describes the energy release of an earthquake through a measure of shock wave amplitude. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale. The Richter 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.

[36] https://www.usgs.gov/programs/earthquake-hazards/science-earthquakes

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. The roman numerals, with I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). The lower values of the scale detail the manner in which people feel the earthquake, 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 table below presents a general comparison between Richter Scale magnitudes and Mercalli Intensity.

Table 5-12: Comparison of Richter Magnitude and Modified Mercalli Intensity Scaled

Richter Magnitude	Modified Mercalli Intensity	Description
1.0-3.0	I	Not felt except by a very few under especially favorable conditions
3.0-4.0	II	Felt only by a few persons typically at rest on the upper floors of buildings
	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings; however, many people do not recognize it as an earthquake. Standing vehicles may rock slightly and experience vibrations similar to the passing of a large semi-truck.
4.0-5.0	IV	Felt indoors by many and outdoors by few during the day while at night some are awakened. Dishes, windows, doors become disturbed; walls make cracking sounds and people experience sensations similar to a truck striking a large building. Standing vehicles are rocked noticeably.
	V	Felt by nearly everyone. Many awakened at night. Some dishes, windows broken. Unstable objects overturned.
5.0-6.0	VI	Felt by all. Damage is mainly slight but noticeable. As heavy furniture is moved and plaster walls can collapse
	VII	Damage slight to moderate in ordinary structures with considerable damage to poorly constructed structures. Some chimneys are destroyed. Little to no damage in buildings of good design and construction;
6.0-7.0	VIII	Damage is slight in specially designed structures, but considerable in ordinary buildings, with partial collapse possible. Damage is great in poorly built structures to include total collapse of chimneys, factory stacks, columns, and monuments.
	IX	Damage considerable even in specifically designed structures. Well-designed frame structures thrown off foundations.
7,0 and Higher	X	Some well-built wooden structures destroyed. Most masonry and frame structures destroyed with steel support beams bent.

Richter Magnitude	Modified Mercalli Intensity	Description
	XI	Few, if any, wooden or masonry structures remain standing. Bridges destroyed. Railways significantly bent.
	XII	Damage total. Lines of sight and level distorted.

Kentucky Fault Lines

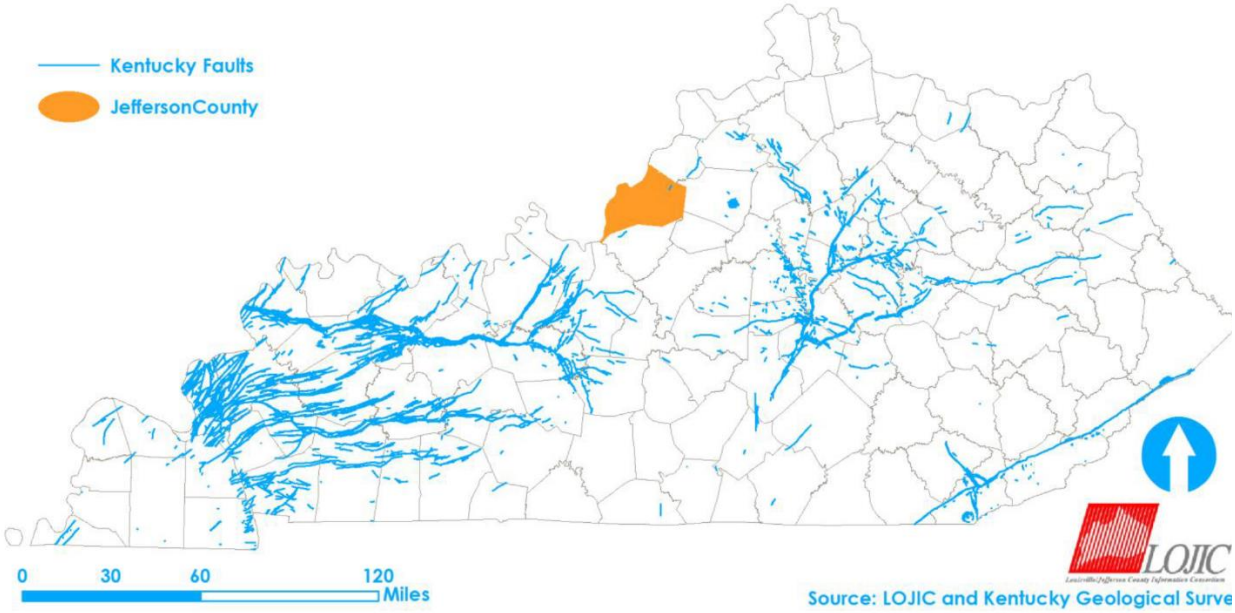
Fault lines run through much of Kentucky, with each of the fifteen area development districts containing at least one fault line or fault system. A number of these systems have remained geologically inactive for significant amounts of time, but scientists believe others are overdue for a surge in activity.

The three seismic zones most likely to put Kentucky and the Louisville Metro are at risk are centered outside of the state, but pose a very real threat to the Commonwealth's citizens. These include the following:

- *The Eastern Tennessee Seismic Zone* extends from southwest Virginia to northeast Alabama, and is one of the most seismically active fault systems in the Southeast. Although the zone has not experienced a large earthquake in historic times, a few minor earthquakes have caused slight damage. The largest recorded earthquake in this seismic zone was a Magnitude 4.6, which occurred in 1973 near Knoxville. Sensitive seismographs have recorded hundreds of earthquakes too small to be felt in this seismic zone. Small, non-damaging felt earthquakes occur about once a year. No evidence for larger prehistoric shocks has been discovered, yet the micro-earthquake data suggest coherent stress accumulation within a large volume. Physical processes for reactivation of basement faults in this region could involve a weak lower crust and increased fluid pressures in the upper to middle crust.
- *The New Madrid Seismic Zone (NMSZ)*, located in the central Mississippi Valley, is generally demarked on the north by the confluence of the Ohio and Mississippi Rivers. From this point in southern Illinois, the zone runs southwest, through western Kentucky (near Fulton), through eastern Missouri and western Tennessee, and terminates in northeastern Arkansas, crossing the Mississippi River three times.
- *The Wabash Valley Seismic Zone*, which threatens southern Illinois, Indiana, and Kentucky, shows evidence of large earthquakes in its geologic history. Since 1895, The Wabash Valley Fault Zone has experienced more moderate quakes than the New Madrid Seismic Zone. Some prehistoric quakes that occurred in this zone between 4,000 and 10,000 years ago may have been larger than M6.0. Earthquake ground shaking is amplified by lowland soils, and modern earthquakes of M5.5 to 6.0 in the Wabash Valley Fault Zone could cause substantial damage if they occur close to the populated river towns and cities along the Wabash River and tributaries.

Figure 5-7 below showcases these known fault lines and others that traverse the Louisville Metro area and Kentucky.

Figure 5-7: Major Kentucky Fault Lines



Source: LOJIC and Kentucky Geological Survey

Specific fault systems in Kentucky include the Rough Creek and Pennyrile Fault Systems, running east-west to the southwest of the Louisville Metro area, and the Cincinnati Arch that runs roughly north-south through Lexington some 75 miles to the east. In general, these faults have been inactive for thousands of years. Earthquakes may occur in areas where faults have not yet been identified; this situation presented itself when an earthquake occurred in Sharpsburg in 1980, in an area previously not known to include a fault.

5.5.1 Hazard Profile and Consequence Analysis

Table 5-13 below represents the typical hazard profile associated with earthquakes.

Table 5-13: Profile Risk Table Earthquake

Period of occurrence:	Year-round
Number of events:	None with epicenter occurrences in the Louisville Metro area. However regional events have affected the area as recently as 2022.
Probability of events:	Rare – A significant (4.5 or greater on the Richter scale with epicenter within 100 miles of the Louisville Metro area) earthquake is not likely to occur within 100 years (>1% chance of occurrence in any given year). There have been no recorded earthquakes (4.0 and above) with epicenter within 100 miles of the Louisville Metro area.
FEMA Risk Rating/Score:	Relatively Moderate - Score 12.10
Warning time:	None to several weeks due to forward shocks

Potential of injury or death:	Low. There have been no reported injuries or deaths attributed to earthquakes over the past 100 years.
Possible Extent:	While there are no significant earthquakes that have affect the Louisville Metro area, the possible extent can be viewed by looking at two recent examples that have effected both the United States and Japan. The Northridge, California, earthquake of January 17, 1994, struck a modern urban environment generally designed to withstand the forces of earthquakes. Its economic cost, nevertheless, has been estimated at $20 billion. Fortunately, relatively few lives were lost. Exactly one year later, Kobe, Japan, a densely populated community less prepared for earthquakes than Northridge, was devastated by the costliest earthquake ever to occur. Property losses were projected at $96 billion, and at least 5,378 people were killed. These two earthquakes tested building codes and construction practices, as well as emergency preparedness and response procedures.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, including individuals with the Kentucky Geological Society, has been performed to better understand and outline the potential impacts that a severe earthquake (Modified Mercalli Scale 3.5+) would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-14 below. It should be noted again that earthquakes occur almost daily, and most go unnoticed by the public. Therefore, when describing the consequences associated with earthquakes, the discussion will center around those greater than 4.0 on the Richter Scale.

Table 5-14: Consequence Analysis Earthquake

Subject	Impacts
Health and Safety of the Public	Louisville Metro's entire population is potentially exposed to the direct and indirect impacts from significant earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of residence, the soil type homes are constructed on, the proximity to the fault, etc. Business interruptions could keep people from working, road closures could isolate populations, and loss of utilities could impact populations where no direct damage was experienced. And finally, if levees and dams are affected, significant and hazardous flash flooding could occur.
Health and Safety of Responders	First responders are likely to experience personal and professional impacts from a significant earthquake. Since responders are also likely local residents, they will be personally impacted by the disaster. Professionally, emergency services will be called upon to help with life safety operations while also seeking to restore day-to-day services.
Vulnerable Populations	Vulnerable populations are more likely to suffer losses during an earthquake and are likely to take longer to recover. Factors influencing likelihood of damage include living in higher hazard areas, living in older, poorly constructed buildings, being less likely to have emergency supplies, and having a higher rate of persons with disabilities. Slower recovery is exacerbated by vulnerable populations having less access to insurance,

Subject	Impacts
	wealth, or savings, being more likely to be renters who are ineligible for many federal recovery programs, making it more difficult to find a new job and to navigate the complex post-disaster systems.
Continuity of Operations (including delivery of services)	Any damaging earthquake has the potential to impact delivery of essential Louisville Metro government services in the days, weeks, months, and even years following an earthquake. The damages to infrastructure and residential or business locations may curtail or even prevent government employees from reaching their work locations or may prevent services from reaching populations in need. Even after initial short term repairs have been made, the impact on the taxable value of properties may cause a revenue shortfall that reduces available services from budgetary impacts. Collection of available tax revenue, the revaluation process, and appeals process might produce a further burden on already stretched government obligations. Earthquakes also have the possibility of damaging any fixed facility at which services are provided. This may include detention facilities, waste water treatment facilities, solid waste disposal systems and facilities, the court system, health and medical institutions and clinics, fire and police stations or equipment, public transportation, schools, and libraries.
Property, Facilities, and Infrastructure	Significant Earthquakes can have a detrimental effect on Louisville Metro's built environment. Specifically, the following elements of key infrastructure would likely be impacted: • Energy: Any number of Louisville Metro area's 40 dams or even the levee system may be impacted by a major earthquake, even if failure is relatively unlikely. Pipelines cross the region carrying fuel and are susceptible to earthquakes. A major concern for maintaining power in facilities while the power grid is down after an earthquake is fuel distribution. If transportation networks are seriously impacted, it will be difficult to ensure a supply of fuel is distributed to hospitals, public facilities, and communications centers. Without this fuel, systems are likely to fail after a few days of operation. • Water/Wastewater: Water and wastewater systems are among the most vulnerable to an earthquake. MSD maintains a wastewater treatment system that operates multiple water treatment plants. Earthquakes can impact the Louisville Metro's ability to treat its wastewater. • Transportation: Transportation lifelines are federal, state and local responsibilities. An earthquake could affect bridges, tunnels and overpasses to the point where roadways would need to be closed until inspections/repairs could be made. And with the greater Louisville Metro area dependent on bridges crossing the Ohio River, any disruption could be devastating. • Airports: Airport runways are critical to economic activities within a region. Any disturbance of runways could also affect the delivery of relief and recovery supplies. • Communications: While the public sector maintains critical radio communications networks, the networks on which most residents depend is privately owned. While cell towers are equipped with backup generators, these generators may only have enough fuel for a few days of continuous operation.

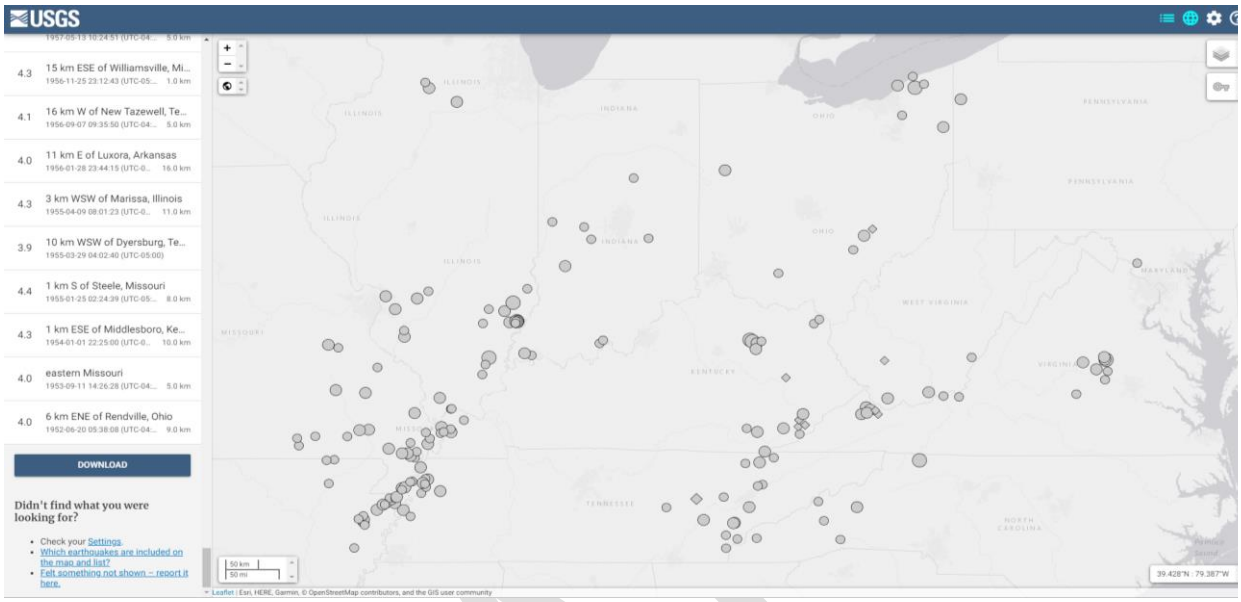
Subject	Impacts
Environment	Impacts to the environment from an earthquake include the creation and disposal of large quantities of debris, releases of hazardous materials, the disruption of environmental conservation programs, and the relaxing of environmental programs during the cleanup and recovery. The greatest potential for environmental damage is from hazardous materials releases as fuel and waste pipelines rupture, underground fuel storage tanks fail, trains, including oil trains, may derail, and other chemicals, including household items, are spilled. The multi-source nature of materials releases, the scale of potential releases, and the lack of resources for cleanup all complicate the scenario.
Economic Conditions	Economic risk from a major earthquake is multi-faceted. Economic impacts from an earthquake include immediate loss of facilities and inventories, ongoing loss of employees and customers, and loss of businesses. Ongoing impacts will depend on the speed of infrastructure restoration, levels of insurance coverage, international economic conditions, and the ability of jurisdictions to develop and implement a long-term recovery strategy.
Public Confidence in Louisville Metro Governance	Disasters of the magnitude expected from a damaging earthquake (similar to 1800s New Madrid) have the potential to shake public confidence in government's ability to maintain law and order, provide essential services, repair or replace needed infrastructure for employment, processing of building permits and inspections, clearing of debris and other needs. Restoration efforts may well take longer than the public is willing to accept. Amendments to zoning and building standards may not be embraced by those seeking to rebuild. If rapid restoration is not possible, the area may lose employers and the population may relocate to other areas of the country in search of employment.

5.5.2 Significant Louisville Metro Earthquake Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to earthquake events.

According to the USGS, since 1950, there have been 171 earthquakes with magnitudes greater than 3.5 that have occurred within 250 miles of Louisville. These earthquakes are depicted on Figure 5-8.

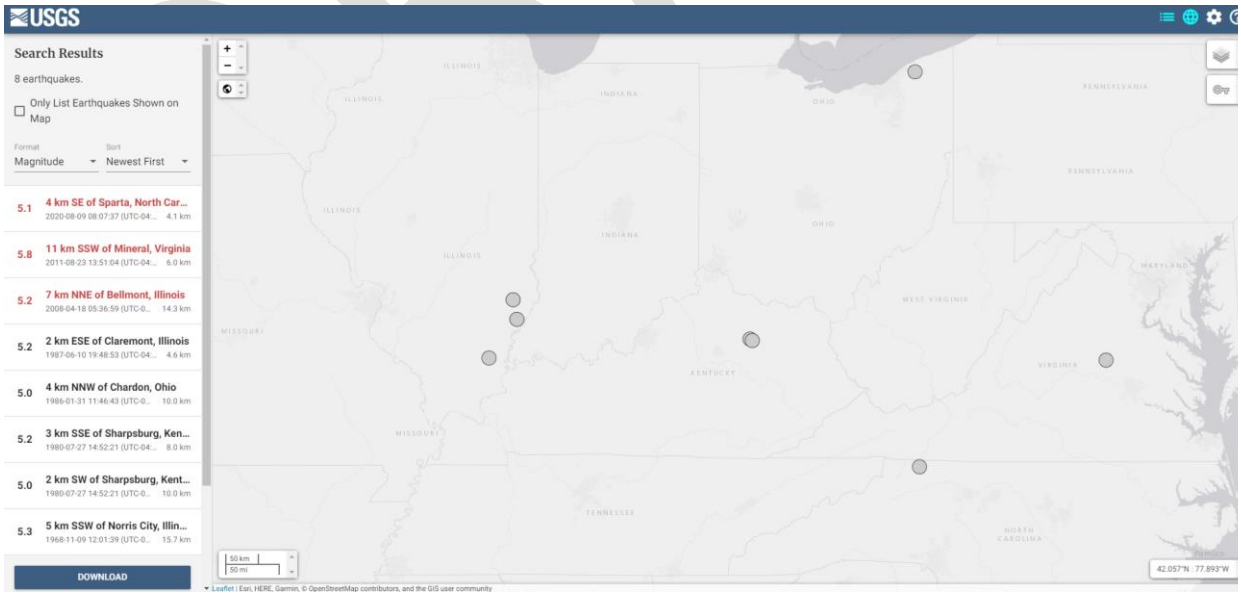
Figure 5-8: Location of Earthquakes (<3.5 on Richter) Occurring Within 250 Miles of Louisville Metro



Source: USGS

Using the same data, there have only been eight earthquakes with magnitudes greater than 5.0 in that time period. These are depicted on Figure 5-9 below.

Figure 5-9: Location of Earthquakes (>5.0 on Richter) Occurring Within 250 Miles of Louisville Metro



Source: USGS

Each of these are further identified in Table 5-15 below.

Table 5-15: History of 5.0 Magnitude Earthquakes Louisville Metro Area Since 1950

Date	Magnitude	Epicenter
8/9/2020	5.1	4 km SE of Sparta, North Carolina
8/23/2011	5.8	11 km SSW of Mineral, Virginia
4/18/2008	5.2	7 km NNE of Bellmont, Illinois
6/10/1987	5.2	2 km ESE of Claremont, Illinois
1/31/1986	5	4 km NNW of Chardon, Ohio
7/27/1980	5.2	3 km SSE of Sharpsburg, Kentucky
7/27/1980	5	2 km SW of Sharpsburg, Kentucky
11/9/1968	5.26	5 km SSW of Norris City, Illinois

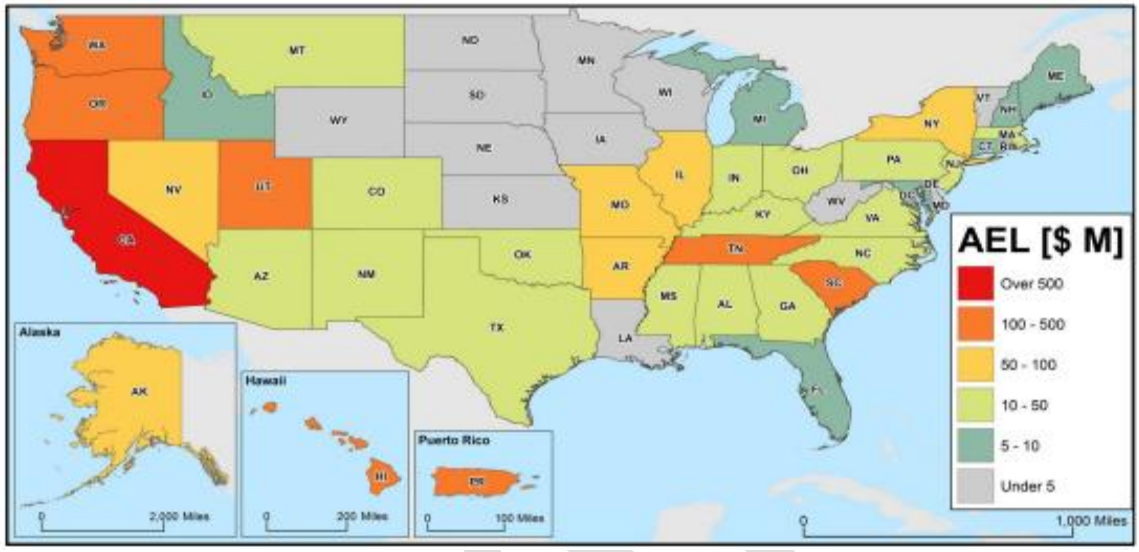
The strongest earthquake in Kentucky since 1900 occurred in 1968, when an M5.3 earthquake struck Saline County, Illinois. This earthquake, with an epicenter approximately 180 due east of Louisville, was felt by city and county residents. It should be noted that earthquakes affecting the Louisville Metro area can occur in surrounding states, as well as other areas in the Commonwealth. Tennessee, Arkansas, Illinois, Indiana, Ohio, and even states farther away all may experience the epicenter of an earthquake that ultimately is felt in Louisville and Jefferson County. Other historical earthquakes likely felt in the Louisville Metro area over the past 50 years are presented in Table 5-16 below.

Table 5-16: History of Earthquakes Likely Felt in the Louisville Metro Area Since 1970

Year	Magnitude	Depth	Epicenter Location
2007	5.4 magnitude	14 km depth	Mount Carmel, Illinois
1979	5.1 magnitude	8 km depth	Owingsville, Kentucky
1986	4.9 magnitude	9 km depth	Sumner, Illinois
2007	4.8 magnitude	10 km depth	Mount Carmel
1989	4.1 magnitude	5 km depth	English, Indiana
1989	3.8 magnitude	5 km depth	English, Indiana
1989	2.9 magnitude	5 km depth	English, Indiana
2015	2.7 magnitude	4 km depth	Shelbyville, Kentucky
2015	2.7 magnitude	4 km depth	Shelbyville, Kentucky
2022	2.3 magnitude	8 km depth	Taylorsville, Kentucky

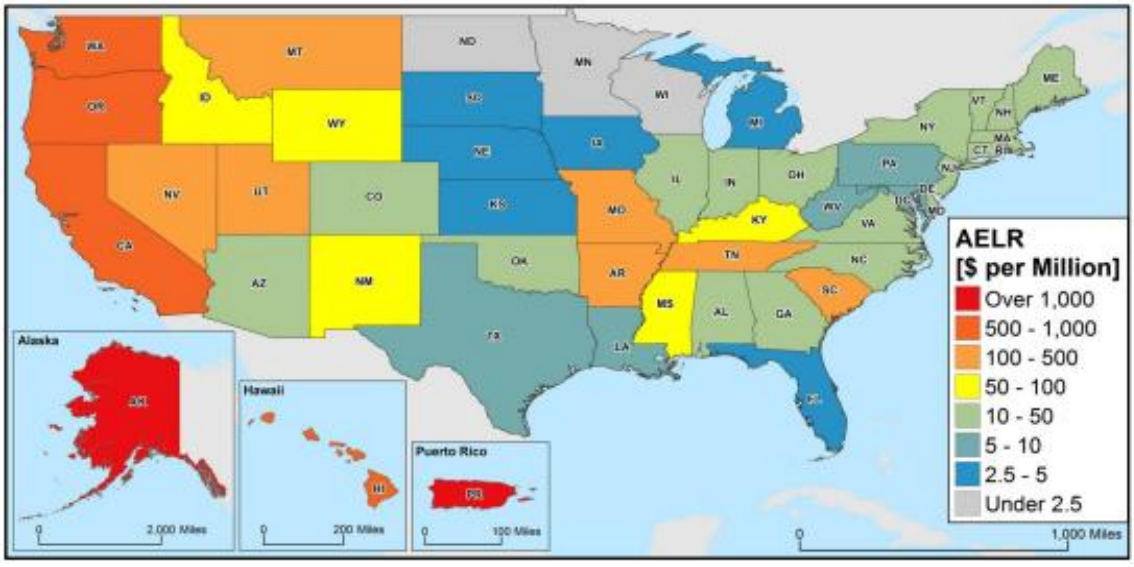
Although there has not been a major earthquake for nearly 200 years in the Louisville Metro area, according to Hazus® Estimated Annualized Earthquake Losses for the United States (FEMA P-366 / April 2017),[37] the annualized earthquake loss (AEL) and the annualized earthquake loss ratios (AELRs) for Kentucky are presented in Figure 5-10 below.

Figure 5-10: Estimated Annualized Earthquake Losses in the U.S.



The AEL for Kentucky is projected to be $43,846,000. This amount ranks 15th in the country.

Figure 5-11: Estimated Annualized Earthquake Loss Ratios in the U.S.



[37] https://www.fema.gov/sites/default/files/2020-07/fema_earthquakes_hazus-estimated-annualized-earthquake-losses-for-the-united-states_20170401.pdf

The AELR for Kentucky is projected to be $94,000,000. This amount ranks 14th in country.

New Madrid Seismic Zone: 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. Although the state was sparsely settled, these great earthquakes affected the whole Commonwealth of Kentucky.

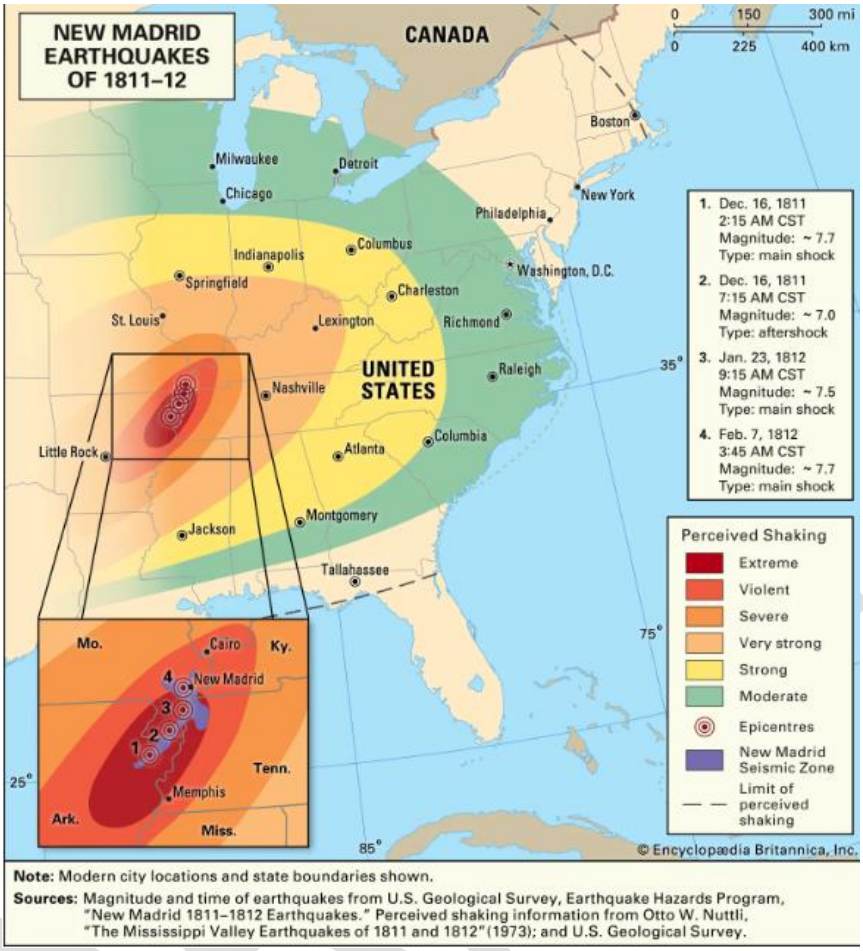
Most of the activity in Kentucky has occurred in the western portion of the state, near the New Madrid seismic zone. The series of catastrophic earthquakes at New Madrid, Missouri, in 1811–1812, dominates the seismic history of the middle Mississippi Valley.

Reports of chimneys being knocked down in many places in Kentucky resulted from the 1811-1812 earthquakes at New Madrid, Missouri. A detailed record of 1,874 tremors from the initial shock of December 16, 1811 through March 15, 1812 was kept by Mr. Jared Brooks at Louisville, Kentucky. Shocks continued to occur at frequent intervals for at least two years, so the total number of shocks was much greater. It is likely that between 2,000 and 3,000 tremors were felt in Kentucky in 1811 and 1812. Reelfoot Lake, a small portion of which extends into Kentucky, is a present-day reminder of the great forces associated with these earthquakes.

Damage associated with the major earthquakes in 1811 and 1812 was not significant due to the low level of development in the area at the time. However, today, over 12.5 million people live in the region impacted by the 1811 to 1812 events. The map below[38] shows the Modified Mercalli intensity for the first event of the 1811-1812 New Madrid earthquakes.

[38] https://www.britannica.com/event/New-Madrid-earthquakes-of-1811-1812

Figure 5-12: 1811-1812 New Madrid Earthquake Map

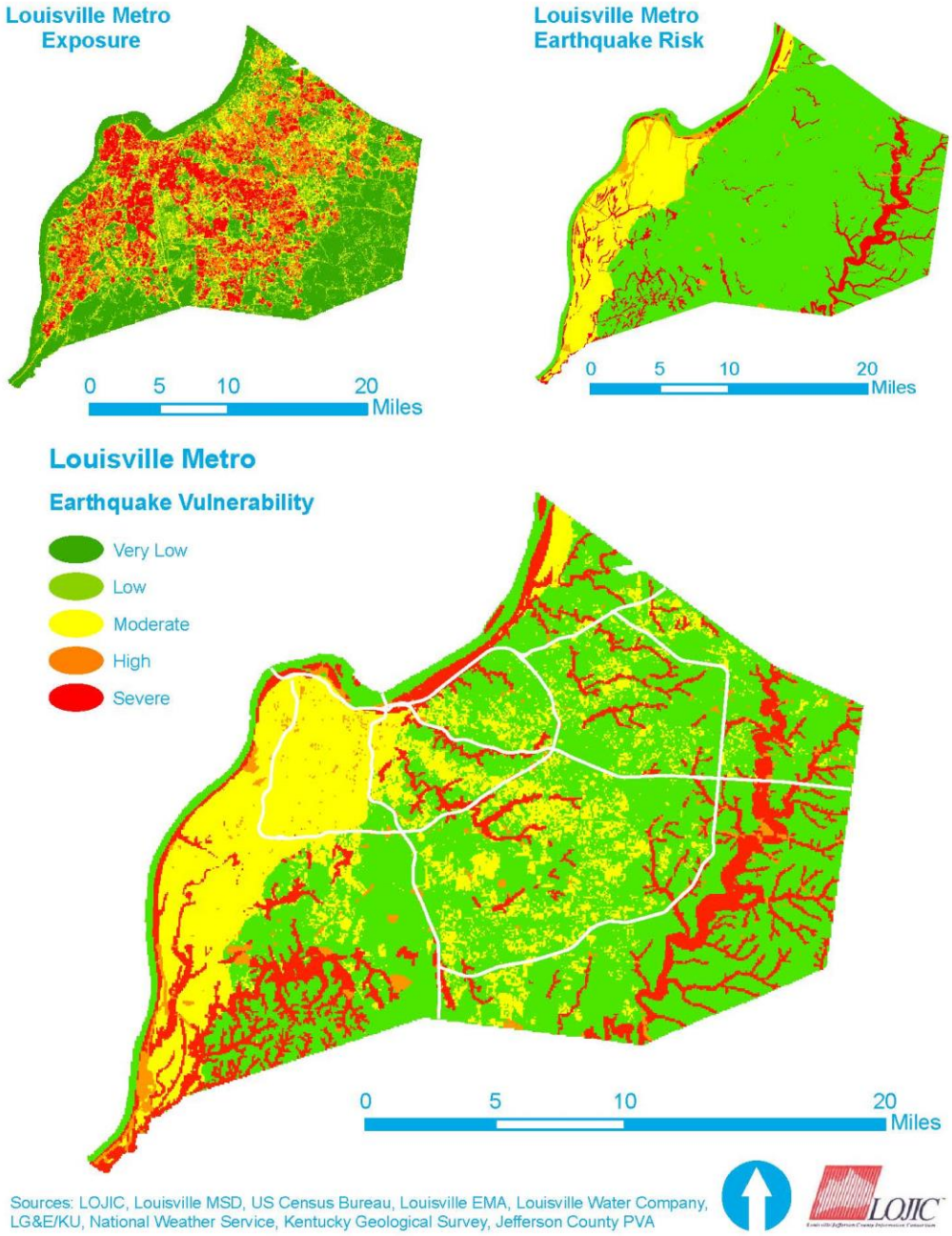


The University of Memphis estimates that, for any 50-year period, the probability of a repeat of the New Madrid 1811-1812 earthquakes with:

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

5.5.3 Assessing Vulnerability

Figure 5-13: Louisville Metro Earthquake Vulnerability Map



To determine structures that are vulnerable and estimated to be damaged during an earthquake, the Hazard Boundary Overlay methodology was used. The hazard boundary used as the overlay was the grid cells that were determined to have the highest level of risk to earthquakes. Soil types were also incorporated into vulnerability maps. This model estimates complete damage of each structure within the hazard boundary. A listing of critical facilities and infrastructure highly vulnerable to earthquakes is presented in Appendix E.

5.5.4 Climate Assessment

Although climate change can lead to increases in earthquakes due to melting glaciers and sea level rise, studies on the specific potential impacts are limited. Information from past periods of warming, such as the retreat of glaciers at the end of the last Ice Age, reveal a picture of extreme redistribution of energy and matter in the form of volcanic activity, seismic shocks, and monstrous landslides. This indicates a "seismically turbulent future" as massive amounts of weight are redistributed around the globe, but specific impacts to an inland area such as the Louisville Metro area and Kentucky in general are currently unknown.

Climate Risk

No definitive information on the risk of earthquakes associated with climate change, and specific to Louisville Metro or Kentucky, is available at this time. More information is needed before a qualitative or quantitative assessment can be done.

5.6 Extreme Heat

Extreme heat events can have a significant impact to human health, commercial/agricultural businesses, and infrastructure. What constitutes "extreme heat" can vary across different areas of the country, based on climate and topography. However, in general, "Extreme Heat" is a prolonged period of excessively hot weather, with temperatures above the average high temperature for a particular region for that time of year, often combined with high humidity[39]. In most of the United States, extreme heat conditions are defined as two days of temperatures over 90 degrees Fahrenheit (°F); in California, it is three days over 100°F. The "Heat Index" is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather that lasts two or more days. A heat wave is applied both to routine weather variations and to extraordinary spells of heat, which may only occur once of century.

Extreme heat affects all populations. However, some populations are more exposed to, or more physiologically or socio-economically vulnerable to physiological stress, exacerbated illness, and an increased risk of death from exposure to excess heat. These include the elderly, infants and children, pregnant women, outdoor and manual workers, athletes, and the poor.[40]

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

In the heat wave of 1980, more than 1,250 people died in the U.S. In addition, in the heat wave of 1995, more than 700 deaths in the Chicago area were attributed to heat. During the last two weeks of July 1999, the Midwest experienced a lengthy series of days with temperatures in excess of 90°F. Before it was over, some 232 deaths were attributed to the heat in the nine-state Midwest region. Most of these fatalities were from vulnerable populations.

Urban Heat

Changes in land use at the scale of cities has been shown to contribute to rising temperatures. Known as the urban heat island (UHI) effect, the displacement of trees and other natural vegetation by the construction materials of urban development increases the amount of heat energy that is absorbed from the sun, and stored in urban materials, such as concrete, asphalt, and roofing shingle. Four specific changes in urban environments drive the UHI effect, including:

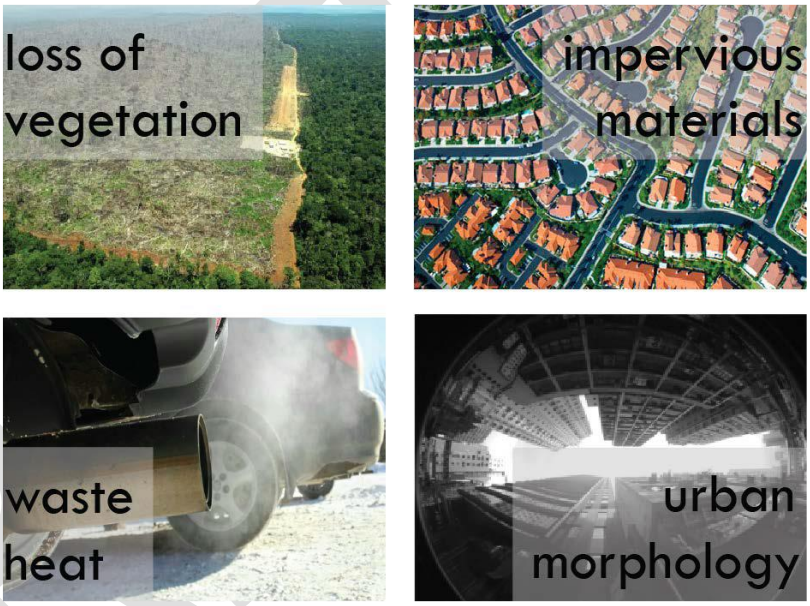
1) The loss of natural vegetation: In cities such as Louisville, these four warming mechanisms elevate the quantity of thermal energy retained and emitted into the urban environment through distinct pathways. The loss of trees and other natural land covers contributes to a warmer

[39] https://community.fema.gov/ProtectiveActions/s/article/Extreme-Heat-What#:~:text=Conditions%20of%20extreme%20heat%20are,often%20combined%20with%20high%20humidity.%20%5B

[40] https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health

environment through a reduction in shading, and most importantly, a reduction in evaporative cooling—the process through which plants use solar energy to convert water to water vapor. As trees and other vegetation are displaced by urban development, less moisture is retained by the urban environment, resulting in less evaporative cooling.

2) The introduction of urban construction materials that are more efficient at absorbing and storing thermal energy than the natural landscape: Compounding the loss of surface moisture is the resurfacing of the urban environment with the bituminous and mineral-based materials of asphalt, concrete, brick, and stone—materials that contribute to higher temperatures through three mechanisms. First, urban construction materials such as asphalt are less effective in reflecting away incoming solar radiation. As the reflectivity of cities is lowered through urban development, the quantity of incoming solar radiation absorbed and retained is greater. Second, mineral-based materials tend to be more effective in storing solar energy than the natural landscape—a property that results in the retention and release of heat energy in the late evening and into the night, keeping urbanized areas warmer than nearby rural areas. Lastly, urban construction materials such as street paving and roofing shingle are generally impervious to water, further reducing the amount of moisture that is absorbed and retained in cities for evaporative cooling.



3) High-density urban morphology that traps solar radiation: A third physical driver of the UHI effect is the morphology or three-dimensional character of the urban landscape. In densely developed downtown districts, tall buildings and street canyons limit the extent to which reflected solar energy from the surface can pass unimpeded back to the atmosphere. As this reflected energy is absorbed by the vertical surfaces of the city, more heat is retained in the urban environment.

4) The emission of waste heat from buildings and vehicles: Lastly, cities are zones of intense energy consumption in the form of vehicle usage, the cooling and heating of buildings, and industrial activities. As immense quantities of energy are consumed in urban environments, waste heat is produced that is ultimately vented to the atmosphere, contributing to rising temperatures. In some U.S. cities, waste heat from energy consumption has been estimated to account for about one-third of the UHI effect.

All of these factors increase the likelihood of extreme heat being felt in the Louisville Metro area. NOAA's Watch, Warning, and Advisory Products for Extreme Heat

Each NWS Weather Forecast Office can issue the following heat-related products as conditions warrant[41]:

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

Heat Index

The heat index, also known as the apparent temperature, is what the temperature feels like to the human body when relative humidity is combined with the air temperature. This has important considerations for the human body's comfort. When the body gets too hot, it begins to perspire or sweat to cool itself off. If the perspiration is not able to evaporate, the body cannot regulate its temperature. Evaporation is a cooling process. When perspiration is evaporated off the body, it effectively reduces the body's temperature. When the atmospheric moisture content (i.e. relative humidity) is high, the rate of evaporation from the body decreases. In other words, the human body feels warmer in humid conditions. The opposite is true when the relative humidity decreases because the rate of perspiration increases. The body actually feels cooler in arid conditions. There is direct relationship between the air temperature and relative humidity and the heat index, meaning as the air temperature and relative humidity increase (decrease), the heat index increases (decreases). The figure below represents NOAA's Heat Index.

[41] https://www.weather.gov/safety/heat-ww

Figure 5-14: NOAA Heat Index Chart

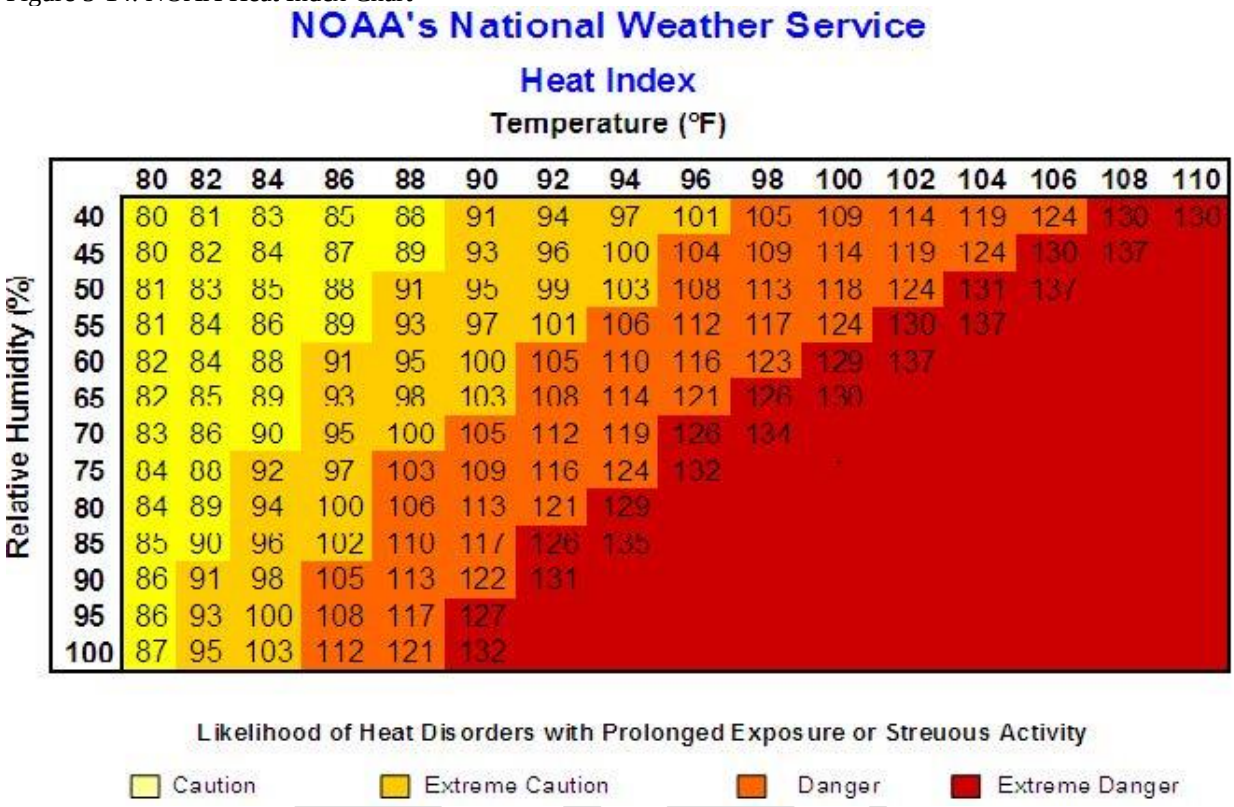


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Figure 5-14 indicates that temperatures exceeding 90°F, coupled with extreme high humidity, results in "Extreme Danger" and severe heat disorders. Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes, and sweating or a chemical (salt) imbalance caused by too much sweating. When the body heats too quickly to cool itself safely, or when it loses fluid or salt through dehydration or sweating, body temperature rises and heat-related illness may develop.

Heat Disorder Symptoms

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

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

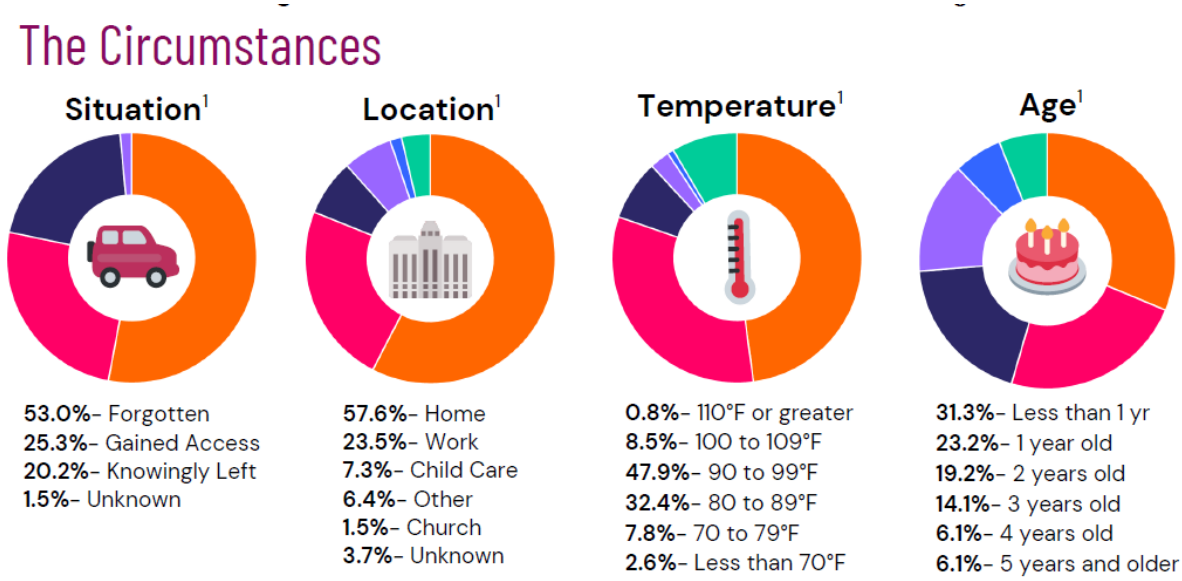
Pediatric Vehicular Heatstroke Death

Over 930 children have died inside hot vehicles since 1998. On average, 38 children die each year from Pediatric Vehicular Heatstroke (PVH).[42] PVH is the leading cause of death for non-crash vehicular deaths among children.[43] In Kentucky, 23 children under the age of 14 have died of PVH since 1998. The circumstances behind the national data are presented in Figure 5-15 below:

[42] https://www.noheatstroke.org/

[43] https://www.noheatstroke.org/

Figure 5-15: PVH Circumstances Chart



A lesser-known cause of PVH is children gaining access to a parked car. When children are playing, they could use car keys or find an unlocked car to gain access, whether it is the caregiver's or a stranger's vehicle.

Just over 34% of PVH deaths have occurred outside of the summer months (June, July, August), and a child has died of PVH each month of the year. PVH deaths can and have occurred at temperatures in the 60s and 70s—temperatures many incorrectly believe are too low for PVH to occur. The majority of PVH deaths involve children under the age of 2 years old, with the average age being 21 months old.

Table 5-17: Temperatures Inside of a Vehicle Over Time

Time	**Temperature**					
Outside Air Temp	**70°F**	**75°F**	**80°F**	**85°F**	**90**	**95°F**
10 Minutes	89°F	94°F	99°F	104°F	109°F	114°F
20 Minutes	99°F	104°F	109°F	114°F	119°F	124°F
30 Minutes	104°F	109°F	114°F	119°F	124°F	129°F
40 Minutes	114°F	118°F	123°F	128°F	133°F	138°F

A child's body heats up 3 to 5 times as fast as a healthy adult. A child's major organs begin to fail at 104°F, and a child can die when their temperature reaches 107°F. Temperatures inside a car can quickly become life threatening regardless of the outside temperature. Leaving windows down or cracked has little to no effect on the temperature inside of a vehicle.

5.6.1 Hazard Profile and Consequence Analysis Profile

The table below represents the typical hazard profile associated with Extreme Heat.

Table 5-18: Profile Risk Table Extreme Heat

Period of occurrence:	Late spring to early fall
Number of events:	10+
Probability of events:	Frequent- Extreme heat events are likely to occur within 25 years (4% chance of occurrence in any given year)
FEMA Risk Rating/Score:	Relatively High - Score 18.84
Warning time:	Days to weeks
Potential of injury or death:	High. Past extreme Heat events have killed numerous people both in the Louisville Metro area and in other areas of the country
Possible Extent:	Extreme heat affects the entire Louisville Metro area.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, has been performed to better understand and outline the potential impacts that an extreme heat event would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-19 below:

Table 5-19: Consequence Analysis Extreme Heat

Subject	Impacts
Health and Safety of the Public	Anyone present in the Louisville Metro area during an excessive heat period is subject to potential impacts. While the likelihood of an extreme heat event is growing with climate change, the likelihood of direct and significant impacts is moderate due to air conditioning and the availability of shelters. Impacts to the public may include sheltering needs for those without air conditioning and increased medical care needs due to heat related disorders.
Health and Safety of Responders	For the most part, first responders train for operating under extreme heat conditions. Although extreme heat can be a contributing factor to other hazards, including civil unrest, drought, and even severe storms, it should not directly affect first responder operations.
Vulnerable Populations	Vulnerable populations are especially exposed during extreme heat events. Since the Louisville Metro area has a moderate climate, many of these populations are unprepared. Extreme Heat events may require opening "Cooling Centers" and canvassing areas to offer shelter services.
Continuity of Operations (including delivery of services)	Extreme heat can have a significant impact on power generation. Because the use of air conditioning and refrigeration increases during periods of extreme heat, the strain on power systems can be overwhelming. Rolling blackouts and even a complete loss of power can limit a government's ability to provide critical services. Although these disruptions typically do not last long, even a short outage can have cascading effects to the Louisville Metro population.
Property, Facilities, and Infrastructure	In general, extreme heat will not negatively affect property, facilities and infrastructure. Main impacts are to public health and safety, especially the vulnerable and elderly. Additionally, heavy use of utilities (electric and water) causes a strain on the system due to air conditioners, fans, and water usage, etc.
Environment	Extreme heat likely is accompanied by drought conditions. People, animals and plants all need and use more water when temperatures rise. This can put a strain on local water supplies.
Economic Conditions	Extended bouts of extreme heat can result in more hospital visits, a sharp loss of productivity in construction and agriculture, reduced agricultural yields, and even direct damage to infrastructure.

Subject	Impacts
Public Confidence in Louisville Metro Governance	Although the public will not typically place the blame on public officials for extreme temperatures, they likely will place the blame on officials if the response to extreme heat is mismanaged resulting in deaths or power outages. Therefore, it is critical to have plans that address the threat of extreme heat and focus on immediate mitigation, as well as response and recovery actions if/when they occur. This is especially true in the face of climate change, where many believe that rising temperatures are predictable and the result of human behavior.

5.6.2 Significant Louisville Metro Extreme Heat Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to extreme heat.

Research has shown there is limited Louisville Metro data for tracking the damages, injuries, or deaths for extreme heat. The summer of 1936 is legendary for intense heat coupled with an extreme lack of rainfall. Although the entire first half of the year was unusually dry, true drought conditions developed with a vengeance in June. Bowling Green suffered through the month with only 12/100 of an inch of precipitation, which still stands today as the 7th driest month on record, and the driest June and driest summer month. Similarly, Louisville received only 0.35 inch of rain (driest June on record), and Lexington got 1.18 inches of rain, 1.06 inches of which fell on one day (2nd driest June on record).

Then came the searing heat. The last few days of June saw afternoon temperatures reach around 100°F, followed by a brief break in the heat for the first three days of July. However, the hot weather had only just begun. Every day from July 8 through 15, all major reporting stations in Kentucky reported 100°F temperatures. Louisville peaked at 107°F on the 14th (still an all-time high), Lexington hit 108°F on the 10th and 15th (their all-time high), and Bowling Green struck 106°F on the 10th and 11th. At night, temperatures dropped often only into the upper 70s and lower 80s.

Hot summer weather continued for the rest of July, although not at record levels. Then in August, another heat wave swept the region from August 16 to August 28. Bowling Green recorded another ten 100°F days, peaking at 106°F on August 28. Louisville topped out at 101°F on the 19th and 22nd, and Lexington made it to 105°F on the 19th (their all-time high for August). The summer of 1936 turned out to be the second-hottest summer ever recorded at Louisville.

Additional periods of extreme heat are highlighted below.

July 1999: During the last two weeks of July 1999, the Midwest experienced a lengthy series of days with temperatures higher than 90°F. Although only a relatively small number of maximum temperature records were set, the combination of high heat, record dew points, strong solar inputs, and weak winds led to a dangerous situation for people. Before it was over, some 232 deaths were attributed to the heat in the nine-state area served by the MRCC; there were additional health, infrastructure, and economic impacts that were quite significant.

The major loss of life was in large cities, where the UHI amplified temperatures by 3 to 5 degrees or more. The majority of those who died were elderly persons, living alone in the inner-city regions, and either were without air conditioning or without the funds to pay for continuous operation of their air conditioning units. Most of the people who died on July 29th and 30th lived in large cities with an old infrastructure of non-air-conditioned brick buildings.

August 2007: Nearly 30 temperature records were set in central Kentucky in August 2007, including 105°F at Louisville on the 16th, which tied the all-time record for the month. Louisville set a new record for consecutive 90 degree days (22). The normal for August is 78.9°F, but this year the average was 85 degrees. Over the whole 2007 year, there were 67 days of 90 degrees or warmer, and 5 of over 100 degrees. At Louisville International Airport, there were 26 days of 90 degree or more temperatures in August. August 2007 became the hottest month ever recorded at Louisville.

As noted in the drought section, these high temperatures and lack of rain led to a water deficit in the early fall. The United States Drought Monitor rated much of Kentucky in extreme conditions from August to October. A federal disaster declaration was granted for the state of Kentucky where farmers were hit hard by the drought. All types of crops were affected—from hay to corn to soybeans.

Summer 2010 (June-July-August): The summer of 2010 was the second hottest on record for Louisville. This is true with respect to both the average temperature and minimum daily temperature.

May 2011: The temperatures reached into the mid-80s during the afternoon of May 21, with a high temperature of 87. On this day, a two-year-old child was found unresponsive in a hot car. It is unclear how long the child had been in the car. The coroner ruled the child died from overheating. The peak temperature during the afternoon was 87°F.

June 2012: An extended period of excessive heat, which began on June 28th, continued through July 7th. The intensity of the heat rivaled the historic heat waves of the 1930s Dust Bowl.[44] During the period, the official high temperature at Standiford Field in Louisville exceeded 100°F nine times within a 10-day period. Official record high maximum temperatures were set at Louisville for 7 out of 8 days ending July 7. This hot weather lead to several heat-related deaths across the Commonwealth, including one in Louisville, when a man working in his yard died of heat stroke during the afternoon of July 6. The official temperature at the time of his death was 101°F.

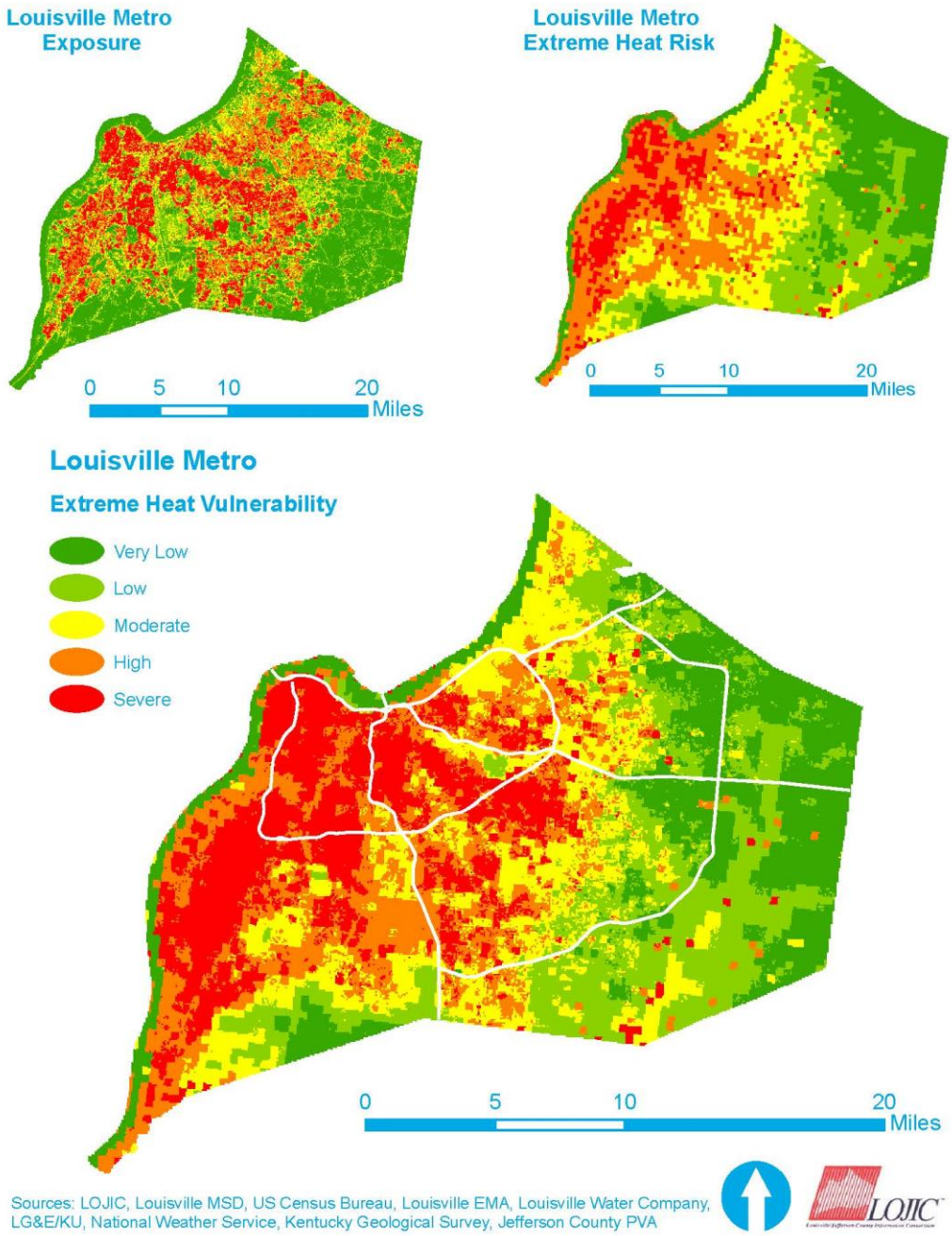
September-October 2019: September 2019 was a very hot month overall, with an initial heat wave in the region from the 10th to the 22nd, with many daily highs in the 90s. After a brief respite, a record-breaking late season heat wave baked the Ohio Valley from September 27 to October 3. Every day during this stretch was in the 90s at Louisville. The hottest day of the stretch was September 30, on which Louisville's average daily temperature was a full 20 degrees above normal. The high that afternoon at Louisville was 98°F. All-time record highs were then

[44] https://www.weather.gov/jkl/2012heatwave

set for the month of October at Louisville, with readings of 97 on the 1st and 2nd of the month. It was the hottest September 27–October 3 period on record. September was also astoundingly dry, because it was Louisville's driest month of all time, with a mere 0.04 inch of rain, all of which fell in a space of less than two hours on September 23.

5.6.3 Assessing Vulnerability

Figure 5-16: Louisville Metro Extreme Heat Vulnerability Map



Identifying individual structures and estimating potential losses from Extreme Heat is a challenging endeavor. Without any current spatial data that truly identify Extreme Heat hazard boundaries, it is assumed that the entire Louisville Metro area has equal vulnerability and the potential to be damaged from Extreme Heat. That being stated, it is assumed that each structure in Louisville Metro has an equal chance of being affected by an Extreme Heat event. To estimate which structures could be damaged from Extreme Heat, it is assumed that all structures could be damaged, although this is highly unlikely. Mapping was made available using data from the Urban Management Study from LOJIC. A listing of critical facilities and infrastructure highly vulnerable to extreme heat is presented in Appendix E.

5.6.4 Climate Assessment

Cities across the Southeast are experiencing more and longer summer heat waves. At 61%, the Southeast has a higher percentage of cities experiencing worsening heat waves than any other region of the U.S. Louisville is showing significant increases in both frequency and duration of heat waves. Intensity is expected to increase as temperatures continue to rise. Figure 5-17 and Figure 5-18 indicate that both temperatures and days above normal are steadily increasing. Temperatures have risen steadily in Louisville since 1970, gaining an average of 3.4 degrees, while the number of warm summer days (days above average) has increased by 25.

Figure 5-17: Louisville Average Summer Temperature Chart

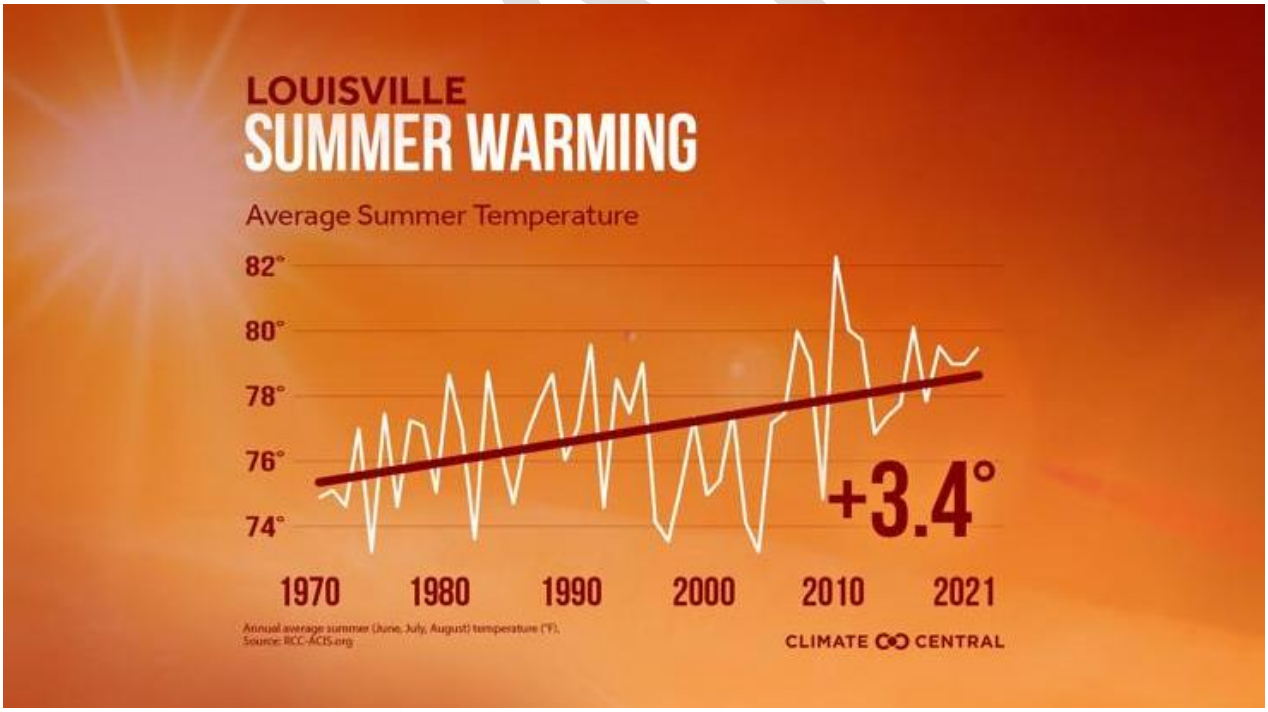
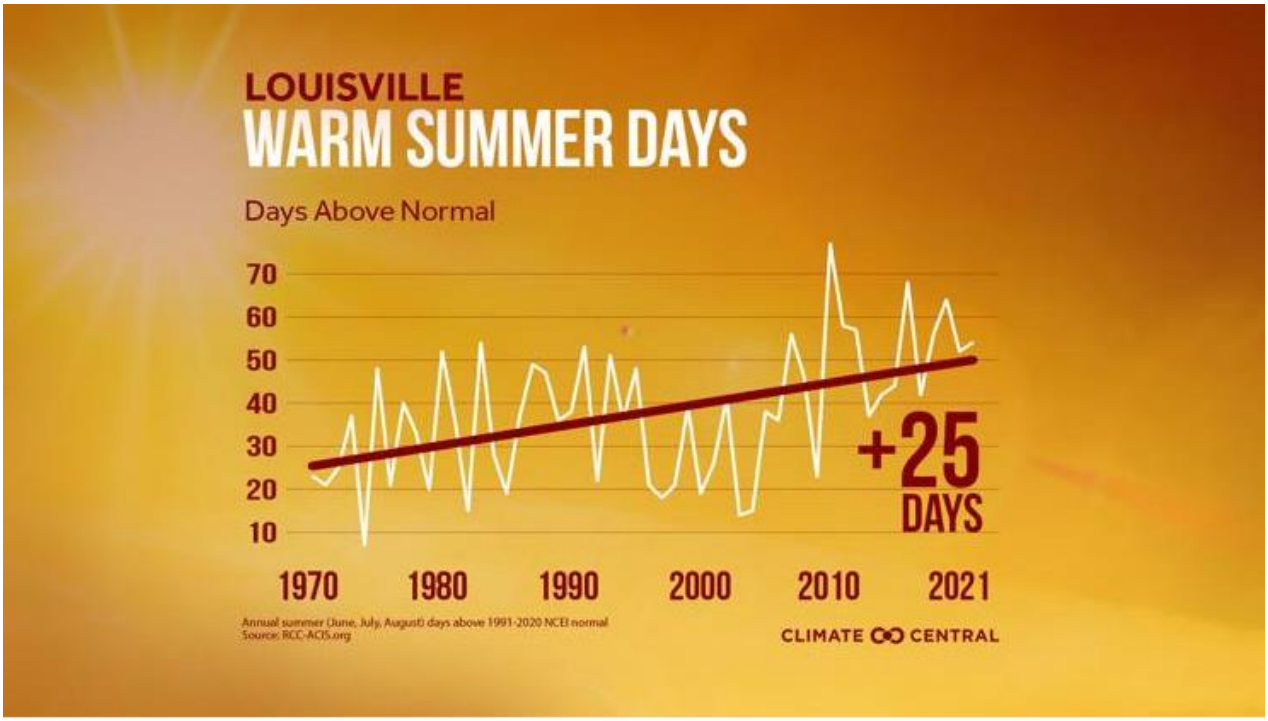


Figure 5-18: Louisville Days Above Normal Temperature Chart



Model projections indicate continued temperature rise for many decades to centuries. If emissions are not reduced, the continued rise is expected to increase extreme maximum temperatures by an average of 8.3°F (range = 3.1°F to 13.6°F) by 2040-2069, and 12.6°F (range of 5.5°F to 19.7°F) by 2070-2099. If emissions are reduced, these extreme maximum temperatures could be limited to about 5.5°F by mid-century, and 7.1°F by late-century.

High humidity and elevated nighttime temperatures greatly exacerbate heat-related illness and mortality. Heat stress occurs in humans when the body is unable to cool itself effectively. Normally, the body can cool itself through sweating, but when humidity is high, sweat will not evaporate as quickly, potentially leading to heat stroke. Exposure to high nighttime minimum temperatures reduces the ability of some people to recover from high daytime temperatures, resulting in heat-related illness and death, especially for the poor and elderly. Daily minimum temperatures in the U.S. are increasing slightly faster than daily maximum temperatures.

Climate Risk

Based on the best available scientific information and trends, heat risk is already worsening, and will continue to worsen, in Louisville. The geographic distribution of this risk is not expected to change with climate change, but the severity is already increasing and is expected to continue. This risk could be lessened if GHG emissions are reduced; however, existing goals are difficult despite renewed efforts.

5.7 Floods

Flooding is the most significant natural hazard in Kentucky. Major flooding occurs in the state almost every year, and it is not unusual for several floods to occur in the Louisville Metro area in a single year. Flooding is Kentucky's most costly natural disaster. The economic, social, and physical damage resulting from floods can be severe.

Floods are natural events for rivers and streams, resulting in an overflow of water onto dry land. The floodwaters can be slow- or fast-rising, but generally develop over a period of days. Thunderstorms, snow melt, tropical systems, or decayed hurricanes can all cause waterways to overflow banks and inundate the surrounding areas.

Floodwater currents are also extremely dangerous and destructive forces that can demolish or weaken buildings and infrastructure; cause extreme erosion issues; and sweep automobiles off roads. Debris and hazardous materials such as chemicals or sewage can contaminate floodwaters. The severity of a flood is impacted by several variables, such as stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions, and the degree of vegetative clearing.

Periodic flooding of lands adjacent to rivers and streams is a natural and inevitable occurrence that can be expected to occur based on established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval. A "floodplain" is the lowland area adjacent to a river, lake, or ocean.

Floodplains are designated by the frequency of the flood that is large enough to cover them. One way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year.

Flood Types

Floods can occur due to a multitude of naturally occurring and human-induced factors, but all floods can broadly be defined as the accumulation of excess water in a short amount time in a concentrated area.

There are several types of floods, which include regional floods, river or riverine floods, flash floods, urban floods, ice-jam floods, storm-surge floods, and debris, landslide, and mudflow floods. For information on dam- and levee-failure floods, see Dam Failure in this section of the Plan. For information on landslides, see Landslide in this section of the Plan.

- *Regional Flooding* occurs when winter or spring rains, coupled with melting snow, quickly fill river basins with an excess of water. If the ground is frozen, the infiltration into the soil is reduced, thereby increasing runoff. Extended wet periods during the year can saturate the soil, sending runoff from any additional rainfall into streams and rivers until capacities are exceeded. Regional floods are associated with slow-moving, low-pressure or frontal storm systems such as a decaying hurricanes or tropical storms.

- *River or Riverine Flooding* is a result of long periods of excessive rainfall and high runoff volumes in a river or stream's watershed. This type of flooding may take days for the river to rise and overflow its banks rather than hours like a flash flood.
- *Flash Floods* may occur within minutes or hours of heavy rains, and with little warning to residents. Factors that may contribute to flash flooding can include rainfall intensity, rainfall duration, surface conditions, and topography and slope of the receiving basin. These floods can be deadly due to the rapid rises in water levels and devastating velocity of flows. Slow-moving thunderstorms, decayed hurricanes, tropical storms, or heavy rains in a localized area are often the source of a flash flood event. Urban areas with large areas of impervious surfaces, as well as mountain streams are susceptible to flash floods.
- *Urban Flooding* can transpire when heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces; or when traditionally undeveloped natural lands, such as wetlands or forests, are developed into roads, parking lots, or structure development; thereby losing the ability to absorb rainfall. When urbanization of a watershed is altered, the hydrologic systems of the basin change; therefore, rainfall can travel at a faster rate in urbanized 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. 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. Floodwaters accelerated by steep stream slopes can cause the flood-wave to move downstream too fast to allow escape, resulting in many deaths.
- *Ice-Jam Flooding* can occur on rivers that are completely or partially frozen, and is created by ice flows piling up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow, allowing for more jamming to occur. The backwaters upstream from an ice dam can rise rapidly and overflow the river or stream's banks; therefore, the flooding will move downstream when the ice dam fails, and then release the water stored behind the dam. From that point on, the flood will take on the characteristics of a flash flood, with the added danger of ice flows that, when driven by the energy of the flood-wave, can inflict serious damage on structures.
- *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 embankments, and can be deadly.

The two most common types of flooding that occur in Louisville Metro area are flash floods and Ohio River flooding; however, urban flooding is becoming more frequent.

Finally, within Louisville's " Plan 40," several goals associated with flood mitigation are presented. These include:

- Mitigate negative development impacts to the integrity of the regulatory floodplain by encouraging development patterns that minimize disturbance and consider the increased risk of more frequent flooding events.
- Base floodplain management standards on a regulatory floodplain that reflects the full development potential of each watershed.
- Ensure that provisions for compensatory storage, as defined by the ordinance, are met when proposals reduce the existing storage capacity of the floodplain.
- Ensure, to the extent feasible, that critical facilities and those that store or use hazardous wastes are located outside the regulatory floodplain. Where essential community facilities must be located within a floodplain (e.g., pumping stations), ensure that these facilities are designed, located, and operated in a manner that minimizes loss of services during flood events, as well as limits, to the extent possible, floodplain disturbance.
- Ensure that sufficient emergency vehicle access is provided for developments proposed in or through the floodplain. Access should be provided above flood levels or through other means to minimize potential hazards for any development that is proposed in or through the regulatory floodplain.

Flood Severity Factors

In general, the overall severity of floods is determined by four main factors:

1. Rainfall intensity
2. Rainfall duration
3. Topography
4. Ground cover

An intense rain can create severe flash floods as well as urban flooding. Extended periods of heavy rain can create severe riverine floods, and water runoff is greater in areas with steep slopes and little vegetation.

Common Flood Mitigation Definitions

The following terms are commonly used in describing flood mitigation efforts:

- *Base Flood (1% Annual Chance Flood):* The flood having a 1 percent chance of being equaled or exceeded in any given year. This is the regulatory standard also referred to as the "100-year flood." The base flood is the national standard used by the NFIP and all federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development. Base Flood Elevations (BFEs) are typically shown on Flood Insurance Rate Maps (FIRMs).
- *Base Flood Elevation (BFE)*: The elevation shown on the Flood Insurance Rate Map (FIRM) for Zones AE, AH, A1-A30, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO,

V1-V30, and VE, which indicates the water surface elevation resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year.

- *Community Rating System (CRS)*: A program developed by FEMA to provide incentives for those communities in the NFIP that have gone beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding.
- *Elevation Certificate*: A certificate that verifies the elevation data of a structure on a given property relative to the ground level. The Elevation Certificate is used by local communities and builders to ensure compliance with local floodplain management ordinances and may be provided by the property owner to their insurance agent to determine if it will lower their insurance costs.
- *Floodplain*: Any land area susceptible to being inundated by floodwaters is known as a floodplain.
- *National Flood Insurance Program (NFIP)*: A federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.
- *Non-Special Flood Hazard Area (NSFH)*: An area in a moderate- to low-risk flood zone (Zones B, C, X) that is not in any immediate danger from flooding caused by overflowing rivers or hard rains. However, it's important to note that structures within a NSFHA are still at risk.
- *Special Flood Hazard Area (SFHA)*: A FEMA-identified high-risk flood area where flood insurance is mandatory for properties. An area having special flood, mudflow, or flood-related erosion hazards, and shown on a Flood Hazard Boundary Map or a Flood Insurance Rate Map as Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE, or V.
- *Regulatory Floodway*: The channel of a river or other watercourse and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.
- *Freeboard*: An additional amount of height above the Base Flood Elevation (BFE) used as a factor of safety (e.g., 2 feet above the Base Flood) in determining the level at which a building's lowest floor must be elevated or floodproofed to be in accordance with state or community floodplain management regulations.
- *Regulatory Floodplain*: For purposes of the Community Rating System, the regulatory floodplain is the flood-prone land area that is subject to a community's floodplain development or floodplain management regulations. The regulatory floodplain includes, at a minimum, the Special Flood Hazard Area (SFHA) (see definition) but may also incorporate other areas outside the SFHA that are also subject to a community's floodplain development or floodplain management regulations.

The Louisville-Jefferson County Floodplain Management Ordinance is based on a local regulatory floodplain, which is determined by assuming a fully developed watershed, which is more conservative than the FEMA Special Flood Hazard Area, which assumes existing land use conditions; therefore, the local regulatory floodplain is geneally larger than the FEMA Special Flood Hazard Area. The following are flood terms as defined in the Louisville-Jefferson County Floodplain Management Ordinance.

- *Local Regulatory Base Flood Elevation*: The height of the local regulatory flood expressed as feet above mean sea level (North American Vertical Datum 1988). This is determined by hydraulic calculations using the runoff from a fully developed watershed using as the basis for calculation a methodology approved by the administering agency which includes storm duration estimates and using zoning maps current as of the time of the calculation, provided that in calculating runoff potential for publicly owned property dedicated to public open space, for existing cemeteries, for existing 18 hole or larger regulation golf courses and for land prohibited from development by ordinance of Louisville/Jefferson County Metro Government or one of the municipalities within its boundaries, the actual use rather than the designated zoning category on the zoning maps shall be used.
- *Local Regulatory Conveyance Zone:* The channel of a river or perennial stream or intermittent stream and the land adjacent to that river or stream which if unobstructed will discharge a local regulatory flood without cumulatively increasing the water surface elevation more than one-tenth of one foot. The conveyance zone is determined by an equal loss of conveyance (at higher elevation) occurring on each side of the channel.
- *Local Regulatory Flood*: The flood having a 1% likelihood of being equaled or exceeded in any given year based on a fully developed watershed.
- *Local Regulatory Floodplain*: Any stream course or normally dry land area susceptible to being partially or completely inundated by the overflow of water from sources of public water or by the unusual and rapid accumulation or runoff of public surface waters and subject to a local regulatory flood.
- *Substantial Damage:* Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred, as determined by the administering agency and/or the Commonwealth of Kentucky.
- *Substantial Improvement:* Any combination of repairs, reconstruction, alteration, additions or improvements to existing development not related to damage taking place during a one-year rolling period in which the cumulative cost equals or exceeds 50% of the market value of the structure, excluding periodic maintenance and upkeep (including without limitation, windows, doors and roofing) that does not increase the value of the structure. (See definition for Market Value.) With regard to damage, Substantial Improvement shall mean any combination of repairs, reconstruction, rehabilitation or improvement to existing development taking place during a one-year rolling period in which the cumulative cost equals or exceeds 50% of the market value of the structure. The cost of repairs,

reconstruction, alteration, additions or improvements shall reflect the value in the marketplace of the labor and materials to be used. The first alteration of any wall, ceiling, floor or other structural part of the structure constitutes beginning of construction of the substantial improvement whether or not that alteration affects the external dimensions of the structure. The term does not include the cost of flood proofing or elevating a structure or any portion thereof to the freeboard elevation. This term does not apply to: (1) Any project for improvement of a building required to comply with existing health, safety or sanitary code requirements which have been identified by the Code Enforcement Official and which are solely necessary to assure safe living conditions; or (2) Any alternation of a "historic structure" as defined in this chapter, provided that the alteration will not preclude the structure's continued designation as a "historic structure" and provided that mitigation measures to minimize future flood damages are used to the maximum extent practicable when historic structures are renovated or when repaired following a floor or other hazard event.

5.7.1 Hazard Profile and Consequence Analysis

Table 5-20 below represents the typical hazard profile associated with Floods.

Table 5-20: Profile Risk Table Floods

Period of occurrence:	Ohio River: December through May Flash floods: anytime, but primarily during summer rains
Number of events:	215
Probability of events:	Frequent - Flooding is likely to occur within 25 years (4% chance of occurrence in any given year)
FEMA Risk Rating/Score:	Relatively High - Score 24.84
Warning time:	River flooding – 3-5 days Flash flooding – minutes to hours
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 Agribusiness losses. Floodwaters are a public safety issue due to contaminants and pollutants.
Potential of injury or death:	High. Flooding has resulted in reported injuries and deaths in the Louisville Metro area. In addition, flooding events nationwide have resulted in deaths, and in 2022, flash flooding in eastern Kentucky resulted in over 30 deaths
Possible Extent:	1937 – Ohio River crested at 460 feet above mean sea level, or 40 feet above its normal height, causing more than 60% of the city to be inundated. 190 flood-related deaths.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, including key personnel at MSD responsible for emergency management, flood planning, and

grant writing has been performed to better understand and outline the potential impacts that extensive flooding would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-21.

Table 5-21: Consequence Analysis Floods

Subject	Impacts
Health and Safety of the Public	Flooding can affect anyone who lives in or near floodplains. Most flood hazards are mapped on FEMA's Flood Insurance Rate Maps, which depict areas of high, moderate, and low risk. Families living in these mapped 1% annual chance floodplains (high risk areas) can expect at least a 26% chance of being affected by floodwaters over 30 years, the length of a typical mortgage. Flooding can threaten lives, particularly in areas where flooding can happen quickly and with little warning, in addition to those driving on flooded roads. Most deaths occur from people driving through floodwaters and being swept away in their cars. Floodwaters are often contaminated and may transmit infectious diseases and cause intestinal distress due to consumption of contaminated water or food washed with contaminated water. Open wounds exposed to floodwaters can become infected and long periods of immersion can result in complications such as trench foot or immersion foot. Hazardous materials are a common floodwater contaminant due to household items and industrial facilities and can pose a serious health risk to communities and residents.
Health and Safety of Responders	First responders play key roles in the response to flooding. Police officers often help close roads to prevent people from driving through floodwaters; firefighters often rescue people trapped by flooding; and paramedics transport people injured by flooding, hypothermia, or other causes. If any of these first responders' buildings are in the 0.2% annual chance floodplain (moderate risk area), their ability to respond is seriously threatened. Of the 8 police stations in the Louisville Metro area, 2 are located in the 0.2% annual chance floodplain. Of the 25 fire stations in the Louisville Metro area, 2 are located in the 0.2% annual chance floodplain. Additionally, neighborhoods with roads that are inaccessible during flooding pose challenges to first responders in reaching injured or stranded people and may require rescue by helicopters or boats to access flooded areas.
Vulnerable Populations	Flooding is a complicated hazard to understand and accessing flood warning, flood insurance, and other information often requires command of English, understanding of government bureaucracy, and access to financial resources. Populations that don't speak English, don't have access to government resources, and those that cannot afford or don't have flood insurance are particularly vulnerable to the long-term impacts of flooding. Renters can be particularly vulnerable to the financial impacts of flooding because they're far less likely to have a flood insurance policy. Renters often have less wealth or savings to draw from to pay for uninsured losses, making it more difficult to recover from flood damages
Continuity of Operations (including delivery of services)	Although many government facilities are located in flood prone areas, because downtown Louisville (where most Louisville Metro offices and critical facilities are located) is protected via a series of levees, Ohio River flooding does not pose a substantial risk to the continuity of government operations.

Subject	Impacts
Property, Facilities, and Infrastructure	Flooding particularly impacts property and often causes many millions of dollars in property damage in major flooding events. Even a small amount of water inside a building can cause significant property damage and leave building owners with large repair bills. For families, damage to homes may mean difficult financial decisions, displacement for weeks, and lost belongings. For business owners, flood damage may mean lost economic output from shutdowns, destroyed inventory, and inability to pay employees. Throughout the Louisville Metro area, there is at least $1.4 billion of building value in floodplains. Federal flood insurance through the National Flood Insurance Program is the primary way building owners financially protect their property in flood prone areas. Many larger commercial or industrial facilities are insured through private contracts, the value of which is not available to government agencies. Critical facilities can also be affected by flooding. The most likely systems are further described below: • Energy systems: most overhead powerlines are not susceptible to impacts from flooding unless the power poles are not resistant to flooding. Buried cables typically aren't affected by flooding. • Water/Wastewater: flooding, particularly from riverine and flash events can damage wastewater infrastructure. MSD operates five treatment plants within Jefferson County, and all are susceptible to flooding events which could cause a release of raw sewage and contaminate drinking water. • Transportation: roads through many portions of the Louisville Metro area are particularly susceptible to flooding and close regularly during high water events. • Communications: most communications infrastructure is not vulnerable to flooding.
Environment	Flooding is a natural process and supports unique ecosystems and habitats. Natural floodplain functions typically result in slower-moving floodwaters with less intense flood height peaks because they provide enough open space to store floodwater until it returns to the water source or is absorbed by the ground. The Louisville Metro area often incorporates natural functions into the design of flood mitigation projects, which helps reduce flood risk as well as protect and restore ecosystems. Reconnecting rivers to their historic floodplains through levee setbacks, creating side channels, and removing obstructions help restore natural functions and bring flood risk reduction benefits as well.

Subject	Impacts
Economic Conditions	Flooding also causes significant property damage and, on average, one foot of water in an average size home can cause over $50,000 in damage. Without flood insurance, this level of damage can overwhelm a family's finances. And those without many financial resources will be severely impacted by flood damage to their home and/or belongings. Flooding also affects those who work in floodplains or commute through them. Businesses in floodplains also will shut down during flooding, particularly if buildings and access roads are damaged. After the 1993 Midwest Flooding, FEMA found that over 40% of small businesses don't reopen after being flooded. Flooding will affect certain industries like production, chemical manufacturing and distribution more heavily because of their presence and reliance on floodplain locations for their facilities. Rubbertown, a major industrial center for Jefferson County, is located along the banks of the Ohio River just southwest of downtown Louisville. This location alone represents risk in the billions of $USD, along with thousands of jobs if a flood were to damage or destroy those facilities.
Public Confidence in Louisville Metro Governance	Flooding occurs frequently in the Louisville Metro area. Currently, confidence is high in the government's ability to respond to flooding events. The multiple iterations of MSD's Flood Hazard Management Plan have featured robust stakeholder involvement processes, which has inspired confidence in MSD's ability to manage floodplains with high regulatory standards, keeping people and property safe from flooding.

5.7.2 Significant Louisville Metro Flooding Occurrences

According to FEMA's Data Visualization Tool, there have been four Declared Disasters in the Louisville Metro area related to flooding. Each is described below.

Kentucky Severe Storms, Flooding (DR-568-KY): A storm entered the southwestern corner of Kentucky and moved northeast, producing record-breaking rainfall totals for the entire area. On December 3, 1978the Louisville Metro area received 2.77 inches of rain. Severe flooding occurred on the Licking, Kentucky, Salt, Green, and Ohio Rivers. Thirty-seven Kentucky counties received a federal disaster declaration due to five lives lost, and property damage at approximately $50 million. Flooding concentrated in Louisville and upstream with total damages of approximately $20 million.

Kentucky Severe Storms, Flooding (DR-821-KY): Precipitation was above normal in Kentucky in the months of December 1988 and January 1989, following an extreme drought during the summer and fall of 1988. By the end of January 1989, minor flooding had occurred on most rivers and streams in Kentucky, setting the stage for major flooding in February 1989. Between February 12-16, rain totals were 8 to 12 inches for an area stretching from Paducah to Lexington. During February, the Louisville Metro area received 9.02 inches of rain, one of the highest totals on record. The President issued a disaster declaration for 67 counties in Kentucky.

Kentucky Severe Storms, Tornadoes, Flooding, Landslides, and Mudslides (DR-4217-KY)

Heavy rains dropped between 2 and 8 inches on Jefferson County on Friday, April 3, 2015, resulting in more than 200 road closures due to flash flooding, which caused Jefferson County Public Schools to close. A washed-out culvert left Highway 22 in eastern Jefferson County closed for several months.

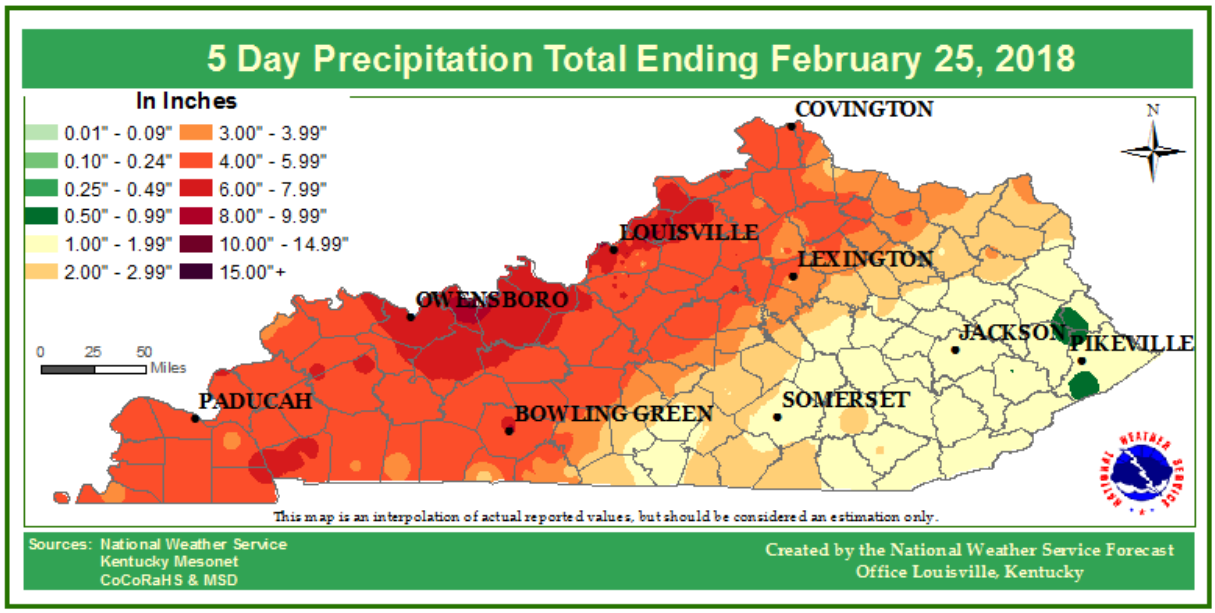
Louisville Metro Emergency Management Agency opened three different shelters for displaced residents. In addition to flash flooding, the storm caused widespread sewer back-ups

Jefferson County was designated for Individual assistance only, and received 666 applications, including those for housing assistance and other needs, totaling more than $1.7M of funding.

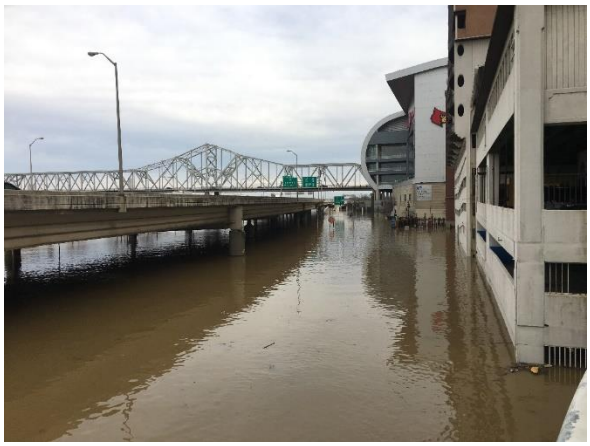
Kentucky Severe Storms, Tornadoes, Flooding, Landslides, and Mudslides (DR-4361-KY): From February 15 to March 1, 2018, the Louisville Metro area experienced repeated rounds of moderate to heavy rains. According to NWS, 8 to 9 inches of rain fell on the entire Ohio River Basin, which includes the Louisville Metro Area. The rainfall amounts for February were 200 to 400% above the normal amount of rainfall the Ohio River Basin experiences. This was Louisville Metro's wettest February in over 135 years.

On February 24 and February 25, a slow-moving thunderstorm system with heavy rainfall moved through the metro area, which was already experiencing extensive flooding. The NWS's records show a flash flood emergency continued in the metro area resulting in road closures, road washouts, mudslides, and 50 water rescues. MSD reported receiving over 1,500 calls for assistance over a three-day period, mostly for drainage and sewer backups. The Ohio River crested at 35.64 feet on February 26. This was the 10th highest level ever recorded.

Figure 5-19: Five Day Precipitation Total Ending February 2018



Source: National Weather Service, 2018.



Ohio River flooding at the Galt House in downtown Louisville February 24, 2018
Source National Weather Service, 2018

On April 10, 2018, Governor Matthew G. Bevin requested a major disaster declaration due to storms, tornadoes, flooding, landslides, and mudslides during the period of February 21 to March 21, 2018. The Governor requested a declaration for Individual and Public Assistance for 35 counties, and Hazard Mitigation for the entire commonwealth.

On April 26, 2018, President Trump declared that a major disaster exists in the Commonwealth of Kentucky.

One interesting sidenote of this flooding incident was the amount of trash that entered waterways. The flooding swept up thousands of plastic bottles, and when the flood waters receded, left river and creek banks covered in trash. At Beargrass Creek, the mounting trash became known as "Trash Island." This "island" was eventually removed by an MSD contractor using a boat and excavator.

Other Flooding Events

Table 5-22: Ohio River Historic Crests (Upper Gauge)

Rank	Crest Level	Date
1	52.15 ft	01/27/1937
2	42.10 ft	03/08/1945
3	41.70 ft	02/16/1884
4	41.20 ft	03/12/1964
5	39.50 ft	02/16/1883
6	39.40 ft	04/02/1913
7	38.76 ft	03/07/1997
8	36.40 ft	01/22/1907
9	36.00 ft	04/19/1948
10	35.72 ft	02/26/2018

The Louisville area has been subject to flooding for thousands of years. In general, the two most common types of flooding that occur in Louisville Metro area are flash floods and Ohio River flooding. Low-lying land along the Ohio River is covered frequently in the winter and spring. Ohio River floods typically occur over days or weeks, and waters rise relatively slowly. Louisville is also prone to flash flooding from interior streams. Heavy rains can also cause intense flash flooding along local streams. Flash floods can also occur due to a dam or levee

failure. Large expanses of flatlands, lowlands, and former swamplands can be quick to flood and slow to drain. Flash flooding often occurs over a short period of time, sometimes in just a few minutes.

For Ohio River flooding, the top ten flooding events are presented in the table above. Based on the historical record, a serious flood event has occurred in the Louisville Metro approximately every decade since the 1830s.

The main flood season for the Ohio River is between the months of January and May. All of the highest floods on record have resulted from general heavy rains throughout the Ohio River Basin. In both summer and fall, intense local thunderstorms also can contribute significantly to local flash flooding and interior drainage problems.

The average duration of Ohio River floods of record in Louisville Metro is about 12 days. However, the sustained flood duration in 1937 was 23 days, in 1945 it was 18 days, and in 1964 and 1997 it was 14 days. The rate of rise at levels above flood stage varies in relation to rainfall and runoff rates for specific storms. Typical rates of rise for the Ohio River, at levels above flood stage, range from 2.5 to 5 inches per hour, with the record rate of rise being 4.7 feet in 12 hours and 8.4 feet in 24 hours in 1964.

The river forecasting services for the Ohio River at Louisville are provided by the National Weather Service River Forecast Center. With normal rainfall distribution over the Ohio River Basin, forecasts of stages and flood crests can be made several days in advance. A river stage forecast is issued daily under normal conditions, and more frequently during periods of an emergency. River forecasts are available on MSD's and NOAA's website and in the local newspaper. Due to the relatively long warning time for Ohio River flooding, residents are generally able to evacuate and move belongings to higher ground before flooding occurs.

The major flash flooding problem in Louisville Metro is related to out-of-bank flash flooding. Out-of-bank flooding is defined as flooding that occurs when the natural embankments of a watercourse are breached. Additionally, ponding also may result in certain areas, at their lowest elevations. The community is also vulnerable to other flooding situations due to street runoff, erosion, and sewer and drainage problems.

Flash flooding occurs in a very short period of time. Flash flood alerts are issued by the National Weather Service. There is typically approximately a one-hour lead-time for flash floods. Evacuations are typically done on an emergency basis for flash flooding events by the police and fire departments. Flash flooding is particularly dangerous for people driving on flooded roads, as well as residents in flooded homes due to the sudden nature of the flooding. To provide emergency warnings, Jefferson County has outdoor sirens, an emergency alert system, a telephone notification system, direct notification from police and fire, a dedicated AM radio station, and websites available to the public.

Please refer to the 2016 Louisville Hazard Mitigation Plan for details describing flood events occurring between January 1913 to December 1995.

Following are examples showcase large flood events impacting the Louisville Metro are between January 1996 to January 2022.

May 26, 1996

Several roads across southern Jefferson County were closed due to high waters as 4 inches of rain fell between 11 pm EST May 25 and 11 am EST May 26. Area creeks were already backed up due to the near-flooded Ohio River. Fifty residents of a nursing home on Dixie Highway had to be relocated when a sump pump failure allowed the halls to be filled with water.

March 1997

Numerous strong thunderstorms along a stalled-out warm front triggered a record 24-hour rainfall for Louisville Metro. On March 1, the Louisville Metro area received 7.22 inches of rain, the highest total on record for one day. The combination of flooding and/or flash flooding from the record rainfall resulted in an estimated 50,000 homes affected by flooding. Many of these homes had basements entirely flooded with water into the main floor. The Ohio River crested on March 7 in Louisville at about nearly 15 feet above flood stage.

Inland Ponding: The hardest hit areas were in the southwestern section of Louisville Metro along the Ohio River. Two other inland areas hit hard were in the Pond Creek watershed south of Louisville and along Floyds Fork in the east. More than 50,000 residences experienced some level of flooding. In addition, high water briefly closed Interstates 64 and 65, as well as scores of secondary roads. The flood pump station at the mouth of Pond Creek alone moved 2.6 billion gallons of water a day, draining the flood-ravaged neighborhoods of Okolona and Fairdale. During the first few days of the flood, MSD received more than 7,000 calls, mostly about sewer backups and surface flooding. MSD estimated that as many as 25,000 customers may not have reported basement backups during the March 1997 flood.

Ohio River Flood: As floodwaters began receding in southern Louisville Metro, the flood stage of the river became a threat. A week after the rains, the Ohio River crested in Louisville 15.8 feet above flood stage. Flooding along the Ohio River continued for two weeks throughout Kentucky. The President declared over 87 of the 120 counties in Kentucky federal disaster areas eligible for federal aid statewide.

Damages: Damage was estimated at $65 million, not including the river flooding on the Ohio River. The southwest floodwall closures passed their first test and protected many areas that flooded in 1964 and 1978. The Ford factory on Fern Valley Road had damage to up to 1,500 Explorers. Twenty-four-hour rainfall totals beginning around February 28 to March 1 ranged from around 6 inches along the Ohio River to 11.5 inches across the communities of Okolona and Fairdale in the southern part of the county. The previous record 24-hour total was 6.97 inches. An estimated 2,500 homes in numerous subdivisions in Okolona and Fairdale and across other parts of the county had to be evacuated with hundreds relocated in temporary shelters. Okolona and Fairdale lie in the Pond Creek floodplain, which was formerly swampland.

National Guard had to get many of these people out by boat or dump trucks. Thousands of cars were evacuated or stalled out due to the high waters. Numerous rescues were made of people trapped in cars and houses. Bloated storm sewers popped off manhole covers that left cars quickly inundated in advancing high water. Several roads were closed around the Jefferson County Memorial Forest due to mudslides. A 16-year-old boy was killed near Jeffersontown as his van was swept off the road by the swollen Chenoweth Creek. Numerous roads, including

parts of Interstates 65 and 64, were closed through the morning of March 2. Because of all the damage, the County Judge Executive declared the county a state of emergency.

In Kentucky, 21 people were killed and an estimated $250 to $500 million in damages were caused by the flooding. The damages incurred by the entire Ohio River flood exceeded $1 billion and over 67 deaths. Fortunately, floodwalls partially protected Louisville, preventing even more damage.

September 22-23, 2006

A slow-moving storm system brought torrential rains to the region on September 22 and 23, 2006, resulting in widespread flash flooding. Six people were killed in the Louisville National Weather Service's service area. It was the deadliest weather event in this area since seven people were killed in the flood of March 1-2, 1997, and the Super Outbreak of tornadoes on April 3, 1974 when 72 lives were lost.

The Bent Creek Apartments in the Buechel area were flooded. More than 100 residents had to be evacuated to an area shelter. Interstate 64 was closed between Cannons Lane and Interstate 71. Water covered many roads in the vicinity of Veteran's Hospital in Louisville. Three feet of water covered 29th Street. Two to three feet of water covered Brownsboro Road about half a mile east of the Mellwood Avenue intersection. Water rescues were conducted in the Lake Forest area and in Jeffersontown. Old Henry Road was flooded and impassable. Property damage estimates were $500,000. Thirty-two flood insurance claims were filed for this event, with a total of approximately $1.7M for both structure and contents damages.

April 3, 2008

A flood on the Ohio River covered local roads and caused damage to low-lying areas and structures. Several vehicles were submerged in the Louisville area, but no injuries or water rescues were reported. Numerous roads were closed due to flooding around the Louisville Metro area. Some of the closures included: a lane of Interstate 65 at the Woodbine exit, Third Street at Eastern Parkway, Breckinridge Lane at Six Mile Lane, Outer Loop at Preston Highway, and Outer Loop at New Cut Road. A frontal system and upper-level low brought widespread heavy rains and flooding to central Kentucky. The event produced 40 flood insurance claims totaling $542,026 in structure and content damages.

August 4, 2009

Severe weather produced torrential rainfall in the Louisville Metro area, with up to 7 inches of rain falling in around two hours’ time. This created massive flash flooding issues across the northwest and central part of Louisville Metro, and caused millions of dollars in damage in Louisville.

The heavy rain and thunderstorms also produced some hail and cloud-to-ground lightning that caused several fires, including one four-alarm apartment complex fire on the eastern side of Louisville.

Nearly 200 people were rescued by emergency workers from the tops of cars and houses. About 50 people were rescued by boat from a University of Louisville administrative office building.

Two children were pulled from a swollen creek when neighbors saw them get swept away as they walked too close to the stream.

Water was reported up to several feet deep in parts of Louisville. Most of the downtown Louisville area received flooding, with many commercial buildings in the immediate downtown area sustaining damage. Many roads in the downtown area had several feet of water covering them, with residential buildings taking on water in basements. Numerous homes on the western side of town were also damaged.

Major flooding affected Churchill Downs and surrounding neighborhoods. Floodwaters poured into homes and engulfed Louisville's main public library downtown, several area hospitals, horse barns at Churchill Downs, and the University of Louisville campus. The entire basement of the Louisville Free Public Library was inundated with water, causing damage to books, computers, vehicles, and other items. Thousands of books were destroyed at the Louisville downtown library, with a million dollars in damage.

The University of Louisville campus had several buildings damaged and flooded, and water rescues had to be performed. Four of the University classroom buildings were closed for more than a month, resulting in a shuffling of numerous classroom locations.

Interstates 64, 65, and 264 were all closed for a period of time due to high water. Other water rescues were performed downtown as people became stranded in vehicles during rush hour traffic.

A Federal Disaster Declaration for Kentucky Severe Storms, Straight-line Winds, and Flooding was issued on August 14, 2009 (DR 1855). Louisville Metro citizens registered with FEMA for federal and Commonwealth disaster assistance following the August 4 severe weather and flooding. The registration period closed on October 13, 2009, with 12,288 registrations for Louisville Metro. Kentucky Emergency Management Agency submitted a request for nearly $6 billion of Public Assistance funding to assist in recovery from the flooding.

April 23, 2011

Five to six inches of rain over a two-day period caused a combination of flash flooding and Ohio River flooding. The storm caused at least 11 road closures due to flash flooding. River crested at 62.9 feet on April 27, 7.9 feet above flood stage. The river remained above flood stage into early May. Much of River Road was under water, and the Third Street ramp to Interstate 64 was under water downtown.

September 5 to September 9, 2018

The remnants of Tropical Storm Gordon reached the Louisville Metro area on September 5, 2018. This was a slow-moving system with showers and thunderstorms for the first two days. As the storm interreacted with a stationary front, the Louisville Metro area experienced a large amount of rainfall resulting in flash flooding.

National Weather Service records reported flooded road across the metro area, which included 29th Street between St. Xavier Street and Bank St; Crittenden Drive to Interstate 65 South; Dixie Highway and Algonquin Parkway; Grafton Hall Road; 15th Street and Breckinridge Street; 17th Street and Dumesnil Street, and Bethany Road.

Multiple automobiles were trapped on flooded roads and interstate ramps. During this timeframe, multiple water rescues occurred across the Louisville Metro area. One death occurred on September 8, 2018, when a cab driver's automobile stalled while driving underneath a flooded railroad overpass at 13th Street and Oak Street. Unfortunately, first responders were not able to reach him in time due to fast rising flood waters.

Overall, this flooding from the storm caused at least $101,000 in damages in the Louisville Metro area.

August 20, 2020

A stationary front arrived in the Louisville Metro area on August 14, 2020. This storm produced flash flooding across the area after 4.6 inches of rain fell in 3.5 hours. There were reports of trees uprooted due to over saturated soil. The National Weather Service reported the following roads were impacted by floodwaters: County Route 657, and Blevins Gap Road near Crane Run Creek.

September 2 to September 3, 2020

The Louisville Metro area experienced cold fronts with embedded lows, which brought isolated storms and flooding on September 2, 2020. A second front moved through on September 3, 2020, that brought additional heavy rains to the saturated metro area, causing urban flooding.

A culvert washed away under the 10200 block of Bunsen Way. It is estimated that the damages cost $250,000 to repair. Flooding was reported at the intersection of Six Mile Lane and Hurstbourne Parkway, and Taylorsville Road near Merioneth Drive was closed due to floodwaters.

February 26 to 28, 2021

On February 26 until February 28, a stalled frontal system that produced heavy rains hovered above the Louisville Metro area. Browns Lane was closed between Bowling Boulevard and Sherburn Lane due to high water.

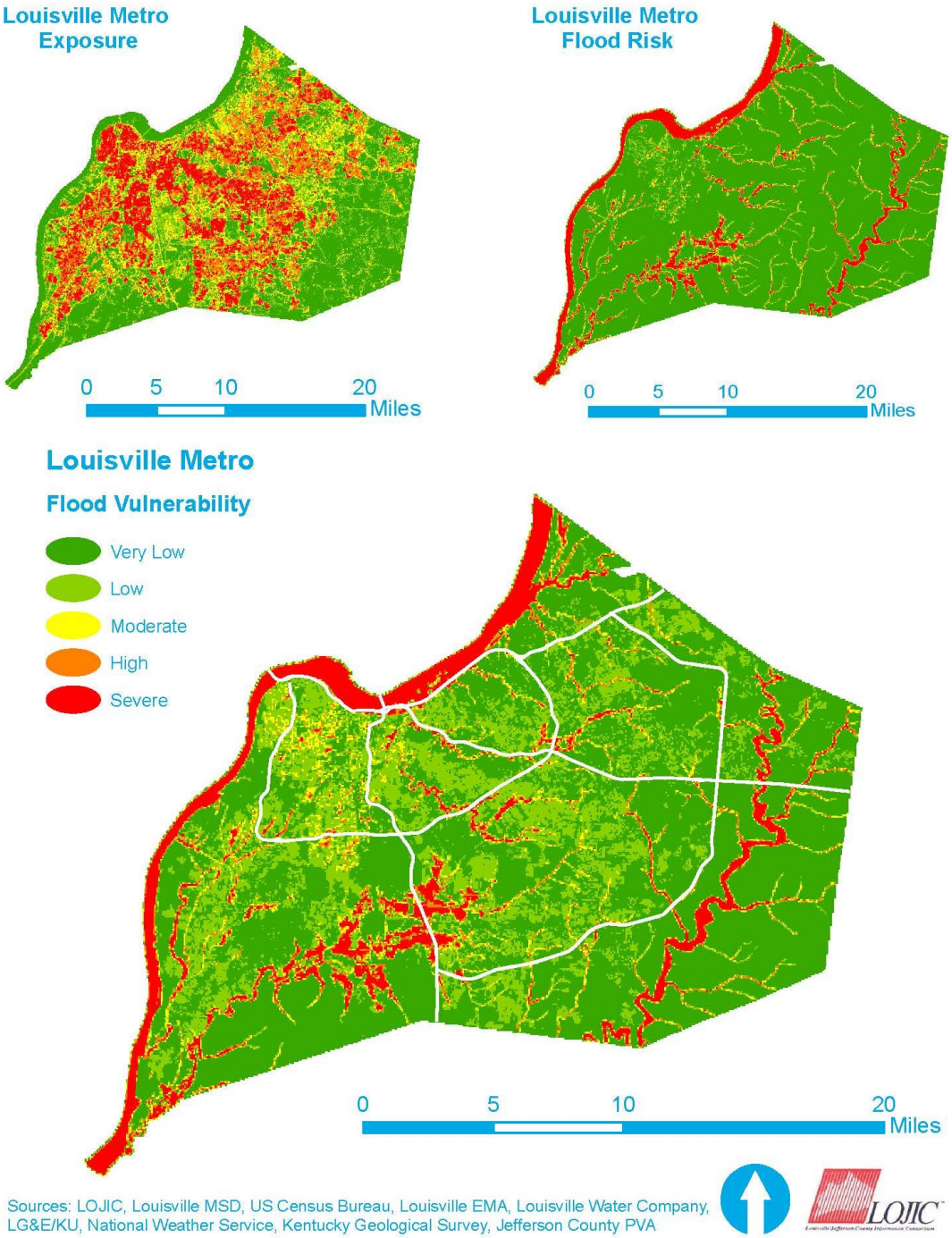
July 1, 2021

Heavy rain arrived in the Louisville Metro area, resulting in flash floods. Floodwaters submerged an automobile on 7th Street at Berry Boulevard, stranded at least five residents, and closed South 4th Street and South 3rd Street at the train overpasses.

5.7.3 Assessing Vulnerability: Flooding

Overall, areas near the Ohio River and its tributaries are more vulnerable to flooding. The Louisville Metro area has a variety of elevations; therefore, those areas with a higher elevation are less likely to experience flooding. To create vulnerability maps, risk was assigned to grid cells based upon the percentage of the area of the cell covered by 1% annual change floodplain – both the effective FEMA Special Flood Hazard Area, and MSD combined sewer area. This methodology was the same as the 2016 report except the hotspots and historical claims were not available. Please refer to Figure 5-20 for additional details showcasing what areas are the most vulnerable to flooding. A listing of critical facilities and infrastructure highly vulnerable to riverine flooding is presented in Appendix E.

Figure 5-20:


Louisville Metro
Exposure
0 5 10 20
Miles
Louisville Metro
Flood Risk
0 5 10 20
Miles
Louisville Metro
Flood Vulnerability
Very Low
Low
Moderate
High
Severe
0 5 10 20
Miles
Sources: LOJIC, Louisville MSD, US Census Bureau, Louisville EMA, Louisville Water Company, LG&E/KU, National Weather Service, Kentucky Geological Survey, Jefferson County PVA
LOJIC

Identifying Structures and Estimating Potential Losses

The Hazard Boundary Overlay methodology was used to determine how many structures are vulnerable to a flood event. The Hazard Boundaries used as the overlay were the Louisville MSD Regulatory Floodplain and the Combined Sewer Flood prone Area. These flood potential maps display areas of mapped flood-prone areas based on scientific studies, displaying areas where potential losses from Floods could occur.

Approximately 5 % of structures in Jefferson County are in the floodplain, and they account for approximately 4% of estimated property values. Of note is that just over 10% of industrial structures and approximately 10% of commercial structures are in the floodplain. One of Louisville's two Ford assembly plants is in the floodplain, as are several major commercial and industrial structures in the Rubbertown area.

National Flood Insurance Program and Repetitive Loss Areas

As of August 2022, Louisville Metro has 4,411 flood insurance policies in force, of which 3,232 cover single family homes. Since 1978, the number of paid losses in the Jefferson County area totaled 4,683, while the dollar value associated with these losses exceeded $78,250,442.54.

Repetitive loss structure locations are a trigger to the community that other adjacent properties may be at risk, and can provide the community an opportunity to designate a repetitive loss area that reflects the vulnerability of a street or neighborhood. A Repetitive Loss (RL) property is a property for which two or more National Flood Insurance Program losses of at least $1,000 each have been paid within any 10-year rolling period since 1978.

FEMA designates as Severe Repetitive Loss (SRL) any NFIP-insured single family or multi-family residential building:

1. That has incurred flood-related damage for which four or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or
2. For which at least two separate claims payments (building payments only) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the building.

In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim. In determining SRL status, FEMA considers the loss history since 1978, or from the building's construction if it was built after 1978, regardless of any changes in the ownership of the building. The term "SRL property" refers to either an SRL building or the contents within an SRL building, or both.

For 2018, the most recent year data is available, there are 347 buildings that meet the definition of a Repetitive Loss or Severe Repetitive Loss property according to the current NFIP definitions within the Louisville Metro area. Of that number, 224 (65%) have flood insurance policies in force. Louisville Metro has the highest number of repetitive loss properties in Kentucky. The table below further identifies RL and SRL properties by property type in the Louisville Metro area.

	Repetitive Loss Properties		Severe Repetitive Loss Properties	
Occupancy	Total Number	Sum of Total Paid	Total Number	Sum of Total Paid
2-4 FAMILY	11	$1,092,850.74	2	$931,500.94
ASSMD CONDO	7	$2,498,402.63	0	$0.00
OTHER RESID	47	$4,869,214.19	3	$446,375.79
OTHR-NONRES	18	$5,235,429.52	0	$0.00
SINGLE FMLY	264	$20,040,871.20	45	$7,736,097.33
Grand Total	347	$33,736,768.28	50	$9,113,974.06

As the floodplain administrator, MSD uses the Louisville Metro's community's official repetitive loss list to determine repetitive loss areas. The official repetitive loss list is provided through FEMA according to data from flood insurance claims. Additional information on Louisville Metro National Flood Insurance Program participation by watershed, including Repetitive and Severe Repetitive Loss properties is provided in Section 5.0.

Louisville Metro recognizes repetitive loss properties as prime targets for mitigation projects. MSD first participated in the FEMA grant buyout programs after the widespread flooding of 1997. The Hazard Mitigation Grant Program was used to purchase residential properties in the hardest hit areas of the county. In 2009, Louisville experienced another unprecedented flooding event that made Hazard Mitigation funding available. Five grant applications were submitted and approved to acquire and demolish floodprone homes in West Louisville based on the 2009 flooding event. Since that time, Louisville has experienced multiple flooding events and has begun to proactively submit grant applications for homes that are known to be floodprone. MSD has received funding through FEMA's Hazard Mitigation Grant Program, Pre-Disaster Mitigation, and Flood Mitigation Assistance. Most FEMA grants require a local match of up to 25%, which has been funded by MSD. Several buyouts have also been funded solely by MSD without the use of FEMA grants. Since the program began, 389 properties have been purchased through the FEMA grant programs and MSD funded buyouts.

In order to be more proactive in grant applications, MSD regularly prioritizes areas for buyouts. The most recent prioritization was completed in June 2022. This prioritization considered flood zone, first floor flood depth, distance to stream, repetitive loss and severe repetitive loss status, interest level from the homeowner, and flood score from First Street Foundation's Flood Factor. Nearly 60,000 properties were scored to determine the highest priorities and the top 100 were planned to be reviewed further. Because of tied scores, the top 107 were reviewed further. Letters of interest were sent to properties in the top 107 that did not have an interest letter on file. Since buyout programs are voluntary, only properties with an interest letter are considered for grants. MSD annually submits grant applications through FEMA's pre-disaster grant programs and also submits applications when post-disaster funding is available. The grant prioritization and interest letters are used to determine future grant applications with consideration given to the

specific requirements of each type of grant (i.e. flood insurance policy, repetitive loss status, etc.). A listing of priority buyout properties by watershed is presented below.

Table 5-23: MSD Priority Buyout Properties

Watershed	Number Of Top Priority Properties
Cedar Creek	3
City/Ohio River	57
Floyds Fork	5
Goose Creek	2
Harrods Creek	1
Middle Fork Beargrass Creek	3
Mill Creek	1
Muddy Fork Beargrass Creek	2
Pond Creek	11
South Fork Beargrass Creek	22
Totals	107

5.7.4 Risk Assessment by Watershed

In Jefferson County, all streams eventually drain into the Ohio River. A Risk Assessment was performed for all eleven watershed and provided data for the following:

- Identifying Critical/Essential Facilities and Infrastructure located in the Regulatory Floodplain
- Assessing and quantifying natural and beneficial function areas
- Mapping known hazard areas (Regulatory Floodplain, Repetitive Loss Properties, Severe Repetitive Loss, Historic Claim Properties, Flood Hotspots, and the Combined Sewer Flood-prone area zones
- Assessing the impact flood will have on life, safety and health facilities, and the effects on the community's economy through loss estimation
- Providing a description of known flood hazards, including source of water, depth of flooding, velocities, and identifying key warning time gauges.

Protecting and preserving natural landscapes plays a vital role in how a floodplain functions, as well as provides benefits to mitigation flooding.

The table below identifies key natural and beneficiary functions in all eleven watersheds. The data showcases areas that should be preserved and maintained to mitigate flood risk; please refer to the watershed overview maps. The following variables provide unique, natural habitats and are considered beneficial based on their ability to remove water pollutants and to store floodwaters during flood events.

Table 5-24: Key Natural and Beneficiary Function by Watershed

Watershed	Total Acres	Hydric Soils		Open Space		Wetlands		Floodplain	
		Acres	%	Acres	%	Acres	%	Acres	%
Cedar Creek	7,187	243	3.37%	169	2.36%	2	0.02%	271	3.77%
City/Ohio River	25,485	280	1.10%	2,263	8.88%	479	1.88%	5,443	21.36%
Floyds Fork	6,6499	519	0.78%	6,393	9.61%	316	0.47%	6,838	10.28%
Goose Creek	11,894	299	2.51%	1,361	11.44%	3	0.02%	896	7.54%
Harrods Creek	9,789	184	1.88%	1,344	13.73%	43	0.44%	857	8.75%
Middle Fork Beargrass Creek	16,082	48	0.30%	2,128	13.23%	7	0.04%	986	6.13%
Mill Creek	21,902	1,373	6.27%	1,785	8.15%	543	2.48%	2,183	9.97%
Muddy Fork Beargrass Creek	5,643	63	1.12%	562	9.96%	1	0.03%	696	12.33%
Pennsylvania Run	4,452	160	3.59%	932	20.93%	7	0.17%	236	5.31%
Pond Creek	57,150	7,828	13.70%	6,774	11.85%	1,005	1.76%	8,921	15.61%
South Fork Beargrass Creek	17,334	191	1.10%	1,083	6.25%	48	0.28%	1,767	10.20%
Total	243,416	11,188	4.60%	24,795	10.19%	2,453	1.01%	29,095	11.95%

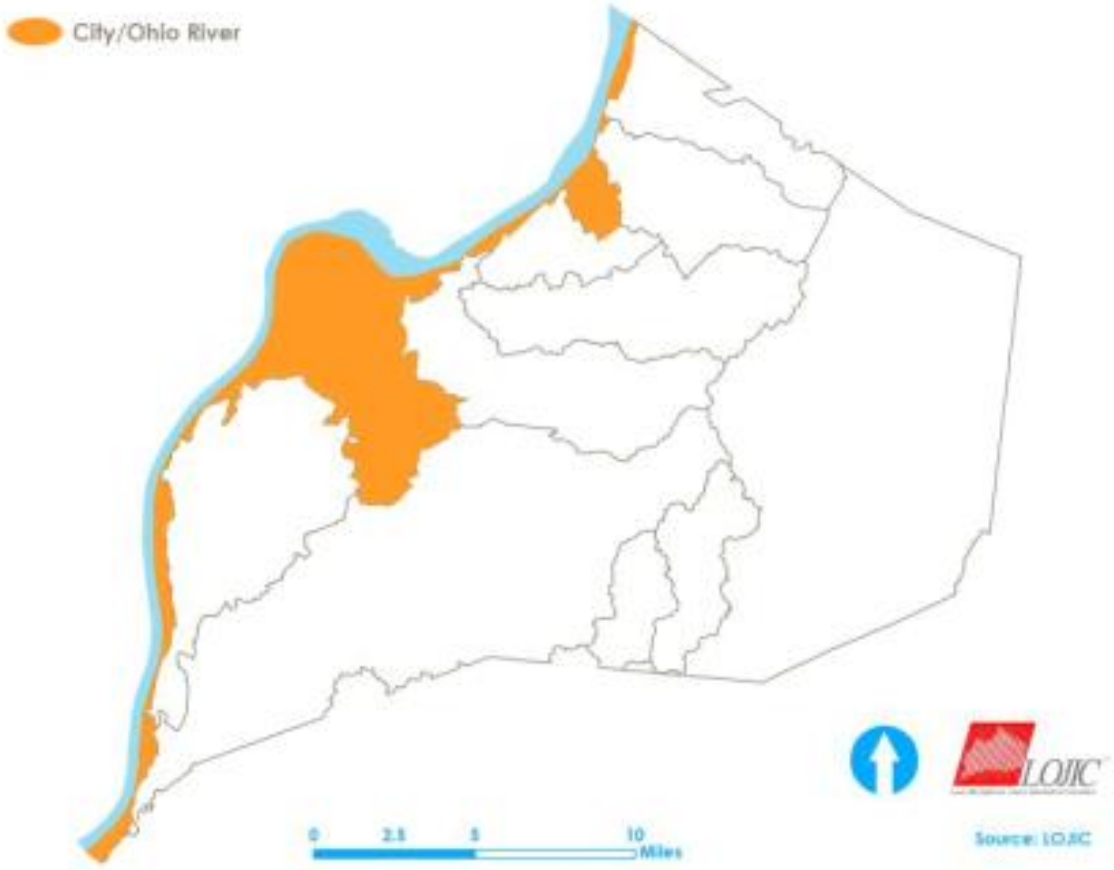
Critical Facilities in the Floodplain

Critical Facilities are essential to the health and wellbeing of a community and play a large role during natural disaster events. Table 5-25 identifies selected critical facilities in the Regulatory Floodplain that were used in the Exposure Score. Understanding and identifying which facilities are in the floodplain will provide the Louisville Metro area a list potential hazard mitigation projects, as well as highlight which facilities may be severely impacted in a disaster; please refer to the watershed overview maps.

Table 5-25: Critical Facilities in the Floodplain

	City/Ohio River	Middle Fork Beargrass Creek	Muddy Fork Beargrass Creek	South Fork Beargrass Creek	Cedar Creek	Floyds Fork	Goose Creek	Harrods Creek	Mill Creek	Pennsylvania Run	Pond Creek	Total
Schools	4	—	—	3	—	—	—	—	—	—	2	9
Hospitals	—	—	—	—	—	—	—	—	—	—	—	—
Nursing Homes	1	—	1	2	—	—	—	—	—	—	—	4
Prison	1	—	—	—	—	—	—	—	—	—	—	1
Police	—	—	1	—	—	—	—	1	—	—	—	2
Fire	1	—	—	—	—	—	—	—	1	—	—	2
EMS Facilities	—	—	—	—	—	—	—	—	—	—	—	—
Emergency Operations Center	—	—	—	—	—	—	—	—	—	—	1	1
Siren	3	—	1	3	—	—	—	—	1	—	4	12
HazMat	8	2	—	1	1	1	1	3	—	—	22	39
Flood Pump Station	1	—	—	—	—	—	—	—	—	—	—	1
Sewer Pump Station	25	—	9	8	1	14	7	12	8	3	19	1—6
Drainage Pump Station	2	—	—	1	—	—	—	—	1	—	—	4
Sewer Treatment Plant	1	1	1	—	2	4	4	4	4	4	16	41
Louisville Water Company Facilities	1	—	—	—	—	—	—	—	—	—	—	1
Water Pressure Station	2	—	—	—	—	1	—	1	—	—	—	4
Electric Station	3	—	—	—	—	—	—	—	1	—	3	7
Electric Tower	13	—	—	1	—	—	—	—	—	—	1	15
LG&E Gas Station	2—	2	2	1	—	—	4	1	—	—	4	34
Totals	86	5	15	2—	4	2—	16	22	16	7	72	283

For more detailed information on each of the eleven watersheds, please review the Louisville and Jefferson County Metropolitan Sewer District Watershed Master Plan 2022.



Ohio River/City Watershed

The Ohio River Watershed has an area of approximately 39.8 square miles, and contains 49.5 stream miles, most of which are the Main Stem of the Ohio River. This watershed is drained by a complex system of combined sewers. No open channels of any magnitude exist.

The Ohio River flows through Louisville Metro area, and is located along the northwestern border of Jefferson County; the far side of the river is in Indiana. A levee and floodwall system separates the river from the rest of Louisville Metro. The flood protection system includes pump stations and dams at all stream crossings and combined sewer overflow (CSO) outfalls.

The following communities are situated in this watershed: downtown Louisville, Kenwood, Southern Heights, Beechmont, Oakdale, Wilder Park, Parkland, South Parkland, Shawnee, and Portland. Regionally notable landmarks in the watershed include the Kentucky Fair and Exposition Center, the University of Louisville, Churchill Downs, Kentucky International Convention Center, City Hall, portions of Iroquois Park, Shawnee Park, and Chickasaw Park.

Along the Ohio River is preserved open space in the Ohio River floodplain. These parks include Eva Bandman Park, Capertown Swamp, Chickasaw Park, Carrie Gaulbert Cox Park, Hays Kennedy Park, Kulmer Reserve, Lannan Park, Portland Wharf Park, Riverside Farnsley-Moorman Landing, Riverview Park, Thurman Hutchins Park, Twin Park, and Waterfront Park.

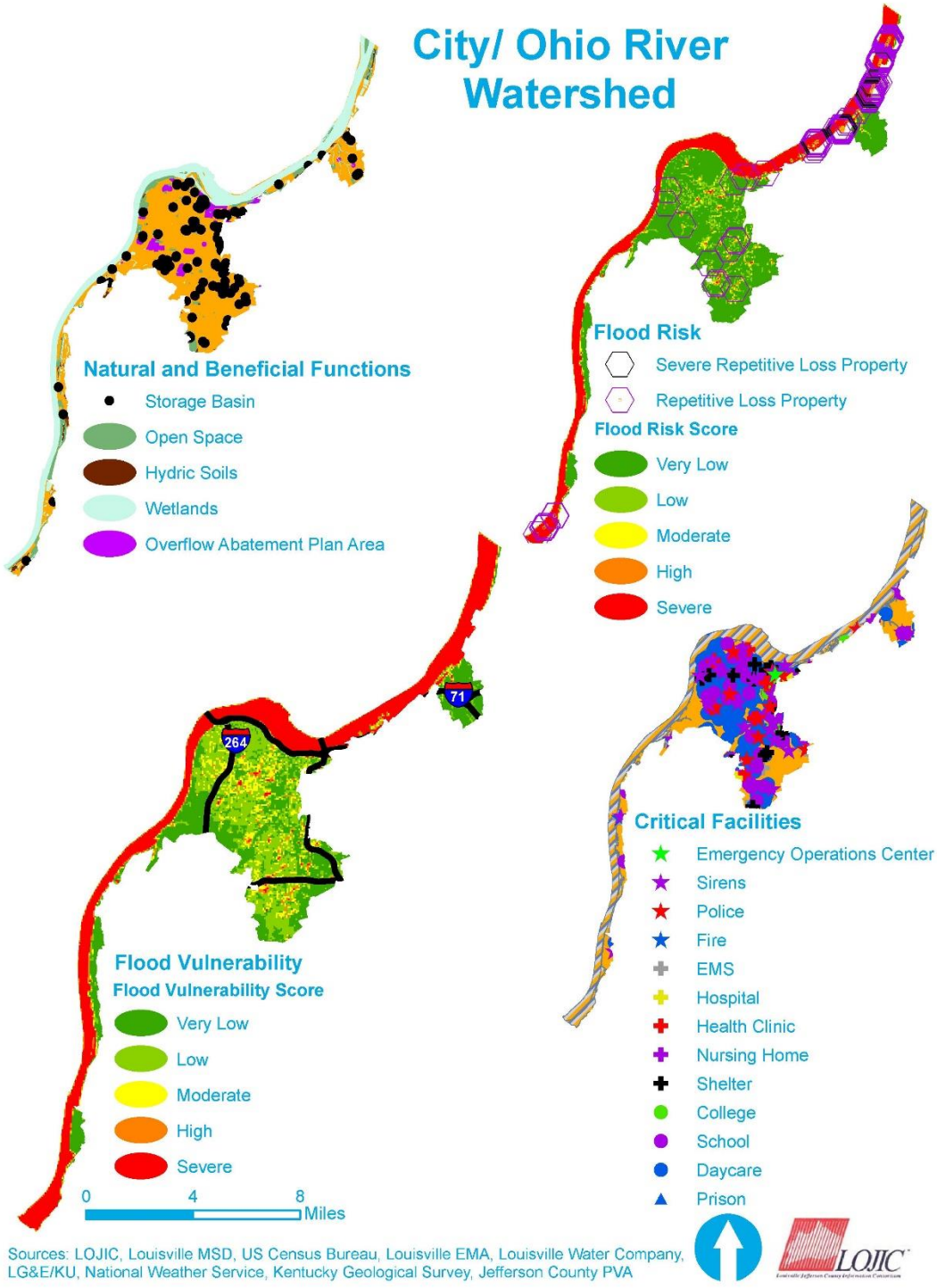
Ohio River and Floodwall

Most of the Louisville Metro area lies in the floodplain of the Ohio River; however, about 17,600 acres of this floodplain are protected by a 28.9-mile-long flood protection system, which includes downtown Louisville. The floodwall system was built to protect Louisville Metro from floods equivalent to the historic flood event of 1937, with 3 feet of freeboard[45]. The flood protection system includes pump stations and dams at all stream crossings and combined sewer overflows (CSO) outfalls to protect populations, critical infrastructure, critical facilities, and neighborhoods. Due to repetitive flooding, many residents living in this watershed have participated in flood acquisition programs. These homes were demolished and the properties have been deed restricted to remain as open space to mitigate the flooding.

Figure 20 depicts the Ohio River/City Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-21 displays critical facilities and the natural and beneficial functions for open space and wetlands locations. For more information about where vulnerable populations are located in the Louisville Metro Area, please refer to the Climate Change Vulnerability in Louisville, Kentucky. It is important to note that these maps are for display purposes; to truly use these data, they should be imported into a GIS program.

[45] FEMA defines the term freeboard in the FEMA Glossary as "a factor of safety usually expressed in feet above a flood level for purposes of floodplain management", July 2020 (https://www.fema.gov/glossary/freeboard#:~:text=Freeboard,a.,or%20community%20floodplain%20management%20regulations) .

Figure 5-21: City/Ohio River Watershed



Middle Fork of the Beargrass Creek Watershed

The Middle Fork of the Beargrass Creek Watershed is in the north-central portion of Louisville Metro and covers about 25 square miles. The headwaters originate in Middletown and flows in a westerly direction through St. Matthews. The stream continues into the Highlands via Seneca and Cherokee Parks, to finally outlet into the South Fork of the Beargrass Creek just south of Main Street.

The Middle Fork headwaters runs through residential neighborhoods, apartment and condominium complexes, three golf courses, a farm, two shopping malls, two parks in St. Matthews, and past hospitals and shopping centers. The creek parallels I-64 as it passes through Seneca Park, flows on down through Cherokee Park and beside a well-traveled greenway, where it converges with the South Fork, then the Muddy Fork, of the Beargrass Creek. The Middle Fork is the least-modified of the urban streams, has a bedrock or stone bed with riffles and pools in the Olmsted parks, and is fed by small groundwater springs for much of the year.

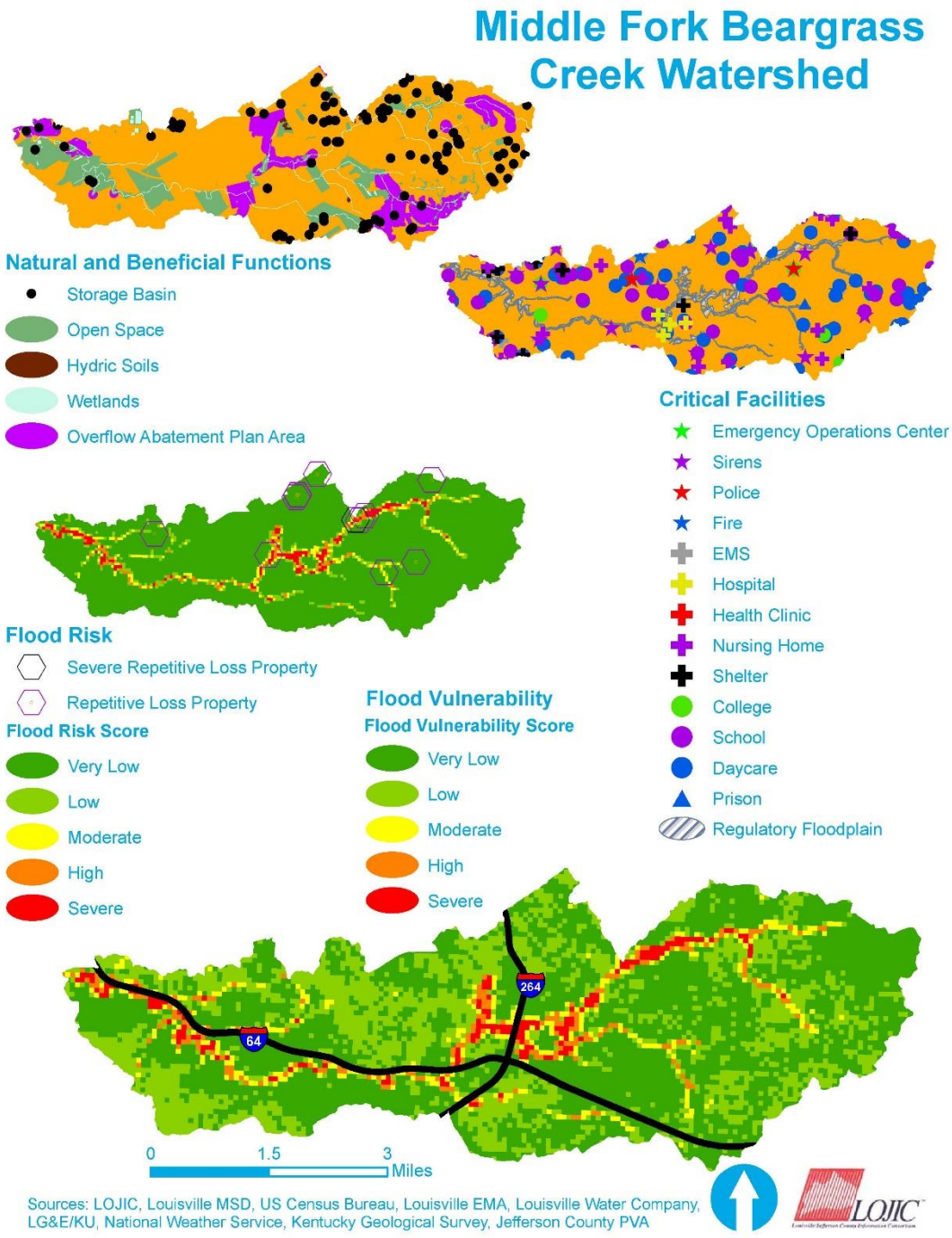
The major streams in the Middle Fork of the Beargrass Creek Watershed are Middle Fork and Weicher Creek. Communities lying in this watershed include the Highlands, Seneca Gardens, St. Regis Park, St. Matthews, Lyndon, Wildwood, Hurstbourne, Douglass Hills, and Middletown. Regionally notable landmarks in the watershed include Cherokee Park, Seneca Park, Cave Hill Cemetery, the Southern Baptist Seminary, Bowman Field, Big Spring Country Club, Oxmoor Mall, and Hurstbourne Country Club.

Several parks are located along the Middle Fork of Beargrass Creek. These parks provide open space where flooding can occur without property damages, and allow recreational use during drier periods. Cherokee Park, owned by Louisville Metro, is along Middle Fork Beargrass Creek in the Highlands area. The City of St. Matthews owns two parks, Brown Park and Arthur K. Draut Park, located in the floodplain along Middle Fork of Beargrass Creek near Bowling Boulevard. The Draut Park includes wetlands, which help improve the natural and beneficial functions of the floodplains, as well as water quality for the creek.

The Whipps Mill Basin is a regional flood storage basin that is situated in the upper portion of the Middle Fork Watershed. The basin, which was built in 2000, covers a 40-acre site and provides flood protection for hundreds of residents in Cherokee Seneca, Bonnycastle, and Cherokee Gardens. The Woodlawn Park Basin is another regional basin in the Middle Fork Watershed.

Figure 5-22 depicts the Middle Fork Beargrass Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-22 displays critical facilities and the natural and beneficial functions for open space and wetlands locations.

Figure 5-22: Middle Fork Beargrass Creek Watershed



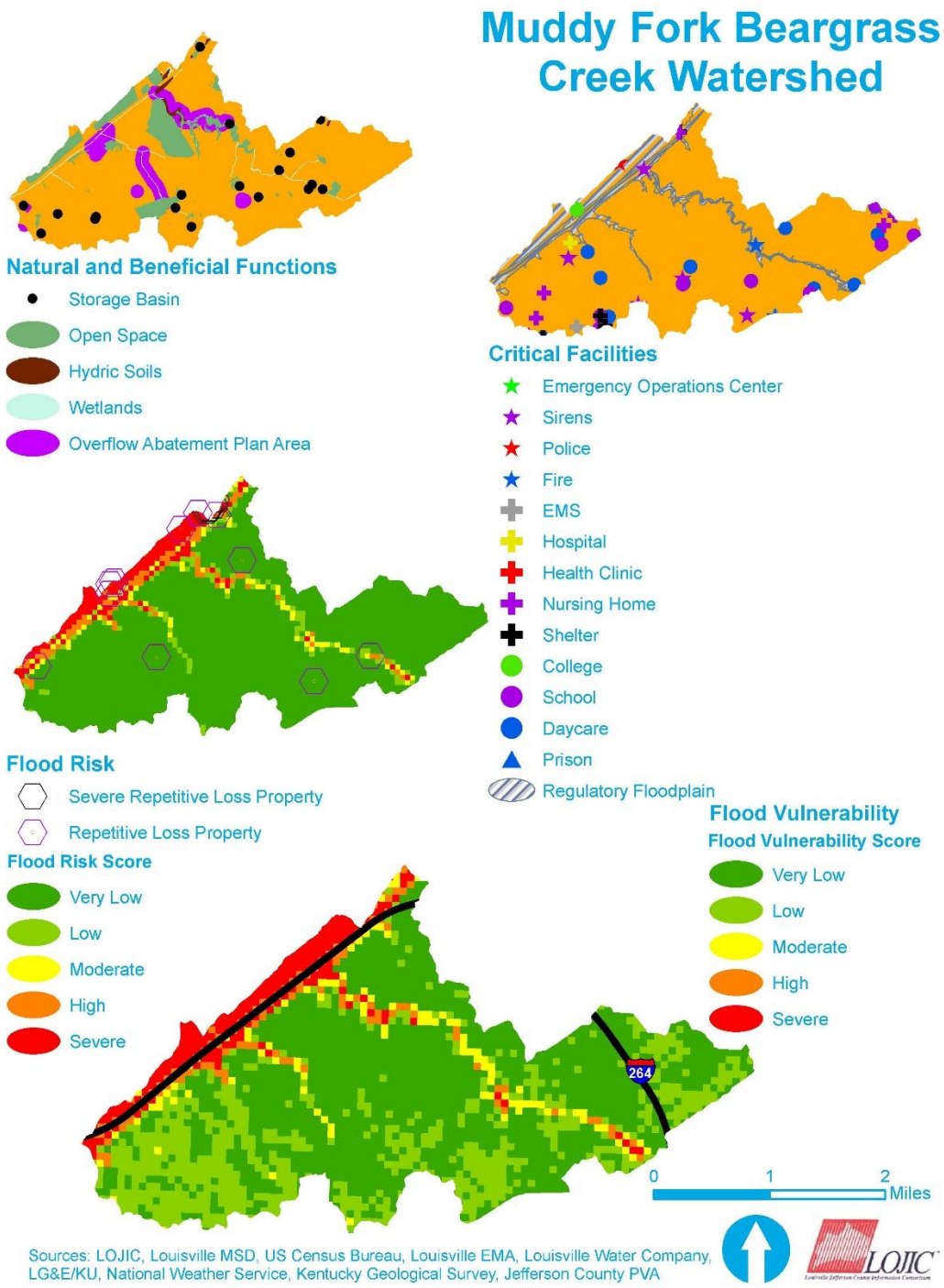
Muddy Fork of the Beargrass Creek Watershed

The 8-square-mile Muddy Fork Beargrass Creek Watershed is in the north-central portion of Louisville Metro, including Indian Hills and a small part of St. Matthews. Its headwaters originate in the Graymoor/Devondale area. After descending from Indian Hills, Muddy Fork runs parallel to I-71 in the Ohio River floodplain, converging with the Main Stem of Beargrass Creek before emptying into the river. Muddy Fork regularly receives backwater from the Ohio River.

Communities lying in this watershed include Graymoor, Devondale, Crescent Hill, Rolling Fields, Mockingbird Valley, Indian Hills, and Windy Hills. Regionally notable landmarks in the watershed include the Veterans Administration (VA) Hospital, Crescent Hill Park, and the Louisville County Club. No regional basins or major channel improvement projects are in the Muddy Fork Watershed.

Figure 5-23 depicts the Muddy Fork Beargrass Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-23 also displays critical facilities and the natural and beneficial functions for open space and wetland's locations.

Figure 5-23: Muddy Fork Beargrass Creek Watershed



South Fork of the Beargrass Creek Watershed

The 27-square-mile South Fork Beargrass Creek Watershed is in the north-central portion of Louisville Metro. Headwaters originate in Jeffersontown and eventually outlet into the Ohio River near Towhead Island. At about mile 0.75 of South Fork, the Louisville Local Flood Protection Project (Floodwall) crosses the stream. The Beargrass Pumping Station is located at this point.

From approximately mile 1.4 to mile 4.1, the stream is a large concrete channel with high vertical sidewalls. Major streams in this watershed include South Fork Beargrass Creek and Buechel Branch.

The South Fork drains a significant area of residential and institutional properties, parklands, and cemeteries where it flows in a straightened canal between Newburg Road and Poplar Level Road. At Eastern Parkway, South Fork enters the concrete "improved channel" and flows toward downtown Louisville, where it joins Middle Fork and becomes the Main Stem.

Some tributaries in older portions of town such as Snead's Branch and the tributary along and under Trevilian Way were enclosed in pipes and converted into sewers during the booming suburban development of the 1890s-1920s. A cave along the creek bank is the only known home of the Louisville Cave Beetle, an endemic species that is listed as a Candidate for endangered species status.

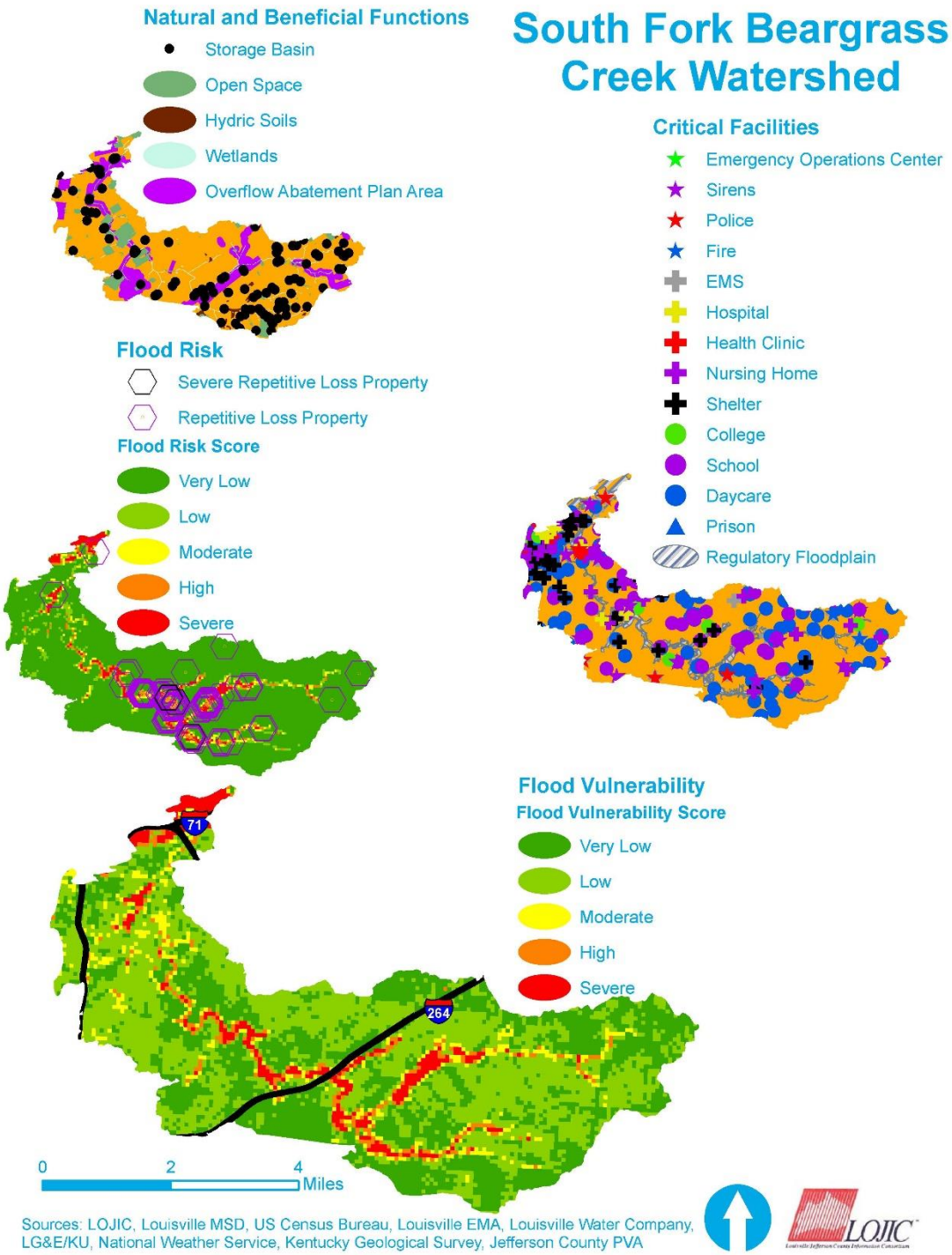
Communities lying in the watershed include Jeffersontown, Phoenix Hill, Germantown, Audubon Park, Strathmoor, Wellington, Buechel, Highgate Springs, Houston Acres, Forest Hills, Schnitzelburg, Smoketown, Shelby Park, Tyler Park, and the Highlands. Regionally notable landmarks in the watershed include the Beargrass Creek Pumping Station, Calvary Cemetery, the Louisville Zoo, Tyler Park, and Rest Haven Memorial Cemetery. Several parks are in the floodplain of South Fork Beargrass Creek, including Joe Creason Park and the Beargrass Creek State Nature Preserve. Buechel Park is situated along Buechel Branch, a tributary of South Fork Beargrass Creek. These parks provide open space where flooding can occur without property damage, as well as recreational uses during drier periods.

The South Fork Beargrass Creek Flood Protection project was initiated in 2001 and completed in 2010. This was a joint project between the Army Corps of Engineers and MSD, and included the construction of eight regional basins, ranging in size from 9 acre-feet to 160 acre-feet of storage throughout the South Fork Watershed. The project also included 2,000 feet of channel improvement, 1,900 feet of floodwall around an apartment complex, and environmental features, such as construction of pools and riffles in the channels, and planting 9 acres of bottomland hardwoods. The purpose of the project was to help relieve flooding in the South Fork Watershed, protecting neighborhoods such as Bon Air, West Buechel, and Watterson Park. The basins are near Bashford Manor, Breckenridge Lane, Downing Way, Fountain Square, Hikes Lane, Gerald Court, Richlawn Avenue, and Old Shepherdsville Road. Another regional basin, the Dry Bed Reservoir, also in the South Fork Beargrass Creek Watershed, was constructed in the 1970s to relieve flooding along South Fork to protect assets such as homes, businesses, and infrastructure.

Due to repetitive flooding, some residents living in this watershed have participated in flood acquisition programs. These homes were demolished and the properties have been deed restricted to remain as open space to mitigate the flooding.

Figure 5-24 depicts the South Fork Beargrass Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-24 also displays critical facilities and the natural and beneficial functions for open space and wetlands locations.

Figure 5-24: South Fork Beargrass Creek Watershed



Cedar Creek Watershed

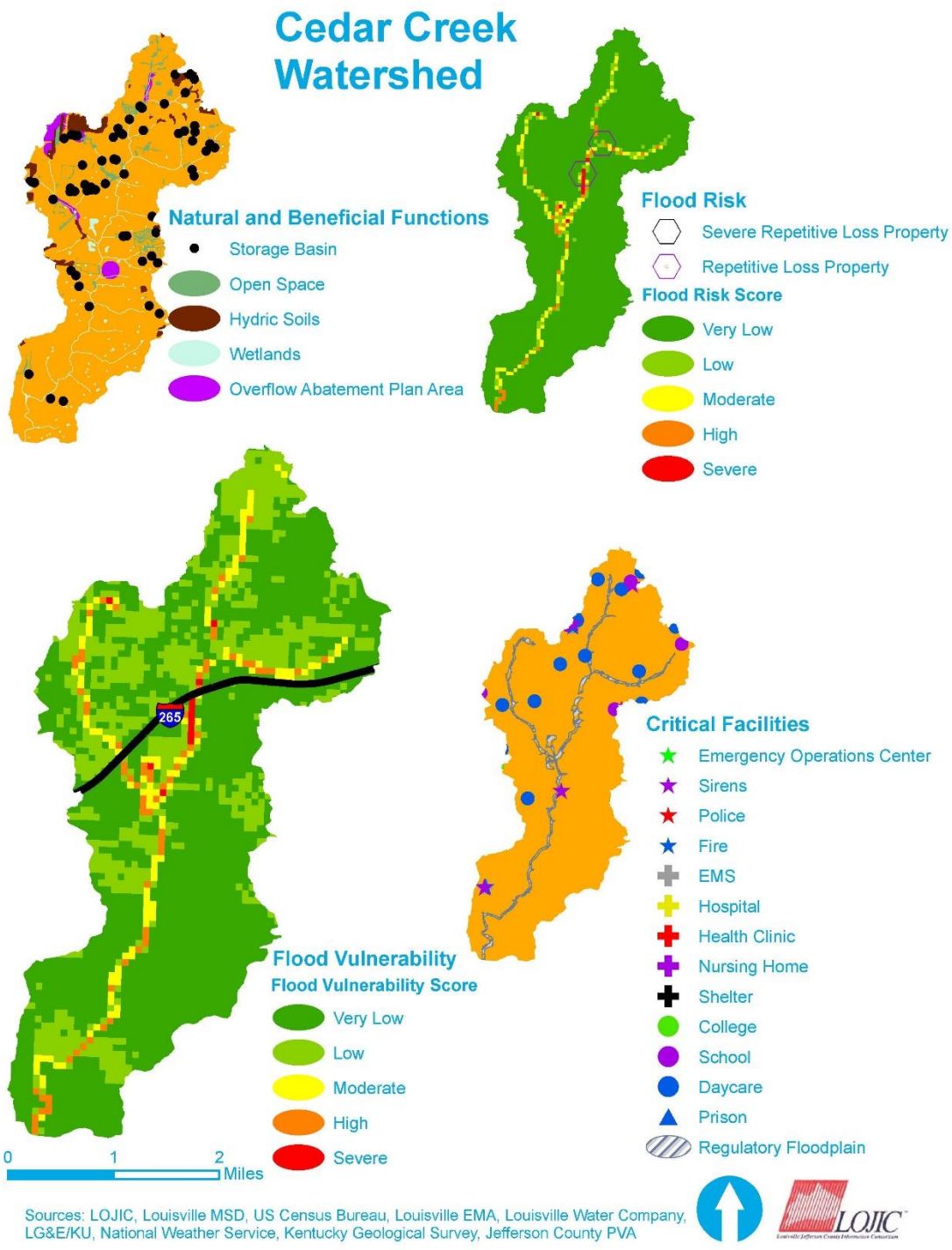
The 11-square-mile Cedar Creek Watershed is in south-central Louisville Metro, and contains 57.9 miles of streams. Its headwaters originate in the Fern Creek area. The stream flows in a southerly direction, passing into Bullitt County, and eventually discharges into Floyds Fork. Cedar Creek is the only major stream in this watershed.

Communities lying in this watershed include Fern Creek and Highview. Regionally notable landmarks in the watershed include Beulah Church and Fern Creek High School. Also in this watershed is the Cedar Creek Regional Wastewater Treatment Plant.

The Cedar Creek Watershed has no regional basins or major channel improvement projects. Due to repetitive flooding, one resident living in this watershed participated in a flood acquisition program. This home was demolished and the property was deed restricted to remain as open space to mitigate the flooding.

Figure 5-25 depicts the Cedar Creek Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-25 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-25: Cedar Creek Watershed



Floyd's Fork Watershed

The Floyds Fork Watershed is in eastern Jefferson County, Henry, Oldham, Shelby, Spencer, and Bullitt Counties. Its headwaters originate in southwest Henry County, approximately 13 miles beyond the Louisville Metro boundary line. Flow is generally southwest through Oldham, Shelby, and Jefferson Counties, and then into Bullitt County, where its outlets into the Salt River. The major streams in this watershed are Floyds Fork, Pope Lick, and Chenoweth Run.

Floyds Fork is the largest watershed in Louisville Metro, covering approximately 103.9 square miles and containing 673.2 stream miles. Floyds Fork, which has a total watershed area of 460 square miles, originates in Trimble County (East Fork), and flows west through Oldham County and enters Louisville Metro at Ash Avenue.

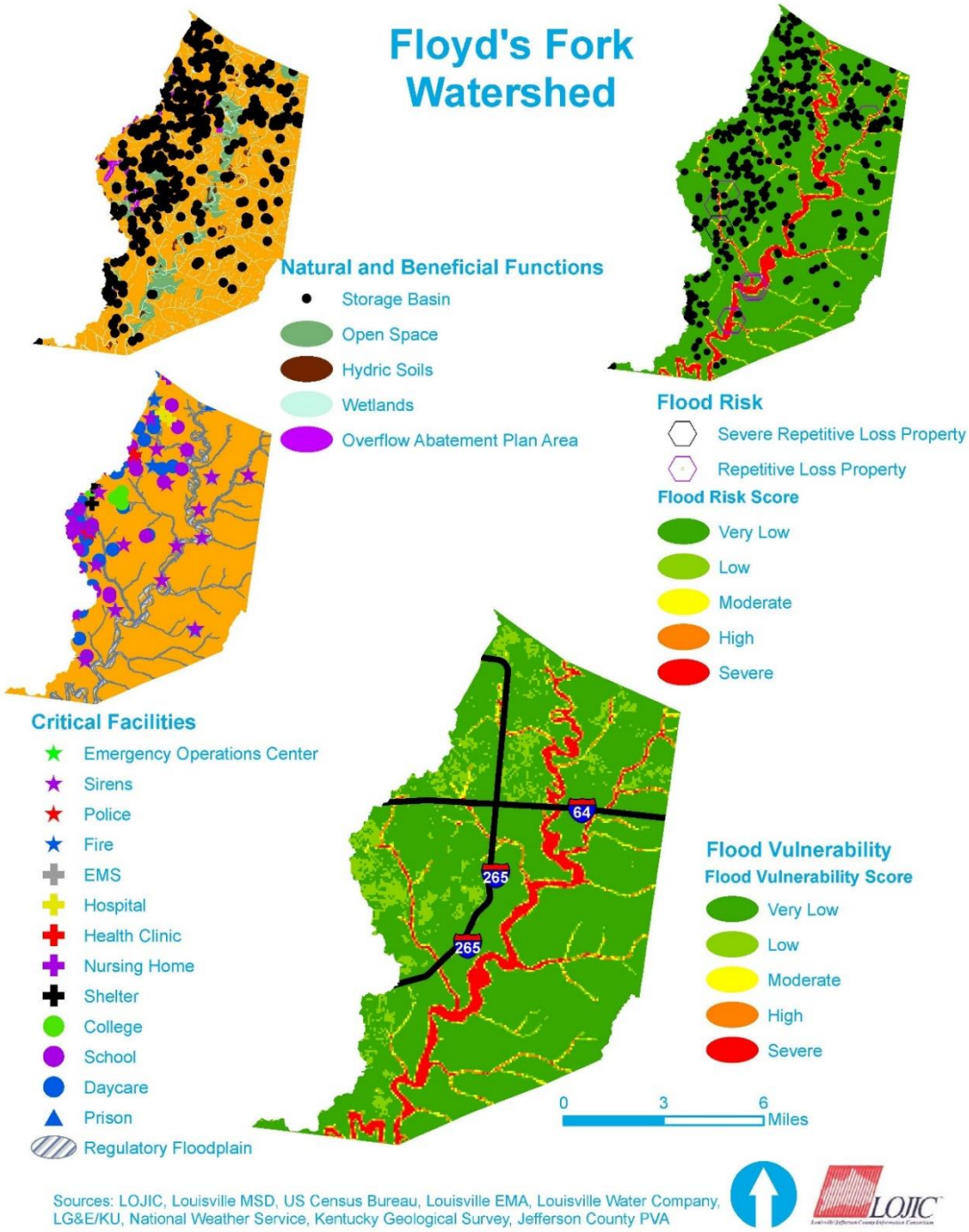
Chenoweth Run is a tributary of Floyds Fork, which originates in the Middletown area and flows south, merging into Floyds Fork. The headwater portion of Chenoweth Run watershed is heavily developed.

Communities in the area include parts of Jeffersontown, Middletown, Anchorage, Berrytown, Woodland Hills, Tucker Station, and Hopewell. Regionally notable landmarks in the watershed include the Parklands of Floyds Fork, Chenoweth Park, Valhalla Golf Course, Midland Trail Golf Course, parts of Bluegrass Industrial Park, Eastern High School, and Jeffersontown High School. Existing parks along Floyds Fork include the Parklands of Floyds Fork, which provides open space that will be preserved along Floyds Fork. The nonprofit organizations City of Parks, Future Fund, and 21st Century Parks have purchased and preserved nearly 4,000 acres in the Floyds Fork watershead, including nearly 2,000 acres of the floodplain along the creeks. For more information on this effort, please refer to The Parklands of Floyds Fork.

There are no regional basins or major channel improvement projects in the Floyds Fork Watershed. Due to repetitive flooding, some residents living in this watershed have participated in flood acquisition programs. These homes were demolished and the properties have been deed restricted to remain as open space to mitigate the flooding.

Figure 5-26 depicts the Floyd's Fork Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-26 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-26: Floyd Fork Watershed



Goose Creek Watershed

The Goose Creek of the Ohio River Watershed has an area of approximately 18.5 square miles, and contains Goose Creek of the Ohio River and Little Goose Creek of Goose Creek. This watershed is in northeastern Louisville Metro and is drained primarily by Goose Creek and Little Goose Creek.

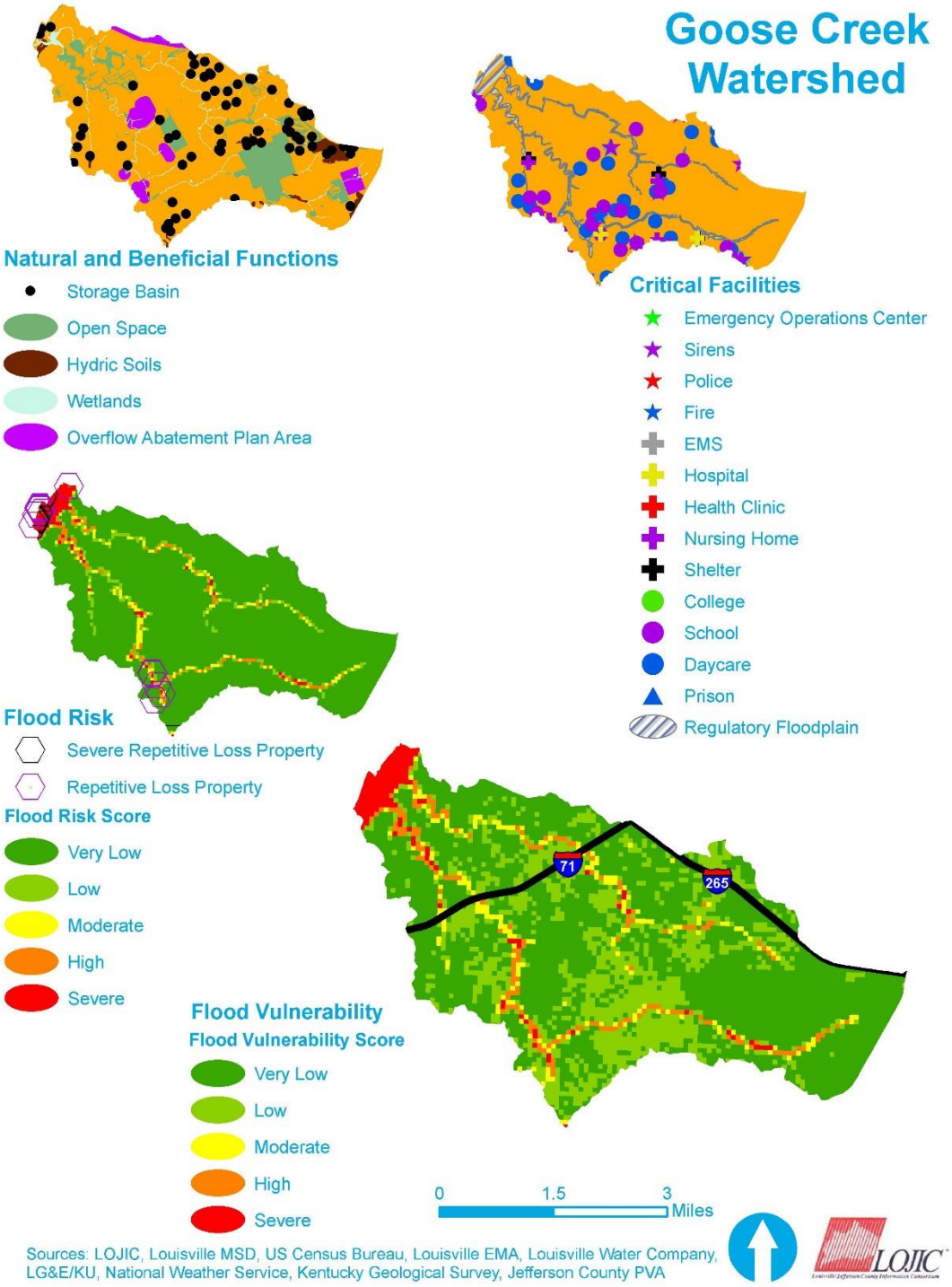
Goose Creek's headwaters originate in Anchorage, flow in a westerly direction to the area of Westport Middle School, then turn generally northwest, and finally outlet into the Ohio River at Six Mile Island. Little Goose Creek's headwaters originate in the Freys Hill area, flows northwesterly, and eventually discharge into Goose Creek about one-half mile from its outlet on the Ohio River.

Communities situated in this watershed include Anchorage, Rolling Hills, Plantation, Old Brownsboro Place, Hills and Dales, Glenview Heights, Brownsboro Farm, and Green Spring. Regionally notable landmarks in the watershed include Kentucky Country Day School, E.P. Tom Sawyer State Park, Owl Creek Country Club, Central State Hospital, Standard Country Club, and Ballard High School. Hounz Lane Park is along Goose Creek and provides open space and wetland areas that will be preserved. E.P. "Tom" Sawyer State Park is another park along Goose Creek that provides open space that will be preserved.

There are no regional basins or major channel improvement projects in the Goose Creek Watershed.

Figure 5-27 depicts the Goose Creek Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-27 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-27: Goose Creek Watershed



Harrods Creek Watershed

The 180-square-mile Harrods Creek Watershed is in northeastern Jefferson County, Oldham, and Henry Counties. Its headwaters originate in the area east of LaGrange, Kentucky, approximately 17 miles beyond the Jefferson County border. The creek flows generally to the southwest, converging with South Fork Harrods Creek about one-half mile outside the Louisville Metro line. From this point, the flow continues southwest through Louisville Metro to an outlet on the Ohio River at Guthrie Beach. Major streams in this watershed include Harrods Creek, Wolf Pen Branch, South Fork Harrods Creek, and South Fork Hite Creek.

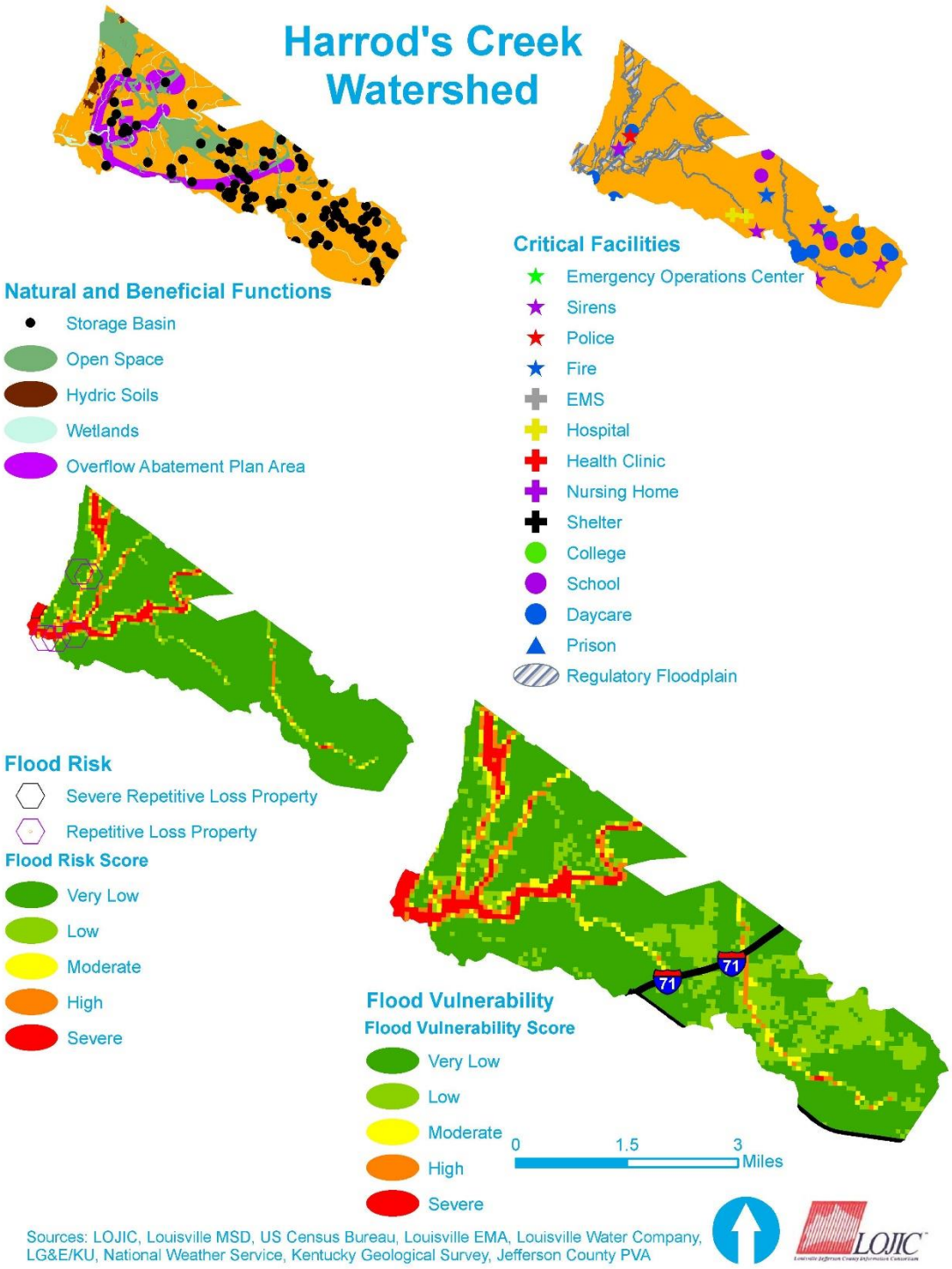
Only 15.3 square miles of the Harrods Creek Watershed lies within Louisville Metro. Wolf Pen Branch, a tributary of Harrods Creek, originates in the Worthington area and flows northwest, merging into Harrods Creek and eventually flowing into the Ohio River.

Communities in the study area include Fincastle, Ballardsville, Pewee Valley, Lake Louisvilla, Worthington, and Prospect. Regionally notable landmarks in the watershed include the Ford Motor Company Kentucky Truck Plant and Hunting Creek Country Club.

No regional basins or major channel improvement projects are in the Harrods Creek Watershed.

Figure 5-28 depicts the Harrods Creek Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-28 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-28: Harrods Creek Watershed



Mill Creek Watershed

The 34-square-mile Mill Creek Watershed is in the western portion of Louisville Metro, and contains 156.8 stream miles, most of it in modified drainage channels. The Mill Creek Cutoff was constructed many years ago to re-route the upper watershed directly to the Ohio River. The Mill Creek Cutoff collects stormwater from the northern end of Iroquois Park, Pleasure Ridge Park, and Shively areas.

Due to the diversion of the upstream reaches of Mill Creek into the cut-off channel, this watershed is divided into two entirely separate sections: Upper Mill Creek and Lower Mill Creek. Major streams included in Upper Mill Creek include Big Run, Cane Run, and Mill Creek Cutoff. Major streams included in Lower Mill Creek include Mill Creek and Black Pond Creek.

The 19-square-mile Upper Mill Creek's headwaters originate in the area of Manslick Road and I-264. From here, they flow in a westerly direction to the western side of Shively, where several tributaries, including Cane Run, Boxwood Ditch, Lynnview Ditch, and Big Run, join the flow. From this point, the flow direction is to the northwest, via the cutoff channel. The stream outlets into the Ohio River just south of Riverside Gardens. A flood pumping station is in the Riverside Gardens area near the stream outlet. This flood pumping station is part of the flood levee system that protects Louisville Metro from Ohio River flooding.

The 15-square-mile Lower Mill Creek's headwaters originate in the area of Lower Hunters Trace and Terry Road. From here, the flow is generally to the south, paralleling the Ohio River. Several tributaries, including Black Pond Creek and Valley Creek, join this flow in the Valley Downs area. The stream eventually outlets into the Ohio River west of Valley Village. A flood pumping station is located 0.75 mile upstream of the mouth of Lower Mill Creek. This flood pumping station is part of the flood levee system that protects Louisville Metro from Ohio River flooding.

Communities lying in the Upper Mill Creek section include Shively, Heatherfield, Hunters Trace, Parkwood, St. Denis, and Riverside Gardens. Regionally notable landmarks in the watershed include Louisville Gas & Electric's Mill Creek Power Station, Western High School, Doss High School, Shively Park, Dixie Manor, and a part of Iroquois Park. Sun Valley Park is on Mill Creek near Lower River Road. This park provides preserved open space along Mill Creek.

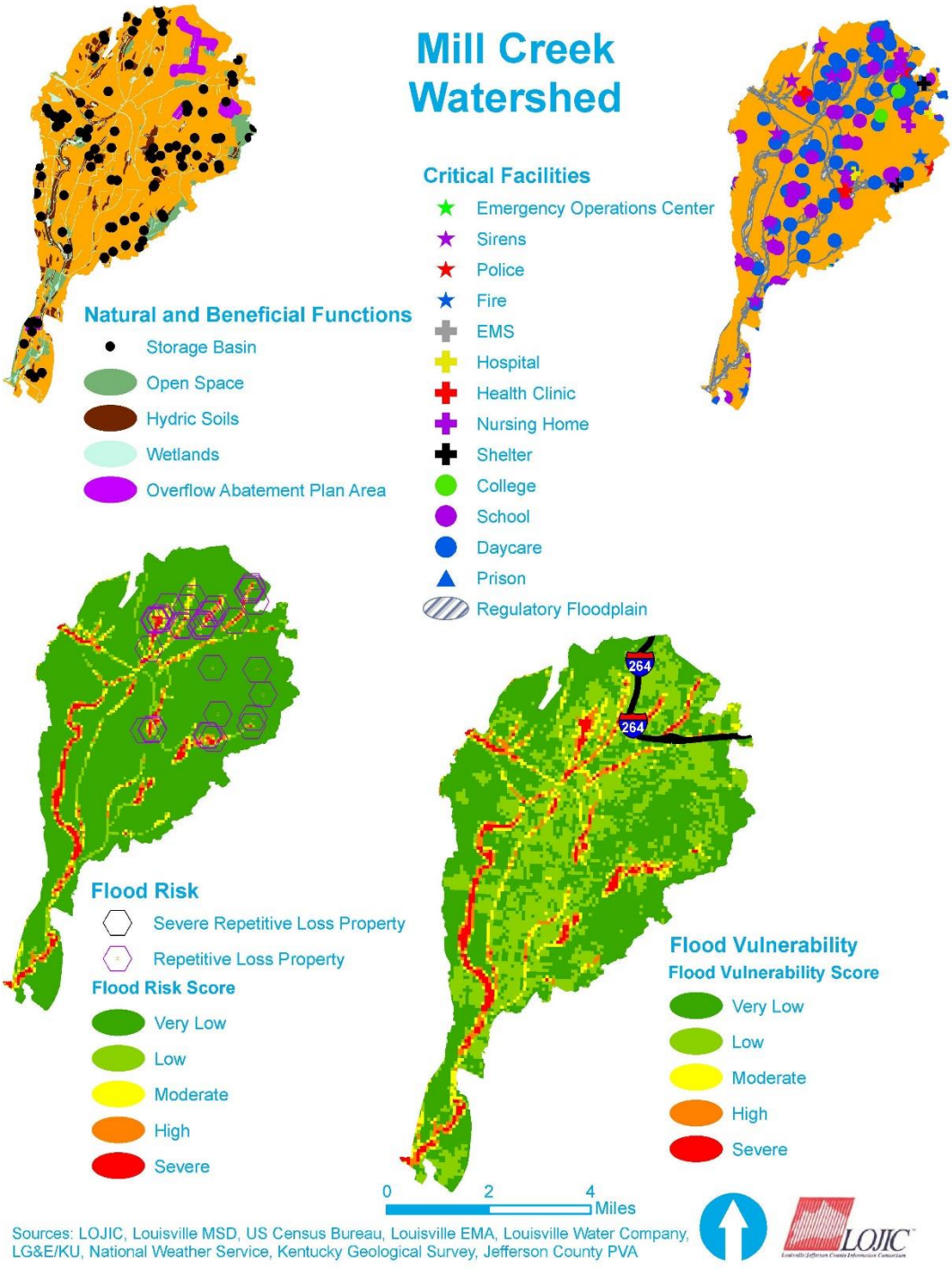
Communities lying in the Lower Mill Creek section include Valley Village, Meadow Lawn, Valley Downs, parts of Valley Station and Pleasure Ridge Park, Sylvania, Greenwood, and Waverly Hills. Regionally notable landmarks in the watershed include Sun Valley Community Park, Valley High School, Waverly Park, and the Louisville and Jefferson County Riverport Authority.

The Wheeler Basin is a regional basin in the Mill Creek Watershed. The basin was constructed to relieve flooding from the combined sewer system. Two other regional basins, Gagel Ave and Stallings Ave, are currently under study to determine if basin outlet modifications or the installation of water quality best management practices can reduce downstream flooding for smaller storms. Several MSD funded property acquisitions have occurred in this area to address localized repetitive flooding issues.

MSD and the USACE have also completed a flood study of the Upper Mill Creek Basin. The study identified one potential project to remove a portion of the old Ohio River levee that is no longer in service.

Figure 5-29 depicts the Mill Creek Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-29 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-29: Mill Creek Watershed



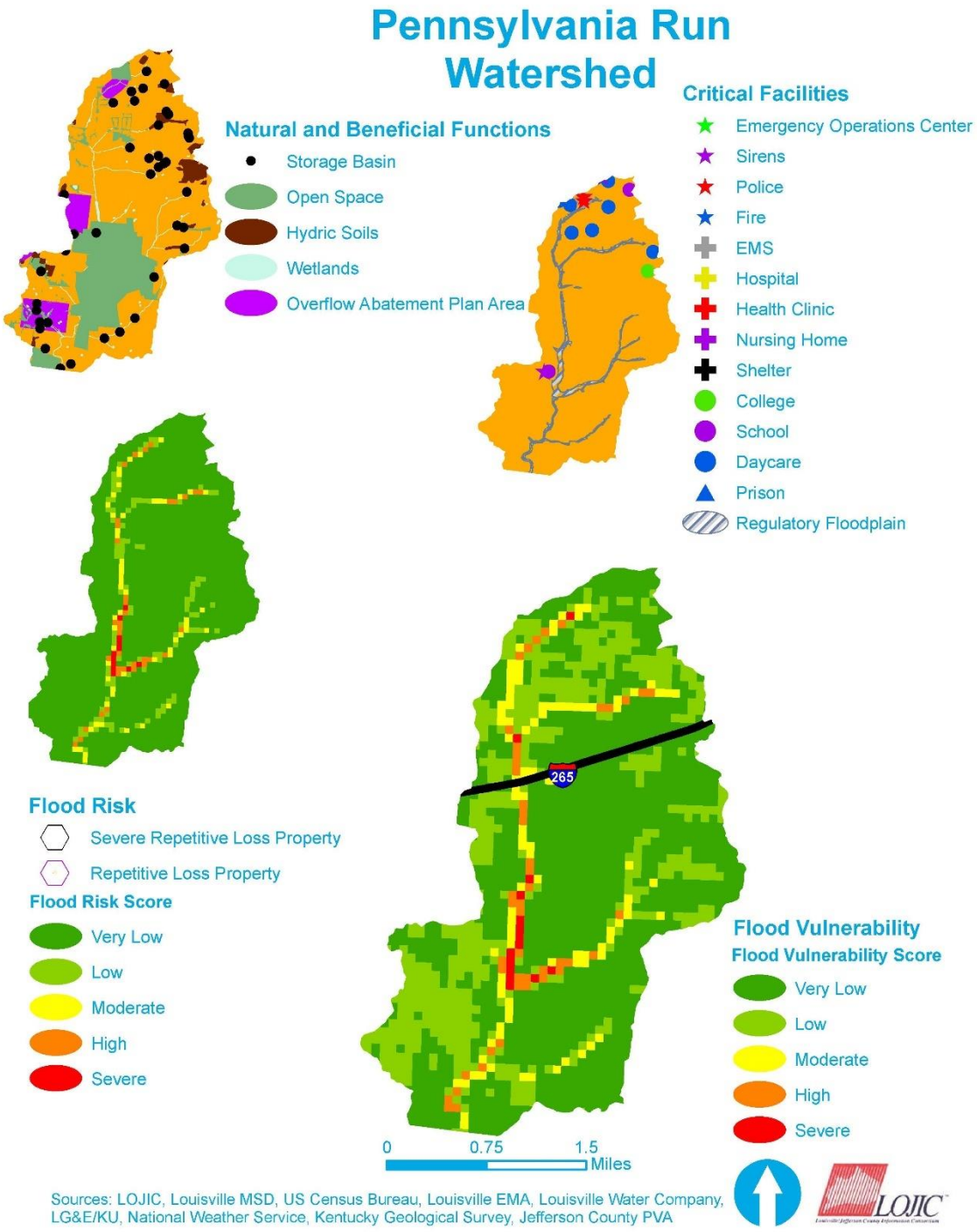
Pennsylvania Run Watershed

The 7-square-mile Pennsylvania Run Watershed is in south-central Louisville Metro, and contains 33.4 stream miles, most of which are intermittent and ephemeral streams, with the exception of McNeeley Lake, a small recreational reservoir. Its headwaters originate in the Highview area, and the stream flows in a southerly direction, passing into Bullitt County, and eventually discharging into Cedar Creek. Pennsylvania Run is the only major stream in this watershed.

Regionally notable landmarks in the watershed include McNeely Lake and McNeely Lake Park. McNeely Lake Park is along Pennsylvania Run and provides preserved open space. No regional basins or major channel improvement projects are in the Pennsylvania Run Watershed.

Figure 5-30 depicts the Pennsylvania Run Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-30 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-30: Pennsylvania Run Watershed



Pond Creek Watershed

The 94-square-mile Pond Creek Watershed is in south-central and southwest Louisville Metro, and contains 649.6 stream miles in Louisville Metro. It is primarily drained by a series of natural and improved channels called Fern Creek, Northern Ditch, Southern Ditch, and Pond Creek. The headwaters of Fern Creek originate in the western side of Jeffersontown, and flow southwest to Shepherdsville Road. At this point, the flow turns to the west, and the improved channel is called Northern Ditch. This westerly flow continues into the vicinity of the Louisville and Nashville Railroad's Osborn Yard, where it turns southwest and finally outlets into Southern Ditch at the Outer Loop. The flow in Southern Ditch, an improved channel, originates in the Smyrna area and moves west, generally paralleling the Outer Loop. From this point, Southern Ditch flows to the west about three-quarters of a mile, then turns to the southwest and flows about one mile to Manslick Road. Downstream from Manslick Road, the natural channel is called Pond Creek. It flows in a generally southwesterly direction to its eventual outlet into the Salt River. Numerous tributaries enter these four main channels, including Fishpool Creek, Mud Creek, Wilson Creek, Bee Lick Creek, Guardian Creek, Duck Spring Branch, Salt Block Creek, Slate Run, Bearcamp Run, Crane Run, Brier Run, and Weaver Run.

Once a backwater slough for the Ohio River floodplain, with shallow lakes and swampy forests called "wetwoods," the hydrology of the central and lower reaches of this watershed have been completely modified over the past two centuries, which resulted in draining the wet areas to make the land developable; however the flood risk still remains. Upstream subwatersheds in the Pond Creek watershed include Fern Creek, Fishpool Creek, Mud Creek and Wilsons Creek. Bee Lick, Manslick, Wetwoods Creek, Guardian Creek, Blue Spring Ditch, Duck Spring Branch, and other channelized drainage ditches also feed into the central drainage canals, called Northern Ditch and Southern Ditch.

Brier Creek along the southern border of the county is in a rural valley in the Knobs, below Jefferson Forest. Brier Creek originates in Metz Gap and Jefferson Hill, close to the Jefferson County Memorial Forest, and flows west before merging into Pond Creek.

Communities situated in this watershed include parts of Jeffersontown, Fern Creek, Highview, Newburg, Smyrna, Okolona, Lynnview, Auburndale, Fairdale, Prairie Village, Medora, Orell, and part of Valley Station. Regionally notable landmarks in the watershed include the Louisville International Airport, General Electric's Appliance Park, Ford Louisville Assembly Plant, Jefferson Mall, part of Iroquois Park, Komosdale Cement Plant, and much of the Jefferson County Memorial Forest.

The first regional basin built by MSD was the Roberson Run Basin, a small basin constructed in the early 1990s. The basin protects the Louisville Airport, neighborhoods, schools, medical clinics, and other critical facilities. Although the impacts on flooding are minimal by today's standards, the basin is a multi-use facility with the incorporation of walking paths around the basin that link adjoining residential areas.

In 1998, MSD, Jefferson County Government, and the U.S. Army Corps of Engineers began the construction phase of the Pond Creek Flood Prevention Project. The project utilizes large basins for flood storage and channel improvements to remove an estimated 2,000 buildings from the

danger of most floods. In addition, the project incorporates greenway principles that provide pedestrian access to Pond Creek. Walking and biking paths help connect neighborhoods. The project also improves water quality along Pond Creek. A description of each phase of the project is listed below.

- Phase I: The Okolona Wetlands Restoration Site is an environmental restoration of 15 acres of wetlands in a former sludge lagoon at the former Okolona Wastewater Treatment Plant. The restoration process includes draining the area of sludge and replanting native vegetation.
- Phase II: The Vulcan Detention Basin included constructing a dam on Fishpool Creek, installing a low-flow pipe, and constructing an overflow structure into the basin, a former limestone quarry. The basin was designed to fill during a 24-hour storm event, and drain over a period of approximately 8 days. This basin became operational in September 1999. The capacity of the detention basin is 450 acre-feet. A diversion dam was constructed across the creek, and an 18-inch pipe was placed through the dam to maintain base flows.
- Phase III: The Melco Detention Basin behind the Ford Louisville Assembly Plant was completed in 2001. It expanded an existing 15-acre borrow pit to 80 acres, which increased the storage capacity to 1,500 acre-feet.
- Phase IV: This phase included channel modifications to Northern Ditch between Preston Highway and the Melco Basin inlet. It also included widening one bank of Northern Ditch for a distance of almost 1.5 miles, replacing culverts, and installing riffle structures and pools in the stream to improve aquatic habitat.
- Phase V: Channel modifications to Pond Creek and the placement of a multipurpose recreation trail alongside the creek were also completed. This phase includes widening one bank of Pond Creek for a distance of 2.4 miles, replacing culverts, and installing riffle structures and pools in the stream to improve aquatic habitat.

In addition to the Army Corps of Engineers project, MSD has also worked with a private company to create a floodplain and runoff compensation bank in the Pond Creek Watershed. This compensation bank is funded through private development. It consists of three basins which have been completed. Pond 1 is near I-65 and the Outer Loop, and is 80 acre-feet. Pond 2 is near Wilson Creek and the Gene Snyder Freeway, and is 26.5 acre-feet. Pond 3 is at National Turnpike and is 234 acre-feet. These ponds also function as wetland mitigation banks.

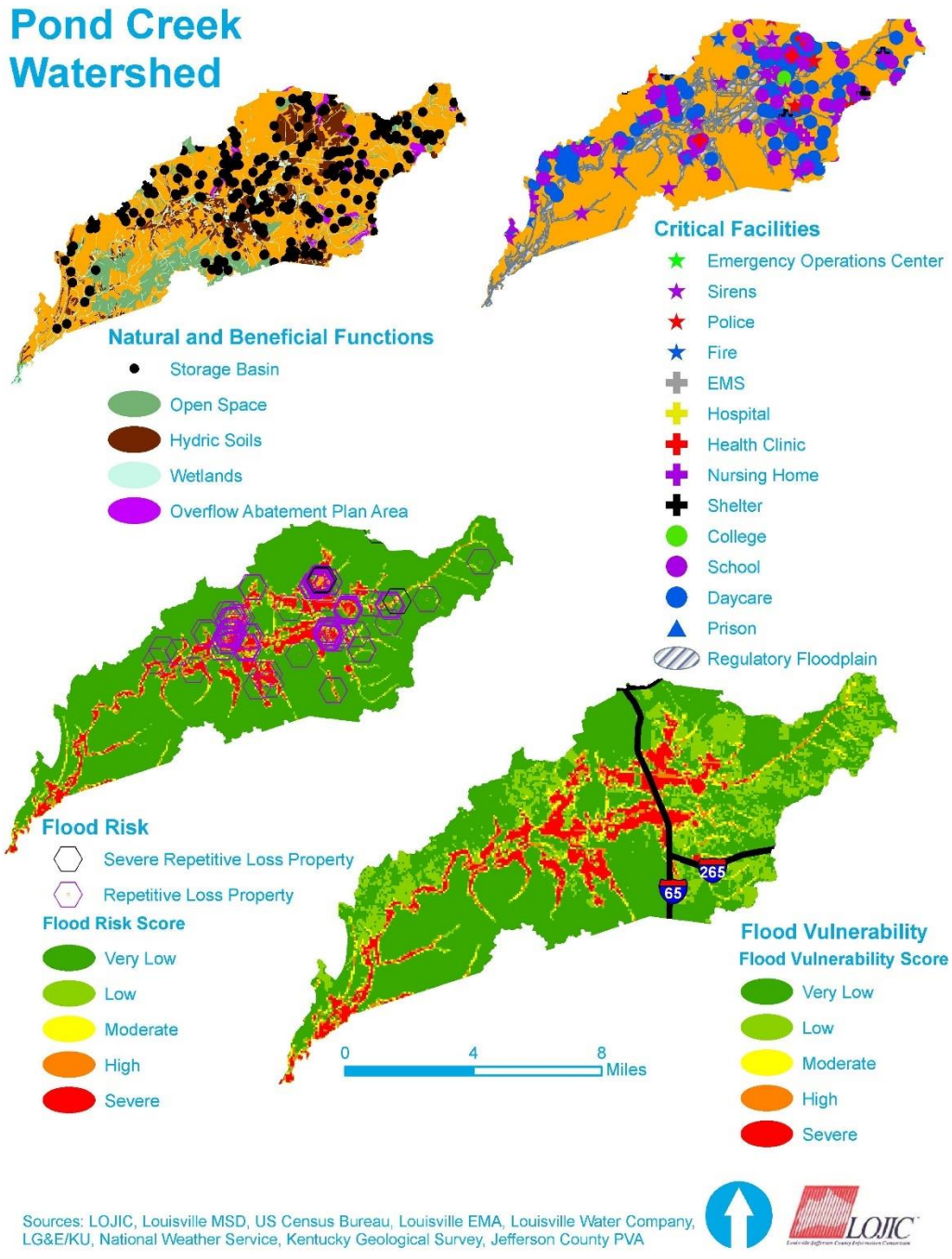
MSD also completed a regional flood control basin on Northern Ditch near its confluence with Southern Ditch called the Aluma Basin. The basin construction was completed in 2012.

Due to repetitive flooding, some residents living in this watershed have participated in flood acquisition programs. These homes were demolished and the properties have been deed restricted to remain as open space to mitigate the flooding.

Figure 5-31 depicts the Pond Creek Watershed Vulnerability Score. This map details areas of high vulnerability based on several different factors, such as Regulatory Floodplain, Combined Sewer Flood-prone Areas, Repetitive Loss Properties, Severe Repetitive Loss, and Historical Claims data. These variables provide a detailed Risk Score that displays areas at risk based on

mapped floodplains and mapped occurrence hotspots. These two factors provide Louisville Metro with a comprehensive understanding of where flooding is occurring, and potentially causing damage. In addition, Figure 5-31 also displays critical facilities and the natural and beneficial functions for open space and wetland locations.

Figure 5-31: Pond Creek Watershed



5.7.5 Climate Assessment

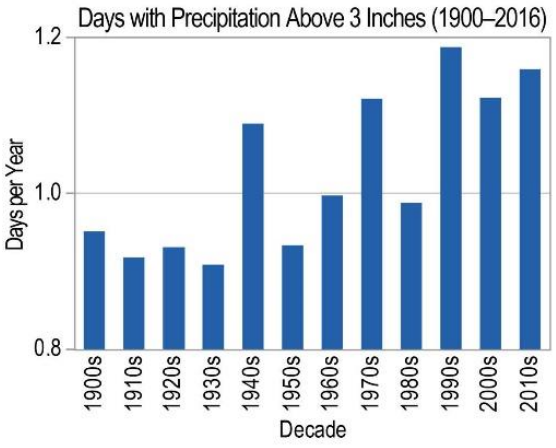
Flooding typically occurs when an area experiences long periods of rainfall or extreme rainfall. The risk associated with rainfall is exacerbated in urban areas, where impervious pavement forces water to run off quickly, filling sewer systems and causing rivers and creeks to overflow its banks. Since the Louisville Metro area is situated on the banks of the Ohio River and encompasses 11 major watersheds, the largest flood risk is a result of riverine flooding. Riverine flooding occurs from snowmelt and/or rainfall upstream in the Metro area.

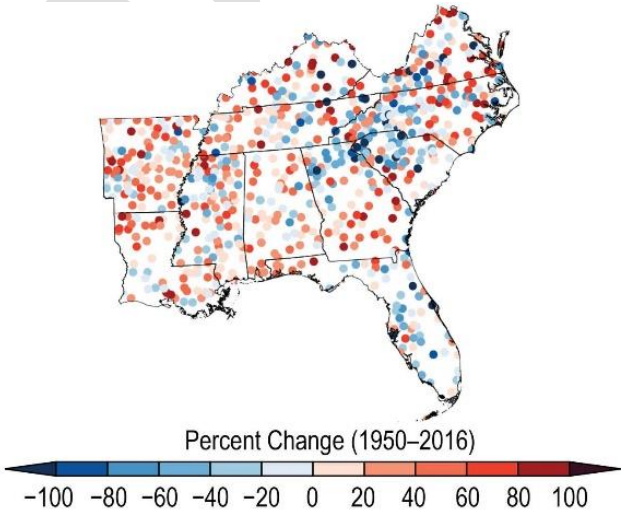
The southeastern portion of the U.S. has experienced an increase in frequency and intensity for extreme rainfall. This trend is expected to continue as the Earth continues to warm.

For each degree of warming, the air can hold about 7% more water vapor. This can lead to larger storms with more precipitation, which is already being seen. The region has experienced a 16% increase in the amount of rain falling during extreme storms. The number of days with more than 3 inches of precipitation has also increased across the region.

According to the National Climate Assessment, there is high confidence (based on high model agreement) that extreme rainfall will continue to worsen over time with climate change. With continued higher emissions (RCP 8.5), model projections show a doubling in the number of heavy rainfall events and 21% increase in the amount of rain falling during those events.

The average annual number of days with more than 3 inches of precipitation has been increasing across the Southeast, especially in the most recent decade.





Similar to the rest of the region, precipitation has been increasing in Louisville since about the 1980's. Data from the Louisville International Airport weather station shows that all three of the wettest years on record have occurred within the last decade. When comparing the most recent 30-year period (1989-2018) with the historical period of 1961-1990, the amount of precipitation in the largest storm has increased by 12% in Louisville.

A study assessing flood risk at the national level provided data on potential flood risk for Louisville Metro. Of note is the fact that these data provide only rough estimates of the potential increase in flood frequency based on climate change model projections. Because of the national scale of the analysis, this dataset does not include localized specificity that is needed to map local trends. However, the data can be used to get an idea about the overall magnitude of change that is projected in this area.

With continued higher greenhouse gas emissions, the 1% annual chance flood events are expected to become 2.5 times to 3.5 times more frequent, as compared to the baseline (1950-2000) throughout much of the Louisville Metro region. Of note is the fact that 100-year flood frequencies can be limited to 1.0 to 1.5 times more frequent if emissions are reduced, saving $4 billion per year in flood damages at the national level.

Climate Risk

Using the available scientific information and climate trends, flood risk will continue to increase in frequency and intensity due to climate change. The more extreme flooding experienced has been associated with relatively short, geographically isolated rainfalls, which cause flash flooding, not Ohio River flooding. To understand the full extent of possible changes in precipitation an analysis upstream on the Ohio River would need to be conducted to fully assess future flooding potential.

5.8 Hail Storm

Hail is a form of precipitation consisting of solid ice that forms inside thunderstorm updrafts. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people.[46]

Hailstones are formed when raindrops are carried upward by thunderstorm updrafts into extremely cold areas of the atmosphere and freeze. Hailstones then grow by colliding with liquid water drops that freeze onto the hailstone's surface. If the water freezes instantaneously when colliding with the hailstone, cloudy ice will form as air bubbles will be trapped in the newly formed ice. However, if the water freezes slowly, the air bubbles can escape and the new ice will be clear. The hail falls when the thunderstorm's updraft can no longer support the weight of the hailstone, which can occur if the stone becomes large enough or the updraft weakens. Falling hail can damage roofs and siding on houses, break windows and damage vehicle finishes, damage and destroy crops and if large enough, cause severe injury and/or death to people and animals.

The fall speed of hail primarily depends on the size of the hailstone, the friction between the hailstone and surrounding air, the local wind conditions (both horizontal and vertical), and the degree of melting of the hailstone. Early research assumed that hailstones fell like solid ice spheres and showed very high fall speeds, even for very small hailstones. However, recent research has repeatedly shown that natural hailstones fall more slowly than solid ice spheres[47]. For small hailstones (<1-inch in diameter), the expected fall speed is between 9 and 25 mph. For hailstones that one would typically see in a severe thunderstorm (1-inch to 1.75-inch in diameter), the expected fall speed is between 25 and 40 mph. In the strongest supercells that produce some of the largest hail one might expect to see (2-inches to 4-inches in diameter), the expected fall speed is between 44 and 72 mph. However, there is much uncertainty in these estimates due to variability in the hailstone's shape, degree of melting, fall orientation, and the environmental conditions. However, it is possible for very large hailstones (diameters exceeding 4-inches) to fall at over 100 mph.

Hail Types

The primary difference between frozen precipitation is how the different types grow and the maximum sizes of the individual particles. The different types of frozen participation are described below

- *Snow* forms mainly when water vapor turns to ice without going through the liquid stage. This process is called deposition. Snow can form in the gentle updrafts of stratus clouds or at high altitudes in very cold regions of a thunderstorm. Snowflakes that most of us are used to seeing are not individual snow crystals, but are actually aggregates, or collections,

[46] https://www.nssl.noaa.gov/education/svrwx101/hail/

[47] https://www.nssl.noaa.gov/education/svrwx101/hail/#:~:text=For%20small%20hailstones%20(%3C1%2D,between%2025%20and%2040%20mph.

of snow crystals that stick or otherwise attach to each other. Aggregates can grow to very large sizes compared to individual snow crystals.

- *Graupel* are soft, small pellets formed when supercooled water droplets (at a temperature below 32°F) freeze onto a snow crystal, a process called riming. If the riming is particularly intense, the rimed snow crystal can grow to an appreciable size but remain less than 0.2 inches. Graupel is also called snow pellets or soft hail, as the graupel particles are particularly fragile and generally disintegrate when handled.
- *Sleet* are small ice particles that form from the freezing of liquid water drops, such as raindrops. At ground level, sleet is only common during winter storms when snow melts as it falls and the resulting water refreezes into sleet prior to hitting the ground. In thunderstorms, sleet is possible above the melting level where cloud droplets become supercooled and may instantaneously freeze when contacting other cloud particles or debris, such as dust particles. Sleet is also called ice pellets.
- *Hail* is frozen precipitation that can grow to very large sizes through the collection of water that freezes onto the hailstone's surface. Hailstones begin as embryos, which include graupel or sleet, and then grow in size. Hailstones can have a variety of shapes and include lumps and bumps that may even take the shape of small spikes. Hailstones must be at least 0.2 inches in size.

Hail size is often estimated by comparing it to a known object. Most hailstorms are made up of a mix of different sizes, and only the very largest hail stones pose serious risk to people caught in the open. When reporting hail, estimates comparing the hail to a known object with definite size are good, but measurements using a ruler, calipers, or a tape measure are best. Table 5-26 below provides a comparison for hail sizes commonly encountered.

Table 5-26: Hail Size Comparison Chart and Torro Hailstorm Intensity Scale

Hail Size (in.)	Object Analog Reported
0.25	Pea
0.50	Marble, Moth ball
0.75	Penny
0.88	Nickel
1.00	Quarter
1.25	Half dollar
1.50	Ping pong ball

Size Code	Intensity Category	Typical Damage Impacts
H0	Hard Hail	No damage
H1	Potentially Damaging o	Slight general damage to plants, crops
H2	Significant	Significant damage to fruit, crops, vegetation
H3	Severe	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Destructive	Widespread glass damage, vehicle bodywork damage
H5	Destructive	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	Bodywork of grounded aircraft dented; brick walls pitted

1.75	Golf ball
2.00	Egg
2.50	Tennis ball
2.75	Baseball
3.00	Hockey puck
4.00	Softball
4.50	Grapefruit

https://www.spc.noaa.gov/misc/tables/hailsize.htm

H7	Destructive	Severe roof damage, risk of serious injuries
H8	Destructive	Severe damage to aircraft bodywork
H9	Super Destructive	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Destructive	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: http://www.torro.org.uk/hscale.php

The size of hail stones is a direct function of the severity and size of the storm. According to NOAA, the largest recorded hailstone in U.S. history fell on July 23, 2010, in Vivian, South Dakota, measuring 8 inches in diameter and weighing 1.94 pounds. The previous record hailstone fell in Aurora, Nebraska, on June 22, 2003, and measured 7 inches in diameter and weighed 1.67 pounds. The largest recorded hailstone to fall in Kentucky fell on April 3, 1974, in Princeton and measured five inches in diameter. There is no official record for the Louisville Metro area.

5.8.1 Hazard Profile and Consequence Analysis

Table 5-27 represents the typical hazard profile associated with Hail.

Table 5-27: Profile Risk Table Hail

Period of occurrence:	Potentially year round, but mainly in the spring/summer. According to the National Insurance Crime Bureau, from 2018 to 2020, hail claims tended to occur most often in the late spring to early summer months (April - June). Conversely, hail claims tended to occur the least often in the winter months (November - February).
Number of events:	180 events between April 1, 1950 and April 30, 2022
Probability of events:	Annually – Hazard event likely to occur every year. Based on data, the Louisville Metro area experiences approximately two significant hail storms per year.
FEMA Risk Rating/Score:	Relatively Moderate - Score 22.36
Warning time:	Minutes to hours
Potential of injury or death:	Low. There have been no reported injuries or deaths attributed to hail since 1950.
Possible Extent:	May 1996 – Hail up to Baseball Size (2.75 inches) was reported over most of Jefferson County resulting in an estimated $20 million in damage to buildings and vehicles.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, has been performed to better understand and outline the potential impacts that a severe hail storm would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-28.

Table 5-28: Consequence Analysis Hail

Subject	Impacts
Health and Safety of the Public	Large hailstones have the ability to cause hard to the public if shelter is not taken. People engaged in outdoor activities, such as school sports, golfing, or camping may find themselves exposed to hail without adequate shelter.
Health and Safety of Responders	First responders are at risk to the secondary effects of hail. Response vehicles in the open could suffer windshield damage and all responders would likely see a significant increase in emergency calls and requests for assistance.
Vulnerable Populations	Vulnerable populations are more likely to suffer losses during a hail event and are likely to take longer to recover. Factors influencing likelihood of damage include living in older, poorly constructed structures. Slower recovery is exacerbated by vulnerable populations having less access to insurance, wealth, or savings, being more likely to be renters who are likely at the mercy of property owners for conducting repairs.
Continuity of Operations (including delivery of services)	Critical facilities are less vulnerable to hail damage as they are typically built to withstand extreme weather events. However, damaging hail has the ability to disrupt communication and power systems, which can in turn disrupt the delivery of government services.
Property, Facilities, and Infrastructure	Large hailstorms can cause severe property and crop damage and destruction. The combination of gravity and a downward wind known as a downburst (a common occurrence during severe thunderstorms) can propel a hailstone at speeds upwards of 90 mph. At such excessive speeds, large hailstones have been known to penetrate straight through roof coverings and the deck to which they are attached. Although most hailstorms are not quite so severe, even moderate hailstorms can damage buildings, automobiles, crops, and other personal property. In 2021, hail damage was identified as the 4th most expensive hazard according to insurance claim payouts.
Environment	Hail can have a detrimental effect on crops (studies have shown that hail is responsible for damaging 2% of U.S. crop production each year), however, aside from crop damage, there are major environmental concerns associated with hail.
Economic Conditions	While most hail damage is covered under various insurance policies, a significant storm can create economic hardships. This is due to the fact that not all people carry comprehensive policies for their vehicles and not all property is insured.
Public Confidence in Louisville Metro Governance	Government officials will likely not be blamed for hail events; however, if issues related to insurance coverages are encountered, the public will likely look to officials to step in an facilitate an equitable recovery.

5.8.2 Significant Louisville Metro Hail Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in the Louisville Metro area related specifically to hail; however, there have been six declarations related to "Severe Storms."

According to the NOAA Storm Events Data Base, there have been 180 recorded hail events in Jefferson County, Kentucky between August 1961 and August 2021. Table 5-29 details each event to include the date, the magnitude (size) of the average hail stone, the number of deaths or injuries reported, and the cost of the event.

Table 5-29: Recorded Hail Events in Louisville Metro Since 1961

Date	Magnitude	Deaths	Injuries	Damage to Property	Damage to Crops
8/17/1961	1	0	0	0	0
8/18/1961	1	0	0	0	0
4/19/1964	1	0	0	0	0
7/10/1966	2	0	0	0	0
7/10/1966	0	0	0	0	0
3/14/1967	1	0	0	0	0
7/22/1968	1.75	0	0	0	0
4/27/1971	1.75	0	0	0	0
5/6/1971	1	0	0	0	0
4/13/1972	0.75	0	0	0	0
5/26/1973	0.75	0	0	0	0
4/3/1974	1.75	0	0	0	0
7/17/1975	1.75	0	0	0	0
8/12/1975	2	0	0	0	0
7/24/1976	0.75	0	0	0	0
7/13/1977	1.25	0	0	0	0
7/2/1980	2	0	0	0	0
3/20/1982	1	0	0	0	0
5/29/1982	2	0	0	0	0
5/29/1982	1.75	0	0	0	0
6/15/1982	0.75	0	0	0	0
9/14/1984	1.75	0	0	0	0
6/2/1985	0.75	0	0	0	0
6/24/1985	1.5	0	0	0	0

Date	Magnitude	Deaths	Injuries	Damage to Property	Damage to Crops
6/24/1985	1	0	0	0	0
8/30/1985	1.75	0	0	0	0
8/30/1985	1.5	0	0	0	0
3/10/1986	1.75	0	0	0	0
5/7/1986	1.5	0	0	0	0
6/16/1987	1.75	0	0	0	0
4/23/1988	1.75	0	0	0	0
5/9/1988	1.75	0	0	0	0
5/9/1988	0.75	0	0	0	0
4/26/1989	1.75	0	0	0	0
4/28/1989	2	0	0	0	0
2/21/1993	0.75	0	0	0	0
4/15/1993	0.75	0	0	50	0
5/25/1994	0.75	0	0	0	0
4/20/1996	1	0	0	0	0
5/3/1996	2.75	0	0	$20,000,000	0
5/28/1996	1	0	0	0	0
5/28/1996	1	0	0	0	0
3/28/1997	1.75	0	0	0	0
3/28/1997	1.75	0	0	0	0
4/8/1998	0.75	0	0	0	0
5/19/1998	1.75	0	0	0	0
4/28/1999	1.75	0	0	0	0
1/3/2000	1.25	0	0	0	0
4/20/2000	0.88	0	0	0	0
10/5/2000	1	0	0	0	0
11/9/2000	0.75	0	0	0	0
4/10/2001	0.88	0	0	0	0
4/10/2001	1.75	0	0	0	0
5/11/2001	1.75	0	0	$5,000	0
5/11/2001	0.88	0	0	0	0
9/23/2001	1.75	0	0	0	0
2/20/2002	0.75	0	0	0	0

Date	Magnitude	Deaths	Injuries	Damage to Property	Damage to Crops
2/20/2002	1	0	0	0	0
2/20/2002	0.75	0	0	0	0
2/20/2002	1	0	0	0	0
3/29/2002	0.75	0	0	0	0
11/10/2002	1	0	0	0	0
11/10/2002	1	0	0	0	0
4/20/2003	0.75	0	0	0	0
5/9/2003	0.75	0	0	0	0
8/27/2003	0.75	0	0	0	0
5/19/2004	1	0	0	0	0
5/24/2004	0.88	0	0	0	0
5/24/2004	1	0	0	0	0
7/6/2004	1	0	0	0	0
7/6/2004	1.75	0	0	0	0
7/6/2004	1	0	0	0	0
7/6/2004	2	0	0	0	0
10/18/2004	0.75	0	0	0	0
4/22/2005	0.75	0	0	0	0
4/22/2005	1	0	0	0	0
11/6/2005	1	0	0	0	0
11/6/2005	2	0	0	0	0
11/6/2005	1	0	0	0	0
1/2/2006	0.88	0	0	0	0
4/2/2006	1	0	0	$2,000	0
4/2/2006	0.88	0	0	0	0
4/2/2006	0.88	0	0	0	0
4/2/2006	1	0	0	0	0
4/7/2006	0.75	0	0	0	0
4/7/2006	0.88	0	0	0	0
4/19/2006	1	0	0	0	0
4/19/2006	1	0	0	0	0
5/11/2006	0.88	0	0	0	0
5/25/2006	1	0	0	0	0

Date	Magnitude	Deaths	Injuries	Damage to Property	Damage to Crops
4/11/2007	0.88	0	0	0	0
4/11/2007	1.25	0	0	0	0
4/11/2007	1	0	0	0	0
4/11/2007	0.88	0	0	0	0
8/16/2007	1.25	0	0	0	0
8/16/2007	1	0	0	0	0
8/16/2007	0.75	0	0	0	0
10/18/2007	1.25	0	0	$10,000	0
7/20/2008	0.75	0	0	0	0
4/13/2009	0.75	0	0	0	0
4/13/2009	1	0	0	0	0
5/15/2009	0.75	0	0	0	0
5/15/2009	1.75	0	0	0	0
5/15/2009	1	0	0	0	0
5/15/2009	1.75	0	0	0	0
5/15/2009	1.75	0	0	0	0
5/15/2009	2	0	0	0	0
8/4/2009	0.75	0	0	0	0
8/4/2009	0.88	0	0	0	0
4/9/2011	1	0	0	0	0
4/9/2011	1	0	0	0	0
4/9/2011	1	0	0	0	0
5/23/2011	0.75	0	0	0	0
3/28/2012	1	0	0	0	0
3/28/2012	1	0	0	0	0
3/28/2012	1	0	0	0	0
3/28/2012	1	0	0	0	0
3/28/2012	1	0	0	0	0
4/28/2012	1.25	0	0	0	0
4/28/2012	1.75	0	0	0	0
4/28/2012	2	0	0	0	0
4/28/2012	1	0	0	0	0
4/28/2012	1.75	0	0	0	0

Date	Magnitude	Deaths	Injuries	Damage to Property	Damage to Crops
4/28/2012	1.75	0	0	0	0
4/28/2012	1.5	0	0	0	0
4/28/2012	1	0	0	0	0
4/28/2012	2	0	0	0	0
4/28/2012	2	0	0	0	0
7/18/2012	1	0	0	0	0
7/27/2012	1	0	0	0	0
4/16/2013	1	0	0	0	0
4/16/2013	1	0	0	0	0
4/16/2013	1	0	0	0	0
4/16/2013	1.25	0	0	0	0
4/16/2013	1	0	0	0	0
6/17/2013	1	0	0	0	0
10/6/2014	1	0	0	0	0
10/6/2014	1	0	0	0	0
10/6/2014	1	0	0	0	0
4/2/2015	1.75	0	0	0	0
4/2/2015	1.25	0	0	0	0
4/2/2015	0.88	0	0	0	0
4/2/2015	1.75	0	0	0	0
4/2/2015	1.25	0	0	0	0
4/8/2015	0.75	0	0	0	0
4/25/2015	0.75	0	0	0	0
4/25/2015	1	0	0	0	0
4/25/2015	0.75	0	0	0	0
5/27/2015	1	0	0	0	0
5/27/2015	1	0	0	0	0
6/29/2015	0.75	0	0	0	0
6/30/2015	0.88	0	0	0	0
5/7/2016	0.75	0	0	0	0
5/7/2016	0.75	0	0	0	0
5/7/2016	0.88	0	0	0	0
5/10/2016	1	0	0	0	0

Date	Magnitude	Deaths	Injuries	Damage to Property	Damage to Crops
6/23/2016	1	0	0	0	0
6/23/2016	1.75	0	0	0	0
2/28/2017	0.75	0	0	0	0
3/30/2017	0.75	0	0	0	0
3/30/2017	0.88	0	0	0	0
3/30/2017	0.75	0	0	0	0
7/20/2018	1.25	0	0	0	0
7/20/2018	2	0	0	0	0
7/20/2018	1.75	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1.75	0	0	0	0
7/20/2018	1.75	0	0	0	0
7/20/2018	2	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
7/20/2018	1	0	0	0	0
4/23/2019	1	0	0	0	0
8/26/2021	1	0	0	0	0

Storm rows highlighted in red are further described below:

May 3, 1996 (Pre-Derby Hailstorm): On the day before the 1996 Kentucky Derby, hail from golf ball to baseball size totaled numerous cars across various parts of Louisville including Churchill Downs, the International Airport, Highview, Fern Creek, Okolona, Jeffersontown, Camp Taylor and Hikes Point. Three car rental lots in the vicinity of the International Airport were totaled. Baseball size hail at Jeffersontown, Fern Creek, Highview and Camp Taylor accumulated to 8 inches. Accumulations were also substantial along the Gene Snyder Freeway just south of Fern Creek. The hail shift was approximately 5 miles wide and went completely through the county. Many insurance companies had hundred claims due to car and home damage. Most of the home damage was to shingles, siding and windows. Approximately $20million in damages was

estimated form this storm to vehicles and buildings. This was the most damaging hail storm in Louisville Metro's history.

May 11, 2001: A thunderstorm on May 11, 2001 produced golf ball size hail in and around Valley Station in Jefferson County. Numerous cars were damaged by the hail, which caused at least $5,000 in property damage. This number is likely low due to limited post-storm reporting. Hail described as "large size" also fell on the National Weather Service weather station in Highview.

April 2, 2006: On April 2, 2005, a thunderstorm released quarter size hail that broke windows along Bardstown Road. This storm caused at least $2,000 in property damage. This number is again likely low due to limited post-storm reporting. Hail also fell in Fairdale and caused an unknown amount of damage.

October 18, 2007: A cold front with strong upper level support collided with a very moist air mass over the lower Ohio Valley. The result was a widespread outbreak of severe thunderstorms, and six confirmed tornadoes. The storms produced property damage, downed trees and power lines, and large hail with many confirmed stones being larger than 1.25-inches in diameter falling in the Crescent Hill area. Approximately $1,000,0000 in damages were reported.

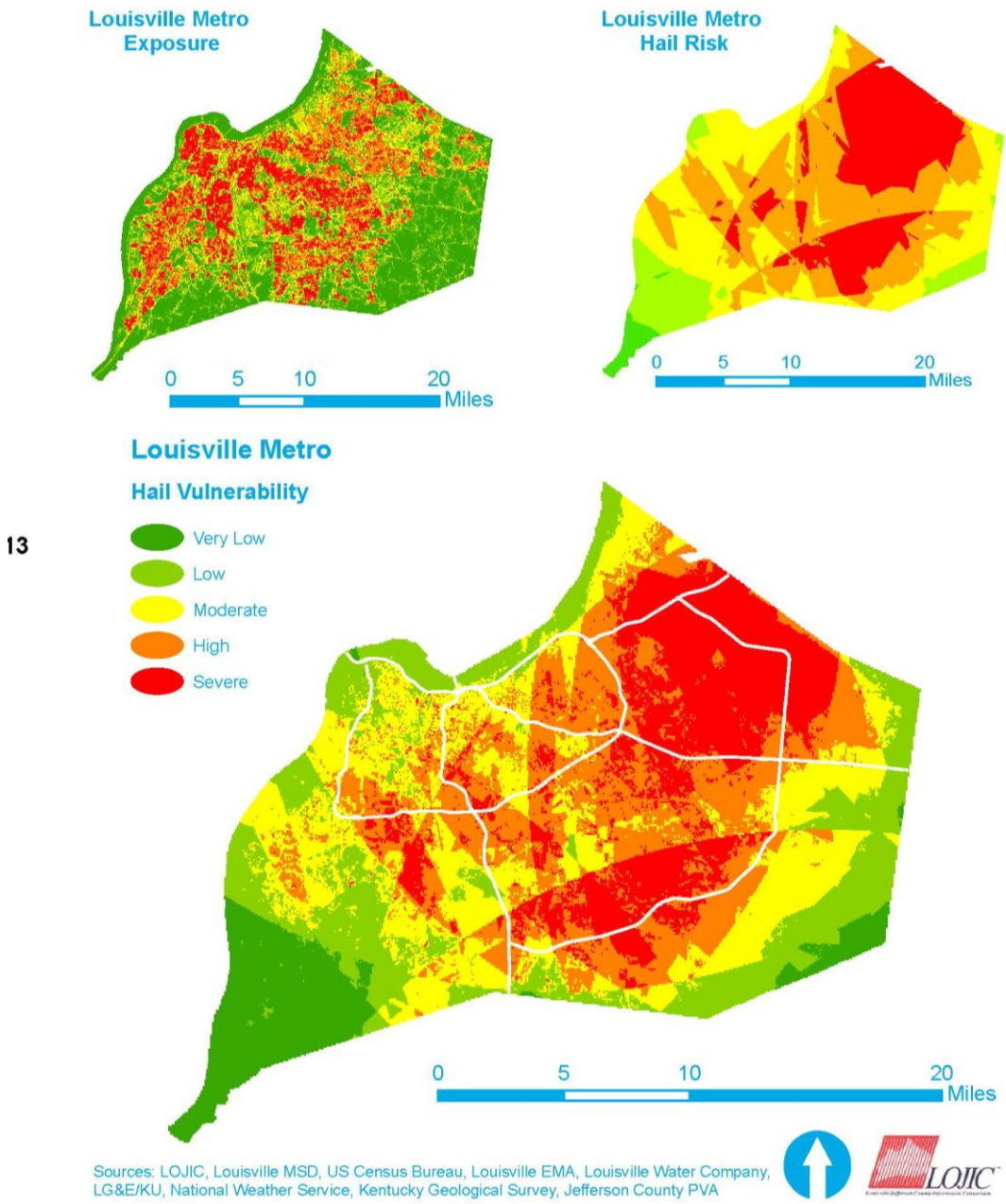
April 28, 2012: During the late afternoon on April 28th, a stationary boundary lay across southwestern Indiana, across the city of Louisville and extending southeastward to just south of Lexington. A cluster of severe storms developed over southern Illinois during the early afternoon. One storm became predominate, growing into a high precipitation supercell that tracked east southeast along the boundary. After spreading widespread large hail across southern Indiana, this storm tracked right across the Louisville metropolitan area. Large hail fell along a path from Shively, through Churchill Downs and Louisville International Airport, to the Fern Creek neighborhood and Billtown Road just south of Jeffersontown. Hail size averaged around 1.5 inches across the metropolitan area, with 2 inch hail reported from just east of Fern Creek. The storm began to weaken as is crossed Spencer and Shelby Counties southeast of Louisville. No official damage estimates are available.

July 20, 2018: Rounds of severe storms hammered southern Indiana and central Kentucky on Friday, July 20, 2018, bringing very large hail, wind damage, heavy rain, and 4 confirmed tornadoes. The largest hail report the National Weather Service received was 4 inches in diameter (softball size) in Tompkinsville, just north of the Tennessee border. Louisville Metro had 11 hail reports within 10 miles of the city center. The largest report of hail near Louisville was 2.00 inches falling in the area of Churchill Downs racetrack. As with many hail storms, no official damage estimates are available.

5.8.3 Assessing Vulnerability

To determine hail vulnerability, hail paths from 1955-2021 were downloaded from the SVRGIS page for the NOAA Storm Prediction Center https://www.spc.noaa.gov/gis/svrgis/ . These were buffered by 25m and intersected with the countywide grid and attributed accordingly.

Figure 5-32: Louisville Metro Hail Vulnerability Map

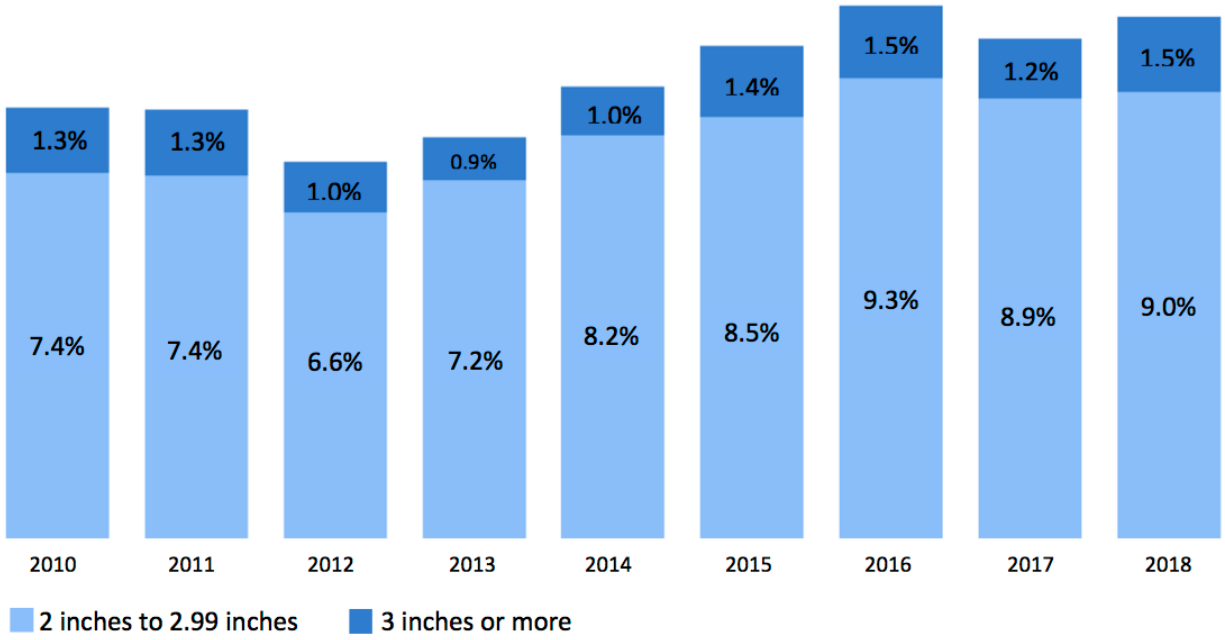


Identifying individual structures and estimating potential losses from Hail's is a challenging endeavor. Without any current spatial data that truly identifies Hail hazard boundaries, it is assumed that the entire county has equal vulnerability and the potential to be damaged from Hail's. That being stated it is assumed that each structure within Louisville Metro has an equal chance of being affected by a Hail. To estimate which structures could be damaged from a Hail it is assumed that all structures could be damaged, although this is highly unlikely.

However there has been data captured to derive an Annualized Loss number for Hail, which states that Louisville Metro will average $$222,411 of loss per event.

5.8.4 Climate Assessment

Although the propensity of hail to form is difficult to model, trends indicate increasing sizes of hail in recent years. One modeling study indicates increasing hail size, but not frequency. Researchers at the National Center for Atmospheric Research have found that in a future climate, there will be more strong thunderstorms and fewer weak ones. This indicates the potential for an increase in hailstone size because stronger thunderstorms cause the hail to be cycled through the cloud layer for a longer time.Figure 5-33: Average Hail Size since 2010



Between 2010 and 2017, 8.8% of U.S. severe hail reports included hail larger than 2 inches in diameter. Figure 5-33 includes a chart from The Conversation (data from NOAA's Storm Prediction Center). These data show hail stones are getting larger over time.

Climate Risk

Little is known about the impacts of climate change on hailstorms. Compared to floods, tornadoes, and hurricanes, hail has received relatively little research attention, although a 2018 North American Workshop on Hail and Hailstorms shed additional light on the hazard.[48]

Researchers hope to develop a better understanding of the characteristics and geography of future hailstorms, to inform decision-makers, the insurance industry, and the general public. Not much is known what effect climate change might have on hail climatology, although a 2017 paper in Nature Climate Change used a novel modeling approach to estimate changes in hail frequency and size for 2014–2070, as compared to 1971–2000[49]. They concluded: "Although fewer hail days are expected over most areas in the future, an increase in the mean hail size is projected, with fewer small hail events and a shift toward a more frequent occurrence of larger hail. This leads to an anticipated increase in hail damage potential over most southern regions in spring, retreating to the higher latitudes and the Rocky Mountains in the summer. In contrast, a dramatic decrease in hail frequency and damage potential is predicted over eastern and southeastern regions in spring and summer due to a significant increase in melting that mitigates gains in hail size from increased buoyancy[50]". More information is needed before a qualitative or quantitative assessment can be done on the changing risks of hail for the Louisville Metro region.

[48] https://www.mmm.ucar.edu/north-american-hail-workshop

[49]https://www.researchgate.net/publication/318162606_The_changing_hail_threat_over_North_America_in_response_to_anthropogenic_climate_change

[50]

ww.researchgate.net/publication/318162606_The_changing_hail_threat_over_North_America_in_response_to_anthropogenic_climate_change

5.9 Hazardous Material Release

Hazardous materials are defined as such because of their chemical, physical, or biological nature, which can pose a potential risk to human health, property, or the environment when released. A release may occur by spilling, leaking, emitting toxic vapors, or any other process that enables the material to escape its container, enter the environment, and create a potential hazard.

Potential sources of hazardous material releases include, but are not limited to superfund sites, storage facilities, residences, manufacturers, transportation carriers, hospitals/medical facilities, veterinary hospitals/clinics, and Brownfield sites. The hazard can be explosive, flammable, combustible, corrosive, reactive, poisonous, toxic, or radioactive, and can exhibit qualities of a biological agent. There are also naturally occurring hazardous materials releases. These naturally occurring hazardous material releases may produce the same potential risk to human health as the manufactured chemicals or agents.

Hazardous materials incidents can occur naturally, and during the manufacture, transportation, and storage and use of hazardous materials. These incidents can occur as a result of human error, natural hazards, deliberate deed, or a breakdown in equipment or monitoring systems. The impact depends upon the quantity and physical properties of the hazardous material, environmental and weather factors at the point of release, the type of release, and its proximity to human and wildlife populations and valuable ecosystems.

Hazardous materials, if released, can cause death, serious injury, long-lasting health impacts, and damage to buildings, homes, and other property. Many hazardous materials are both used and shipped daily through Louisville Metro's highways, railroads, waterways, and via pipelines. These substances are most often released as a result of transportation accidents or because of chemical accidents/releases in industrial plants.

In the late 1970s and early 1980s, MSD was at the center of several serious hazardous material incidents that gained regional and national media attention. In 1985, the governments of both the City of Louisville and Jefferson County adopted an ordinance requiring the submittal of a Hazardous Materials Use and Spill Prevention Control (HMPC) Plan by any business that manufactures, uses, or stores hazardous materials in excess of designated quantities. The HMPC plan must state how a business will respond to spills or discharges of these materials. The ordinance also directs the MSD to administer and enforce the program. If an MSD facility is the site of a hazardous material release, Louisville Emergency Services will have enforcement control.

The current Louisville Metro Hazardous Materials Ordinance was approved on July 2, 2007 as Ordinance No. 121, Series 2007, which amended and re-enacted Chapter 95 of the Louisville Metro Code of Ordinances. The purpose of the ordinance is for the protection of public health and safety through the prevention and control of hazardous materials incidents and releases and to require the timely reporting of releases.

According to the Louisville Metro Hazardous Materials Ordinance, a Hazardous Materials Incident is defined as:

> *"The actual release of a hazardous material which:*

1a) poses and imminent threat to the environment or to the health, safety or welfare of either individuals at the site of the incident or of the general populations and,

1b) requires immediate response. Incident assessment, control; containment and abatement of the immediate hazard by an outside agency, or,

2) Involves a reportable quantity of hazardous materials, regardless of whether abatement occurs by employees at the site of the incident or by any outside agencies."

Mitigating the risks associated with hazardous materials may require the application of safety precautions during their transport, use, storage, and disposal. Laws and regulations on the use and handling of hazardous materials may differ depending on the activity and status of the material. For example, one set of requirements may apply to their use in the workplace, while a different set of requirements may apply to spill response, sale for consumer use, or transportation.

This section focuses on incidents that relate to sudden hazardous material releases that occur at facilities and along Louisville Metro area transportation routes. Slower releases such as leaking underground or aboveground storage tanks or leaking pipelines are not applicable to this section.

Hazardous Material Sources

Hazardous materials include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, biohazardous, toxic, pathogenic, or allergenic. Also included are physical conditions such as compressed gases and liquids or hot materials, including all goods containing such materials or chemicals, or may have other characteristics that render them hazardous in specific circumstances.

To help emergency responders become aware of the possible chemicals they may encounter at the locations of an incident, the U.S. Department of Transportation has established a hazardous materials placard system. Railroad cars and trucks carrying chemicals or hazardous wastes must display a diamond-shaped placard that includes a material identification number; a hazard class number and symbol that identifies the material as a flammable liquid or solid, non-flammable or flammable gas, explosive, corrosive, toxic, oxidizer or organic peroxide, environmentally hazardous, or radioactive material.

Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, schools and universities, hospitals, and hazardous materials waste sites. Varying quantities of hazardous materials are manufactured, used, or stored at an estimated

4.5 million facilities in the United States—from major industrial plants to local dry cleaning establishments or gardening supply stores.

EPA's Toxics Release Inventory (TRI) contains data on certain toxic chemicals that are manufactured, processed, otherwise used, and/or managed at thousands of facilities—including federal facilities—throughout the United States and its territories. TRI data reflect, among other things, quantities of chemicals managed by facilities as waste, including those quantities released into the environment, treated, burned for energy, recycled, and transferred from one facility to another for release or further management. The TRI also has information on how facilities are working to reduce or prevent formation of chemical wastes. The TRI is a valuable source of information that supports environmental and human health protection. It is widely used to:

- Identify the locations and quantities of chemical releases to air, water and land, and transfers of chemical waste sent of site to other facilities.
- Learn about a facility's practices for managing toxic chemical wastes; identify potential environmental concerns that may warrant further investigation.
- Measure industry progress toward improving environmental performance.
- Help companies learn from each other's best practices for reducing toxic chemical use and the amount of chemical waste being managed.

According to data as of July 20, 2022, there are 65 facilities currently in the Louisville Metro area identified on the TRI database. These facilities are presented below in Table 5-30:

Table 5-30: TRI Facilities Within Louisville Metro

Tri Facility Id	Facility Name	Address	Submissions
4022WCMMRC12612	CMC Rebar	12612 Avoca Rd, Louisville, 40223	1
4021WKLLYT141S1	Kelley Technical Coatings Inc.	1401 S. 15th Street, Louisville, 40210	2
40272LSVLL14660	Louisville Gas & Electric Co. - Mill Creek Station	14660 Dixie Hwy, Louisville, 40272	21
40258NTRPL7501D	Zschimmer & Schwarz Interpolymer	7501 Distribution Dr, Louisville, 40258	5
4029WRFNSM1271P	Eurofins MWG Operon LLC.	12701 Plantside Drive, Louisville, 40299	2
40213FRDMTFERNV	Ford Louisville Assembly	2000 Fern Valley Rd, Louisville, 40213	16
40203FRTHT600BE	Forth Technologies Inc.	600 Bergman Ave, Louisville, 40203	2
40225GPPLNAPPLI	GE Appliances A Haier Co - Appliance Park	4000 Buechel Bank Rd, Louisville, 40225	7
40222FRDMT3001C	Ford Motor Co Kentucky Truck Plant	3001 Chamberlain Ln, Louisville, 40241	16

Tri Facility Id	Facility Name	Address	Submissions
40216RHMND4300C	Rohm & Haas Louisville Pl Ant	4300 Campground Rd, Louisville, 40216	12
40211RYNLD4101C	Eckart America Corp	4101 Camp Ground Rd, Louisville, 40211	3
40201RCCRB4400B	Carbide Industries LLC.	4400 Bells Ln, Louisville, 40211	1
40299RSSTC11208	Russtech Admixtures Inc.	11208 Decimal Dr, Louisville, 40299	2
40210ZCHMX1314S	Zeochem LLC.	1314 S 12th St, Louisville, 40210	1
40216MTHRS2287R	Ferrara Candy Co.	2287 Ralph Ave, Louisville, 40216	1
40258RPBLC731LG	Republic Conduit Manufacturing	7301 Logistics Dr, Louisville, 40258	7
40214BNKWR5540N	Beneke Wire Co.	5540 National Turnpike, Louisville, 40214	2
40212NGLHR3400B	BASF Corp.	3400 Bank St, Louisville, 40212	3
40211RYNLD2827H	Reynolds Consumer Products LLC. Louisville Foil Plant	2827 Hale Ave, Louisville, 40211	1
40219CRDNL6910P	Cardinal Aluminum Co. Plant 1	6910 Preston Hwy, Louisville, 40219	2
40211LSVLL4510A	MPLX Terminals LLC. Louisville Ky Terminal	4510 Algonquin Pkwy, Louisville, 40211	11
40214NTDDF163RO	BAE Systems	163 Rochester Dr, Louisville, 40214	4
40214LRDNC7753N	Louisville Packaging	7745 National Turnpike, Louisville, 40214	6
40209RLNCN4730C	Allnex USA Inc.	4730 Crittenden Dr, Louisville, 40209	13
40201GLDNF2500S	Aarhuskarlshamn Aak	2520 S 7th St, Louisville, 40216	1
40210TRSTT1133O	Tri-State Plating Inc..	1125 S 12th St, Louisville, 40210	3
40213PTMTV4415E	Faurecia Exhaust Systems Inc Louisville Plant	4415 E Indian Trail, Louisville, 40213	1
40206RMRFD1200S	Swift & Co.	1200 Story Ave, Louisville, 40206	1

Tri Facility Id	Facility Name	Address	Submissions
40211ZNCHM4100B	Zeon Chemicals LP	4100 Bells Ln, Louisville, 40211	9
40272KSMSC15301	Kosmos Cement Co LLC.	15301 Dixie Hwy, Louisville, 40272	5
4021WGNRLQ33FER	General Equipment & Manufacturing Co Inc.	3300 Fern Valley Rd, Louisville, 40213	1
40202MRCSP235EM	Marcus Paint Co.	235 E Market St, Louisville, 40202	1
40213NTDCT4900C	Clariant Corp. Crittenden Drive Facility	4900 Crittenden Dr, Louisville, 40209	11
40219CRDNL4005O	Cardinal Aluminum Co Plant No. 3	4005 Oaklawn Dr, Louisville, 40219	7
40216SPRRS4211B	Superior Industrial Solutions Inc.	4211 Bramers Ln, Louisville, 40216	15
40211LSVLL4401B	Chevron Louisville Terminal/Lubricants Blend Plant	4401 Bells Ln, Louisville, 40211	1
4021WNDPND3615K	Forterra Concrete Industries Inc.	3615 Kramers Ln, Louisville, 40216	1
40208MRCNB2300S	American Bluegrass Marble Co Inc.	1510 Algonquin Pkwy, Louisville, 40210	1
40210KLLYT1445S	Kelley Technical Coatings Inc.	1445 S 15th St, Louisville, 40210	2
4021WFLSVL7625N	AAF Louisville Cartridge Plant	7625 National Tpke - Louisville, 40214	1
40211CNSLV3601R	Frontier Logistical Services LLC.	3601 Ralph Ave, Louisville, 40211	4
4021WKCHFL841AB	Koch Filter Corp.	8401 Air Commerce Dr, Louisville, 40219	1
40219CLDWL4000T	Caldwell Tanks Inc.	4000 Tower Rd, Louisville, 40219	4
40210HNRYV1000W	Vogt Ice LLC.	1000 W Ormsby Ave Louisville, 40210	2
40216LSVLL3920K	MPLX Terminals LLC. Louisville Ky Terminal	3920 Kramers Ln, Louisville, 40216	11
40216LFTCH4350C	Altuglas Louisville Plant	4350 Campground Rd, Louisville, 40216	2
4021WTNNNT567NB	Tennant Co.	5607 National Tpke, Louisville, 40214	1

Tri Facility Id	Facility Name	Address	Submissions
40210STHRN1335S	BYK USA Inc.	1335 S 13th St, Louisville, 40210	2
40258KNTCK77INT	Kentucky Trailer Paint	7070 International Dr, Louisville, 40258	1
4025WNHKSP16FRE	NHK Spring Precision of America	10600 Freeport Drive, Louisville, 40258	3
40214BYLSG6310K	Azz Galvanizing Services-Louisville	6310 Kenjoy Dr, Louisville, 40214	2
4021WDPNTL425CA	Dupont Louisville Plant	4250 Camp Ground Rd, Louisville, 40216	2
40216DPNTL4200C	Chemours Louisville Plant	4200 Camp Ground Rd, Louisville, 40216	7
40210NTDCT1227S	Clariant Corp 12th Street Facility	1227 S 12th St, Louisville, 40210	14
40211BFGDR4100B	Lubrizol Advanced Materials Inc.	4200 Bells Ln, Louisville, 40211	13
40258MRTHN8600C	Marathon Petroleum Co - Louisville Cane Run Terminal	8600 Cane Run Rd, Louisville, 40258	4
4022WFRCNT2STAN	Faurecia Interior Systems	2000 Stanley Gault Pkwy, Louisville, 40223	1
40214LSVLL7657N	Louisville Cooler Manufacturing Co.	7635 National Turnpike Louisville, 40214	1
40258MSMTL711IN	Misa Metal Fabricating Inc.	7101 International Dr, Louisville, 40258	5
40210PRLouisville Metro1620B	Parallel Products of Kentucky	1620 Bernheim Ln, Louisville, 40210	1
40214SFTYK261EI	Safety-Kleen Systems Louisville	261 Eiler Ave, Louisville, 40214	3
40214LYMPC6804E	Ppg Architectural Coatings	6804 Enterprise Drive, Louisville, 40214	5
40216BRDNN6200C	Bakelite Synthetics	6200 Campground Rd, Louisville, 40216	15
40216MRCNS4500C	American Synthetic Rubber Co.	4500 Campground Rd, Louisville, 40216	13
4021WNLSTL48ALL	O'Neal Manufacturing Services	4800 Allmond Ave, Louisville, 40214	3

These facilities have been identified as releasing hazardous materials into the environment. It should be noted that "release" refers to different ways that toxic chemicals from these industrial facilities enter the air, water, and land, most of which are regulated under various permits. In

addition, according to the U.S. EPA Envirofacts database, there are literally hundreds of facilities with the Louisville Metro area that use and store hazardous materials.[51] Each one of these facilities, and likely many others that do not report as required, is capable of having a release incident.

Louisville Metro Hazardous Material Release Technical Capabilities

The overwhelming number of hazardous material releases in Louisville Metro are minor in nature and are remediated quickly with little concern. However, there have been and likely will continue to be spills and releases of hazardous materials that will affect human health and the environment. When these occur, the need for skilled technical response teams is critical.

Through their Hazardous Materials Program, the Louisville Metro Environmental Division responds to hazardous material (chemical, biological or radiation) releases 24 hours a day, 7 days a week[52]. Responses are made at the request of a fire district or when public health and safety is threatened.

Program staff routinely work with all Metro Louisville Fire Districts, the Air Pollution Control District, MSD, Louisville Metro Emergency Services, and Metro Police, all of whom have trained hazardous material response teams. Staff at each agency is trained to perform many functions at a hazardous materials incident, including:

- Determine the health impact to the community by the release
- Assist the responding agencies to ensure responder safety
- Utilize monitoring and other equipment to determine the material released and to make a hazard assessment
- Advise responsible parties to ensure proper cleanup after the release

Louisville Fire Department Hazardous Materials Specialists oversee matters pertaining to production, processing, storage, transportation, and disposal of hazardous materials in the community. There are over 700 locations storing hazardous materials, and an annual review and inspection of these properties is required. The Fire Department is also responsible for "Community Right to Know" information, which is provided from the federal government and distributed to applicable fire stations. Finally, program staff also investigates improper disposal, environmental crime, and indoor air quality complaints during regular business hours, and provides training to external agencies in areas of their expertise.

5.9.1 Hazard Profile and Consequence Analysis

Table 5-31 represents the typical hazard profile associated with Hazardous Material release.

[51] https://enviro.epa.gov/enviro/find.html?zipcode=Jefferson+County%2C+KY&x=14&y=11

[52] https://louisvilleky.gov/government/health-wellness/hazardous-materials

Table 5-31: Profile Risk Table Hazardous Material Release:

Period of occurrence:	Anytime
Number of events:	1,000+ per year (the majority of which are related to vehicular accidents)
Probability of events:	Annually – Hundreds of hazard event likely to occur every year
FEMA Risk Rating/Score:	Not Applicable
Warning time:	None
Potential impact:	Impacts human life, health, and public safety. Mass evacuations and potential surge medical events.
Potential of injury or death:	Medium. HazMat incidents have a moderate potential for injury or death.
Possible Extent:	The extent of a hazardous material release varies in terms of the quantity of material being transported as well as the specific content of the container. The main concern during a release or spill is the population affected. This plan will therefore consider all buildings located within the county as vulnerable. In February 1981, Ralston-Purina was responsible for a series of large explosions in Louisville's sewer system, causing damages to roadways, vehicles, and homes in the area of Old Louisville. Over $20million was awarded in damages.

Industrial community hazardous materials can be found almost anywhere, and releases of the materials into the environment can be deadly events. These releases can occur at almost any time, but in conjunction with another natural disaster such as a flood or earthquake, the damages can multiply exponentially.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and Plan stakeholders, has been performed to better understand and outline the potential impacts that a severe Hazardous Material Release would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-32.

Table 5-32: Consequence Analysis Hazardous Materials Release

Subject	Impacts
Health and Safety of the Public	Chemicals that are dangerous to human health can be found almost everywhere and are used on a daily basis. Therefore, a hazardous material incident could occur anywhere at any time and it could occur in a variety of ways. Depending on the type and quantity of chemicals released and the weather conditions, an incident can affect larger areas that cross jurisdictional boundaries. When hazardous substances are released in the air, water or on land they may contaminate the environment and pose danger to human health. Exposure may be either acute or chronic, depending upon the nature of the substance and extent of release and contamination.
Health and Safety of Responders	Although first responders are trained in hazardous material incident response, the very nature of their responsibilities put them at risk.

Subject	Impacts
Vulnerable Populations	Vulnerable populations are at particularly at risk from hazardous material incidents. This is because poor and less educated area typically are found near both industrial lands and major transportation routes.
Continuity of Operations (including delivery of services)	Hazardous materials incidents likely will have little to know effect on Louisville Metro's ability to provide government services.
Property, Facilities, and Infrastructure	Potential losses to property caused by a hazardous material incident, whether in transit or at fixed sites, is difficult to quantify. The degree of damages depends on the scale of the incident. Potential losses may include inaccessibility, loss of service, contamination and/or potential structural and content losses if an explosion occurs. The closure of waterways, railroads, airports, and highways as a result of a hazardous materials incident has the potential to impact the ability to deliver goods and services efficiently. Potential impacts may be local, regional, or statewide depending on the magnitude of the event, its timing, and level of service disruptions.
Environment	Hazardous materials that are released into the environment can be harmful to species and their habitats. Hazardous materials that get into waterways will be disruptive and sometimes deadly to aquatic species. Consequentially, these materials can also contaminate drinking water supplies. Hazardous materials released into the environment can also leach into soils and travel with wind, which not only impacts the localized habitat, but can create issues for surrounding communities.
Economic Conditions	If a significant hazardous materials incident occurred, not only would life, safety, and building stock be at risk, but the economy of Louisville Metro may be impacted as well. A significant incident in an urban area or Rubbertown may force businesses to close for an extended period of time because of contamination or direct damage caused by a possible explosion. Estimated impacts on the economy are difficult to determine, given the uncertain nature of the size and scope of incidents. Hazardous material incidents have the potential to lead to major transportation route closures, to include waterways, railroads, airports, and highways. This in tourn can affect the ability to deliver goods and services. Potential impacts may be contained to the Louisville Metro area, the Kentuckiana Region, or statewide (including neighboring Indiana), depending on the magnitude of the event and the level of services disruptions.
Public Confidence in Louisville Metro Governance	If a significant hazardous Materials incident occurred in the Louisville Metro area that is not contained in a timely fashion, confidence is Louisville Metro government will be tested. This is especially true if public health issues are perceived to exist. Louisville Metro and MSD have invested significant resources into hazardous material incident clean-up capabilities. If these capabilities fail, the public will want accountability.

5.9.2 Significant Louisville Metro Hazardous Material Release Occurrences

According to FEMA's Data Visualization Tool, there has been one Declared Disaster in the Louisville Metro area related specifically to a Toxic Substance Release. This incident is described below:

February 13, 1981: In an incident commonly referred to as the "The Sewer Explosions," two women going to work at a hospital drove under the railroad overpass on Hill Street near 12th Street when there was a gigantic blast, and their car was hurled into the air and onto its side. At the same time, a police helicopter was heading toward the downtown area when the officers saw an unforgettable sight: a series of explosions, "like a bombing run," erupting along the streets of Old Louisville and through the University of Louisville campus.

More than 2 miles of Louisville streets were pockmarked with craters where manholes had been and several blocks of Hill Street had fallen into the collapsed, 12-foot-diameter sewer line. Miraculously, no one was seriously hurt, but homes and businesses were extensively damaged, and some families had to be evacuated. Louisville was in the headlines and on broadcast news throughout the country for several days.

Hill Street after the 1981 Sewer explosions
Source: historycollection.com

The cause of the explosion was traced to the Ralston-Purina soybean processing plant southeast of the university campus, where thousands of gallons of a highly flammable solvent, hexane, had spilled into the sewer lines. The fumes from the hexane created an explosive mixture, which lay in wait in the larger sewer lines. As the women drove under the overpass, a spark from their car apparently ignited the gases.

Several blocks of Hill Street soon became an open trench, as crews cleared away the debris and prepared to replace the sewer line. The trench remained open throughout the summer while work continued. It took 20 months to repair the sewer lines, and another several months to finish the work on the streets.

Ralston-Purina pleaded guilty of four counts of violating federal environmental laws and paid a fine of $62,500. In February 1984, the company agreed to pay MSD more than $18 million in damages. Many millions more were paid to other government agencies and private individuals who suffered damage. By 1985, the city passed a law giving MSD the right and obligation to regulate hazardous materials.

In addition to this event, there have been several other significant hazardous material incidents that have adversely affected the Louisville Metro area. These are described below.

March 17, 1977: "Hexa" and "Octa" Event: employees at the Morris Forman water treatment plant noticed a strong chemical odor that made them sick. It was the beginning of an environmental incident that would set legal precedent in the United States. It took more than a week to identify the highly toxic chemicals used in pesticides as a mixture of hexachloropentadiene and octachlorocyclopentene, quickly abbreviated to "hexa" and "octa." The contaminated treatment plant was shut down on March 29th, discharging 100 million gallons of untreated wastewater into the river each day.

The U.S. Army sent teams wearing protective gear into the sewers to find the source of the chemicals, and the FBI joined the investigation. June 7th, a federal grand jury charged Donald E. Distler, president of Kentucky Liquid Recycling, and two of his employees with dumping toxic chemicals into the sewers. The chemicals were wastes that had been sent to Distler's company for disposal, and Distler's company dumped them down a manhole in western Louisville.

The treatment plant was shut down for nearly three months while the contaminated material was removed—three months of discharging all the raw sewage into the river. It took another two years to remove the contaminated material from the sewer lines—years during which the raw sewage from these lines was shunted around the plant and into the river.

In September 1979, the month the cleanup ended, Distler was found guilty—the first time an individual was convicted in a trial of federal criminal charges of polluting a waterway. He was sentenced to two years in prison and fined $50,000. After appealing all the way to the U.S. Supreme Court, he was sent to prison in early 1982.

In January 1983, the companies that had originated the waste—Velsicol Chemical Corp. of Chicago and Chem-Dyne Corp. of Hamilton, Ohio—agreed to pay MSD $1.9 million for the medical costs of employees and the cost of cleaning up the sewers and the treatment plant.

December 1, 2017: On December 1, 2017, Zeon Chemicals accidentally released over 700 pounds of 1,3 butadiene when the chemical was inadvertently transferred to the wrong tank. This release occurred over an eight-hour period into the ambient atmosphere. Zeon was fined $2,000 and required to implement several additional safety features, including installing more protective valves and piping, and instituting training programs on safely handling hazardous materials.

November 19, 2021: At 2:20 a.m. Friday morning, a gas known as a cancer-causing substance sprayed out of a relief valve in the Zeon Chemical Plant on Bells Lane, causing Pleasure Ridge Park Fire Department's HAZMAT team to respond. The gas, formally called "1,3-Butadiene," was released into the air for three minutes, according to Louisville Metro Air Pollution Control District spokesperson Matthew Mudd. The chemical is used in the production of synthetic rubber products.

The release was caused when a reactor pressurized as an agitator malfunctioned. An employee with Louisville Emergency Services said about 10 pounds of the gas escaped into the air—not enough to be an immediate threat to nearby neighbors.

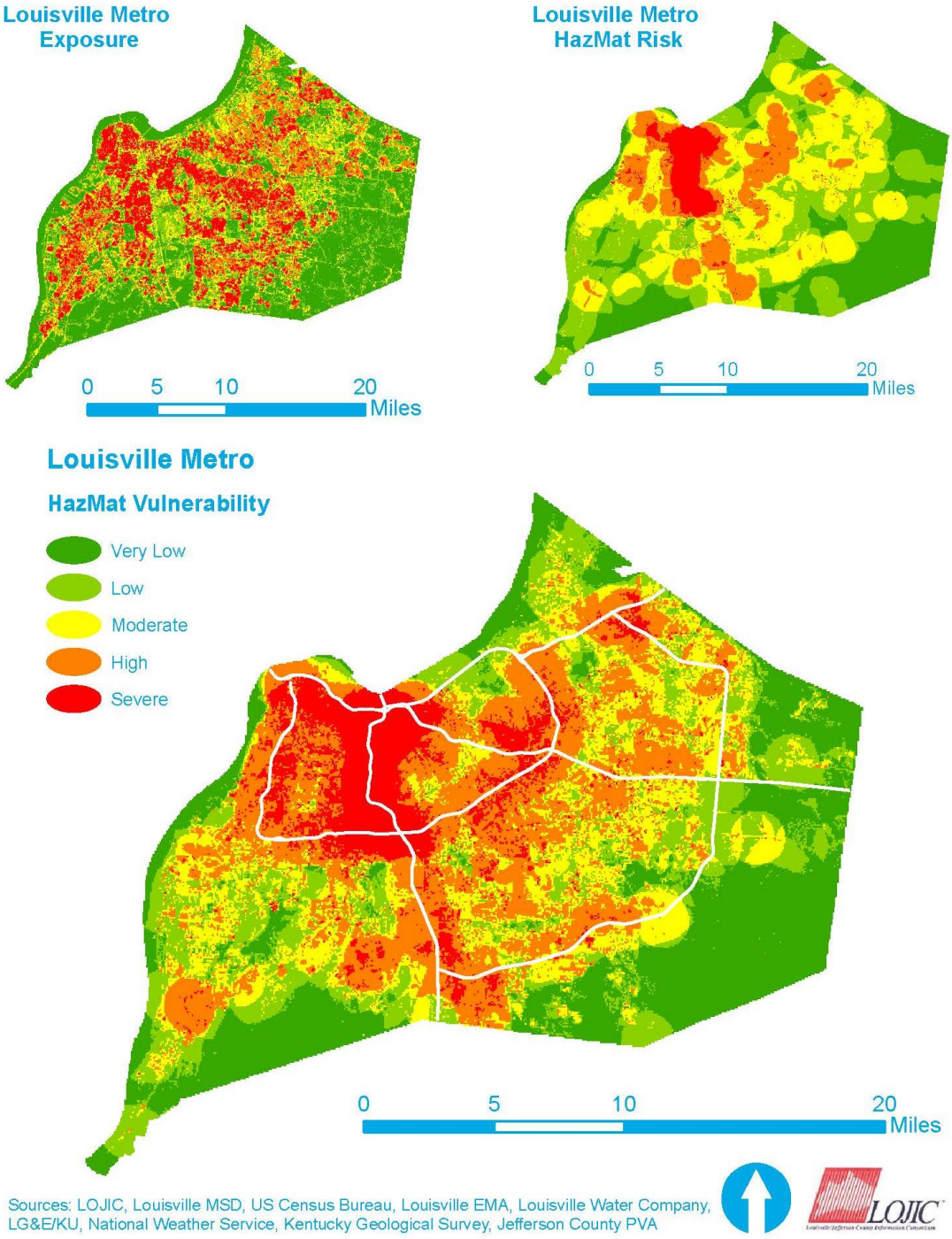
March 11, 2022: On March 11, Louisville Metro emergency management agencies to include the Health Department and MSD, responded to complaints of an odor in the area near a chemical

manufacturer. People who lived in the area said they woke up with the smell, and texted nearby neighbors to ask if they also smelled the odor. The odor was identified as Styrene, a chemical used to make things such as latex and synthetic rubber, which had accidentally spilled into the sewer system. The source came from Allnex, a chemical manufacturer on Crittenden Drive near the Southside neighborhood.

5.9.3 Assessing Vulnerability

Because the overwhelming majority of HazMat releases occur due to transportation accidents, mapping vulnerability took interstates, parkways, railroads and Kentucky or US Highway and buffered them by one mile. Grid cells with the highest count of buffers intersecting them received the highest risk score.

Figure 5-34: Louisville Metro HazMat Vulnerability Map



Identifying individual structures and estimating potential losses from hazardous materials (HazMats) is a challenging endeavor. Without any current spatial data that truly identify HazMat boundaries, it is assumed that the entire county has equal vulnerability, and the potential to be damaged from HazMats. It is assumed that all structures could be damaged by a HazMat

incident, although this is highly unlikely. A listing of critical facilities and infrastructure highly vulnerable to HazMat incidents is presented in Appendix E.

5.9.4 Climate Assessment

According to a September 2022 article published through Springer Link, natural hazards are the underlying cause of between 1 and 7 percent of federally reported HazMat releases in the US every year[53]. During the period from 1990 through 2019, the fraction of releases caused by natural hazards has increased, in large part due to increased releases from hurricanes, as well as floods, storms, and wind. Many of these events are minor, but some have resulted in large and expensive releases, as well as deaths, injuries, and evacuations. The variability of these releases is correlated with occurrence of extreme weather and associated climate indices. Given observed and future predicted increases in extreme weather events, it is likely many of these types of releases will continue to increase. Greater attention to management of natural hazard risk to industry, and particularly to bulk storage facilities, is required to prevent further increase in the frequency and severity of these events.

In addition, in February 2022, the U.S. General Accounting Office (GAO) released Report GAO-22-104494 to address threats climate change pose to facilities that make, use, handle, or store hazardous substances.[54] The report found that more than 11,000 facilities across the nation have extremely hazardous chemicals in amounts that could harm people, property, or the environment if accidentally released. Risks to these facilities include those posed by natural hazards, which may damage the facilities and potentially release the chemicals into surrounding communities. GAO was asked to review climate change and how it would affect risks at these facilities. The GAO made six recommendations, including that EPA issue regulations, guidance, or both to clarify requirements and provide direction to facilities on incorporating natural hazards and climate change into risk management programs.

Climate Risk

Based on the best available scientific information and trends, it is likely that HazMat incidents will worsen in Louisville with increased extreme events, including larger storms, more flooding, and increasing heat. Regulations related to the use, storage, and transportation of these materials are likely forthcoming to address the effects of climate change. These regulations will affect private industry, MSD, and Louisville Metro agencies tasked with managing and responding to HazMat releases.

[53] https://link.springer.com/article/10.1007/s11069-022-05572-9

[54] https://www.gao.gov/assets/gao-22-104494-highlights.pdf

5.10 Karst Terrain/Land Subsidence/Sinkholes

Derived from a Slavic word meaning "barren, stony ground," the term karst has been variously used to describe a landscape, a geologic setting, and a type of aquifer characterized by features formed by the dissolution of soluble bedrock. The technical definition of karst is:

> *"A terrain, generally underlain by limestone or dolomite, in which the topography is chiefly formed by the dissolving of rock and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, and caves.*[55]*"*

Another definition of karst describes groundwater flow in a karst aquifer as follows:

> *"A karst aquifer has fast and turbulent flow of groundwater in secondary porosity (features, bedding planes, and small conduits) and in tertiary conduits and caves."*

As further described in the Kentucky State Hazard Mitigation Plan,

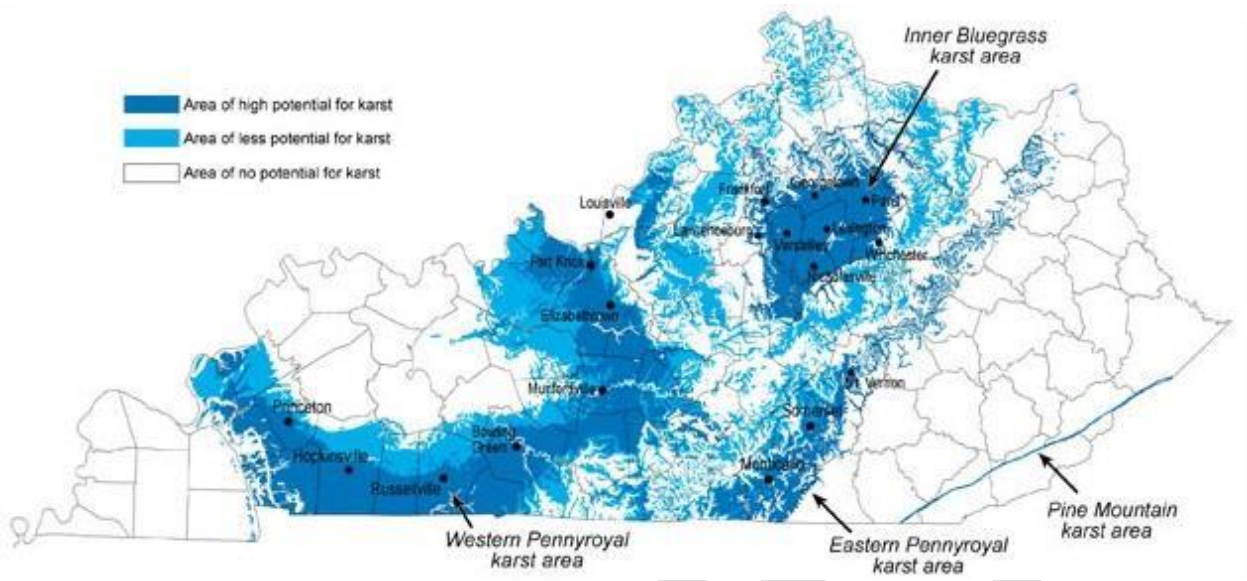
> *"Karst has a wide geographic distribution, covering approximately 13 percent of Earth's land surface, and is present on almost every continent underlain by carbonate rocks of various geologic age (Ford and Williams, 2007). In the United States, approximately 18 percent of all exposed or shallow bedrock exhibits, or has the potential for forming, karst or karst-like features (Weary and Doctor, 2014). Many geologic, topographic, and climatologic factors influence the development of karst, and not all karst features—such as sinkholes, caves, and springs—are present to the same extent or develop in the same way in every karst area. For example, although the occurrence and formation of sinkholes in Florida are often used for conceptual and comparative purposes, karst features there have formed in bedrock and under very different geologic and hydrogeologic conditions from karst features in Kentucky. Although comparing karst characteristics in the various states can be useful and informative, karst features are also locally to regionally unique, so that karst features in one state may not be completely analogous to those in another."*

According to the Kentucky Geological Survey, Kentucky is one of the most famous karst areas in the world. Much of the state's beautiful scenery, particularly the horse farms of the Inner Bluegrass, is the result of development of karst landscape. The karst topography of Kentucky is mostly on limestone, but some is also on dolostone. The areas where those rocks are near the surface closely approximate where karst topography will form.

Figure 5-35 shows the outcrop of limestone and dolostone, and closely represents the karst areas. The bedrock is millions of years old, and the karst terrain formed on it is hundreds of thousands of years old. In humid climates such as Kentucky's, it should be assumed that all limestone has karst development, although that development may not be visible at the surface.

[55] (Monroe, W.H., 1970, A glossary of karst terminology: U.S. Geological Survey, Water-Supply Paper 1899, 26 p.)

Figure 5-35: Outcrops of Limestone/Dolostone that Closely Represent Karst Areas



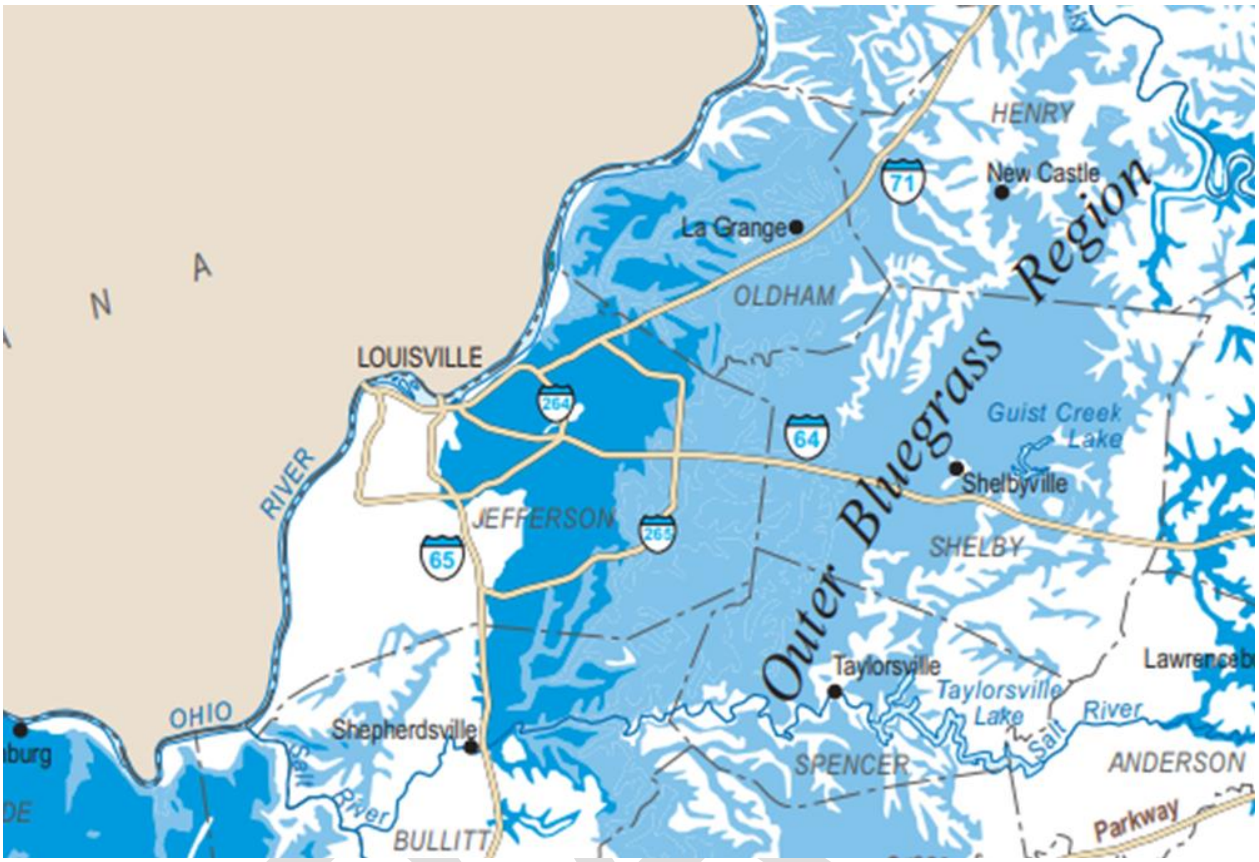
The outcrop area of the limestone bedrock in Kentucky has been used to estimate the percentage of karst terrain or topography in the state. About 55 percent of Kentucky is underlain by rocks that could develop karst terrain, given enough time. About 38 percent of the state has at least some karst development recognizable on topographic maps, and 25 percent of the state is known to have well-developed karst features. Some Kentucky areas located on karst include Frankfort, Louisville Metro, and Lexington. It should be noted that according to the map above, a significant section Louisville Metro is mapped as having "Area of no potential for karst." Although this is true for the downtown area and lands southwest of downtown, the eastern section of Jefferson County is home to karst formations.

A "Livability" Goal in Plan 40 indicates that future land use developments "Determine site susceptibility to erosion; identify the presence of on-site carbonate conditions and features that are vulnerable to site disturbance; identify the extent of existing groundwater use and the impacts of the project on groundwater resources, flow patterns, and existing and proposed surface drainage. Then mitigate potential hazards to such systems resulting from the project."

Karst Landscape

A karst landscape has sinkholes, sinking streams, caves, and springs. Geologists have adopted karst as the term for all such terrain. The term "karst" describes the whole landscape, not a single sinkhole or spring.

A karst landscape most commonly develops on limestone, but can develop on several other types of rocks, such as dolostone (magnesium carbonate or the mineral dolomite), gypsum, and salt. As noted on the figure below, precipitation infiltrates into the soil and flows into the subsurface from higher elevations and generally toward a stream at a lower elevation. Weak acids found naturally in rain and soil water slowly dissolve the tiny fractures in the soluble bedrock, enlarging the joints and bedding planes.



Although the majority of karst events occur out of sight and go unreported, the estimated damage caused by karst hazards every year in Kentucky is between $0.5 million and $1 million.

Karst as a Geologic Hazard

A geologic hazard is a naturally occurring geologic condition that may result in property damage or is a threat to the safety of people. Many hazards to man-made structures can be associated with the type of bedrock, the presence of faults, and other earth processes that occur in Kentucky. Earthquakes get the most press coverage and are the most notorious. However, annually, landslides, shrink-swell soils, and flooding cause more damage than earthquakes in Kentucky because they occur more often. Although karst hazards cause less damage than earthquakes, they can still have devastating effect on properties, infrastructure, and people. Four geologic hazards are associated with karst include:

- Cover-collapse sinkholes, which occur when covering sediments contain a significant amount of clay.
- Sinkhole flooding, which causes the most damage to buildings.
- Increased radon concentrations, which are found in basements and crawl spaces of houses built on karst.
- Increased pollution threats, due to karst hydrogeology making groundwater vulnerable to increased pollution.

Each of these situations creates a hazard to the Louisville Metro population.

5.10.1 Hazard Profile and Consequence Analysis

Table 5-33 represents the typical hazard profile associated with Karst and Sinkholes.

Table 5-33: Profile Risk Table Karst Terrain/Land Subsidence/Sinkholes

Period of occurrence:	Anytime
Number of events:	Actual events unknown; however, there have been 443 mapped sinkholes in Louisville Metro area.
Probability of events:	Frequent - Karst/Sinkholes are likely to occur within 25 years (>4% chance of occurrence in any given year).
FEMA Risk Rating/Score:	Not Applicable. No FEMA data on this hazard.
Warning time:	None to months, based on monitoring.
Potential of injury or death:	Low. There are no reported injuries or deaths related to Karst and/or sinkholes in the Louisville Metro area.
Possible Extent:	Typical sinkholes in the area are one-foot to ten foot in width, and cause destruction to small sections of a roadway or parts of a structures. The best example of a sinkhole creating damage occurred recently at the Louisville Zoo.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, has been performed to better understand and outline the potential impacts that a significant land subsidence/sinkhole would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services, property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in the table below:

Table 5-34: Consequence Analysis Karst Terrain/Land Subsidence/Sinkholes

Subject	Impacts
Health and Safety of the Public	Landowners across the Louisville Metro area are at risk to impacts from a soil movement event. Impacts to the public include potential for injury or loss of life, and destruction and/or loss of land and property due to emergencies from soil movement.
Health and Safety of Responders	First responders, such as fire and police, would be called to support specific incident area(s) across the Louisville Metro area dealing with sinkholes and land movements. For a soil movement event, as with all disaster events, responders face the risk of personal injury while performing necessary job functions.
Vulnerable Populations	While karst and sinkholes are more likely to occur in rural areas than cityscapes, they still will have an increased effect on vulnerable populations. Vulnerable populations are at particularly at risk from karst and sinkholes

Subject	Impacts
	because they likely do not have the financial means to recovery from incidents. Although insurance may cover some losses, studies show that people from lower income levels do not have sufficient coverage to address total structure losses.
Continuity of Operations (including delivery of services)	The impacts on continuity of operations would be limited, unless a facility or critical infrastructure component is within the area of movement zone associated with the soil movement. Delivery of services may be slowed or halted in adjacent areas if key roadways become impassable due to debris blockages or loss of structural integrity.
Property, Facilities, and Infrastructure	Home and landowners within karst and sinkholes zones may experience damage to or loss of property depending upon the severity of movement in the area. Infrastructure may experience impacts in the form of damage to roads and bridges, temporary closure of transportation routes, the potential inability of the stormwater system to handle floodwaters, and loss of power.
Environment	Erosion and debris flows would be the major impact to the environment during a significant incident of karst and sinkhole development.
Economic Conditions	A karst and sinkhole event would typically be more localized and costly for local governments because of the potential for damages from flooding. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event if insurance was unavailable.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively Louisville Metro responds to and remediates the damages associated with a karst or sinkhole event.

5.10.2 Significant Louisville Metro Karst Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in the Louisville Metro area related specifically to karst or sinkhole events.

The most noticeable hazards associated with karst in Kentucky are sinkhole flooding and cover collapse. Soil collapses are common in karst terrain, where water drains to caves through fissures in the bedrock. Over time, domes of soil form over these fissures, and new development increases the drainage into these fissures, forming a sinkhole. Unfortunately, collapses are seldom reported to any central agency. This makes identifying sinkholes and karst events difficult. However, there has been one high profile event that recently occurred in the Louisville Metro area, which is described below.

Louisville Zoo Sinkhole, March 6, 2019: A sinkhole opened up on the grounds of the Louisville Zoo. The sinkhole was nearly the size of a football field and located in an unused part of the zoo's property. Aerial footage showed a section of woods 60 yards wide and 90 yards long that shifted and dropped several feet. The sinkhole caused the zoo to shut down for approximately two weeks. Although no animals or people were hurt, the event has triggered several lawsuits

involving the Louisville Water Company, MSD, the Zoo, and the adjacent Mega Cavern amusement center.

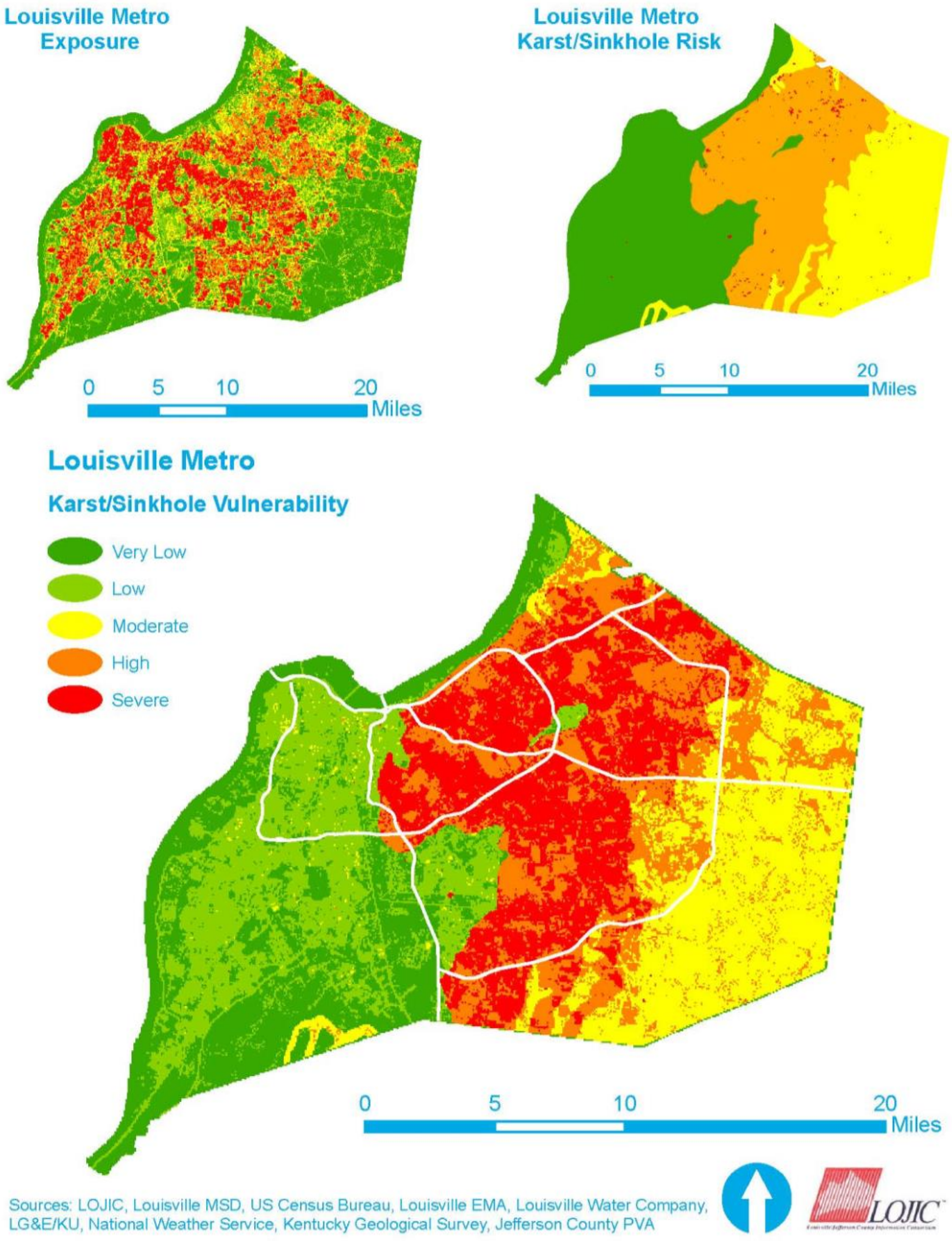
Louisville Zoo Sinkhole
Photo: Wave3

5.10.3 Assessing Vulnerability

Major Karst and Moderate Karst vulnerabilities were gathered from the 500K Karst Potential dataset from the Kentucky Geological Survey (2021). Sinkholes were gathered from the KY Water Resources Sinkhole Drainage Areas (2018). Sinkholes were ranked the highest risk, followed by the "major karst" and then

"moderate karst" areas. A listing of critical facilities and infrastructure highly vulnerable to karst is presented in Appendix E.

Figure 5-36: Louisville Metro Karst/Sinkhole Vulnerability Map

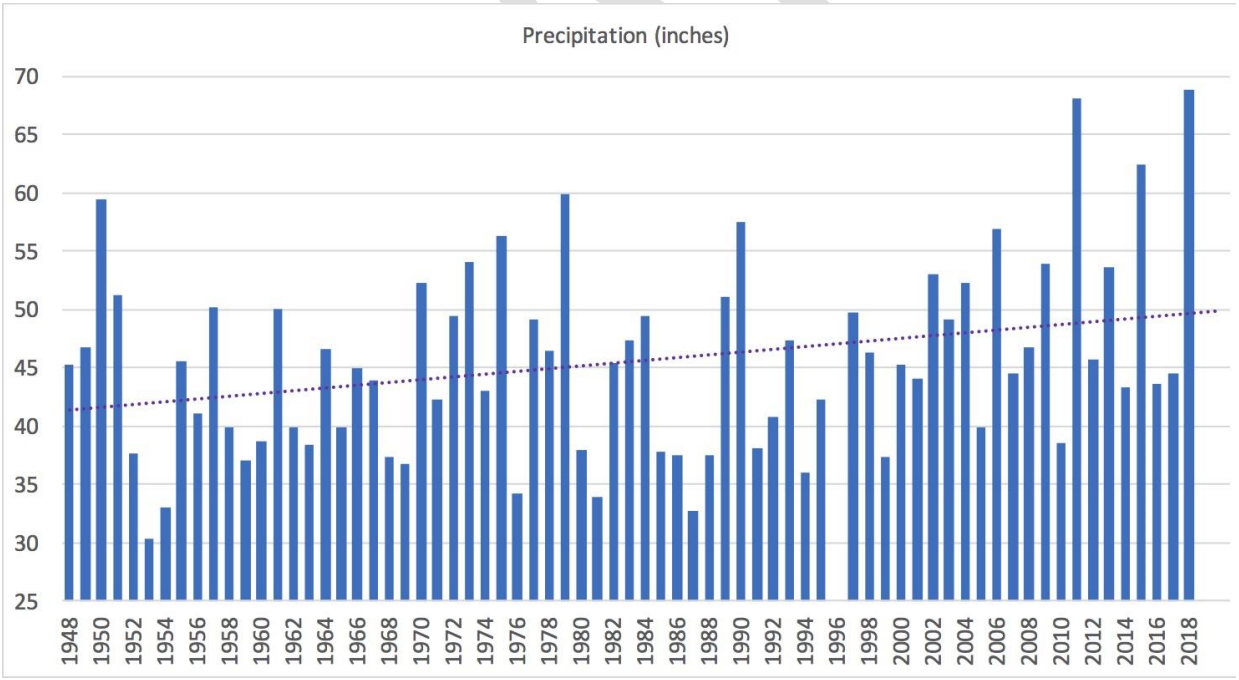


5.10.4 Climate Assessment

Recent research from the USGS Climate Adaptation Science Center shows that sinkhole hazards will likely intensify as a result of climate change[56]. Quantification of the impact on sinkholes, however, has been limited. A case study from Florida showed that for every 0.18°F rise in global temperature, the number of sinkholes in that region increased by 1 to 3%. Sinkholes could increase through a variety of different pathways. First, karst sinkholes and aquifers form through the dissolution of rocks by water, increases in precipitation, and especially in large and severe storms, which could increase the rate of substrate weakening, karst sinkhole development, sinkhole flooding, and dam leakage. Second, sinkhole and aquifer collapse can be closely linked to drought and could increase with increasing drought severity and/or frequency. Third, in response to higher temperatures, evaporation rates, and incidence of drought, the human response is likely to be intensification of water pumping, which leads to groundwater level reduction and related sinkhole development.

Average annual precipitation has been increasing in Louisville, with the three wettest years on record all occurring within the last decade. Although precipitation remains highly variable year-to-year, overall, as Figure 5-37 shows, average precipitation from 1989-2018 was 9% higher compared to 1961-1990.

Figure 5-37: Average Annual Precipitation as Measured at the Louisville International Airport from 1948-2018



[56] https://www.usgs.gov/programs/climate-adaptation-science-centers/science/evaluating-impacts-climate-extremes-karst

Climate change model projections indicate that precipitation could increase an additional 5% to 9% in the near future. However, precipitation is expected to occur in fewer, larger storms, which could have more impact on karst sinkhole flooding and dissolution of substrate. Climatic moisture deficit, a measure of drought stress, is expected to increase 47% by mid-century (2040-69) and 63% by late-century (2070-2099), further contributing to potential increases in karst/sinkholes.

Climate Risk

Based on the best available scientific information and trends, it is likely that karst/sinkhole risk will worsen over the coming century. However, there is not enough information at this time to do a quantitative assessment. Although the geographic distribution of this hazard is not expected to change with climate change, the total counts could increase over time with larger and more severe storms, and increased incidence of drought.

5.11 Landslides

A landslide is a general term for the downslope movement of rock, soil, or both under the influence of gravity. The interplay of geology, soils, water, and steep slopes contribute to landslides.[57] The style of movement and resulting landform or deposit are influenced by the rock and soil type, slope location, and how fast the rock or soil moves. Landslides occur when the strength of rocks or soil is exceeded by stress applied to those hillslope materials. Common stresses are gravity, increased pore-water pressure, earthquake shaking, and slope modification. Landslides can be a slow, gentle sloughing off of the materials over the underlying bedrock, or a fast collapse of materials moving downward at a high speed with a lot of energy.

Triggers for landslides include intense rainfall, changes in groundwater level and nearby bodies of water (e.g., dams, reservoirs, and rivers), erosion, earthquakes, and human activities such as removal of vegetation at toe slopes, construction, and mining activities. As noted, gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include saturation by water, steepening of slopes by erosion or construction, alternate freezing or thawing, and earthquake shaking. Population increase, rapid urbanization, and development will cause an increasing trend in landslide activity.

Areas that are generally prone to landslide hazards include the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Conversely, areas that are typically considered safe from landslides include areas that have not moved in the past; relatively flat-lying areas away from sudden changes in slope; and areas at the top or along ridges, set back from the tops of slopes.

[57] Crawford, Matthew M. *Kentucky Geological Survey Landslide Inventory: From Design to Application.* Kentucky Geological Survey, Lexington. Information Circular 31, Series XII, 2014.

Landslide Types

The USGS has identified five major types of landslides: sliders, flows, lateral spreads, falls and topples, and slope failures. Each is described below.

- *Slides:* The downward displacement of soils or rocks along one or 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:* These 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 a 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:* These 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 are sparse.
- *Slope Failures:* A slope failure (also referred to as mass movements) is classified based on how it moves, and the type of material being moved. Five major types of slope failures have been identified:

- *Creep:* Very slow movement of rock or soil downslope.
- *Falls:* Very rapid fall of rock and earth material from vertical or near vertical slopes.
- *Flows:* Slow to rapid movement of rock, soil, snow, or ice. Types of flows include mudflows, earthflows, debris flows, and snow avalanches.

- *Slides:* Very slow to very rapid movement of soil or rock. This category includes rockslides, earth slides, and slumps.
- *Subsidence:* Slow to very rapid collapse of rock or soil into underlying spaces. Sinkholes in Karst/Sinkhole landscapes are a common example.

Landslides are more likely to occur in the southwestern portion of Louisville Metro due to the steep slopes along the highest elevations in the Metro-Area, and erosion by the numerous streams that originate there. Probability increases at the base of a steep slope; the base of a drainage channel; and developed hillsides where leach-field septic systems are used. Several studies have shown that almost any modification of a slope by people increases the risk of slope movement, especially in areas already susceptible.

Landslide problems are usually related to certain rock formations that yield soils that are unstable on moderate to steep slopes. Often, slopes are cut into or oversteeped to create additional level land for development. Individuals can take steps to reduce their personal risk.

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 causes 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.

Louisville Metro Landslide Potential

Unstable soils also contribute to landslide potential in Louisville Metro, as shown on “Core Graphic 4” of the Louisville and Jefferson County Comprehensive Plan. Soil types that are subject to mass wasting such as creep, slump, or even landslides and mudslides coincide with slopes over 6 percent and the presence of underlying shale bedrock. Listed below are the soil types that are considered unstable due to the presence of underlying shale. Any highly sloped area may be subject to unstable conditions regardless of the presence of underlying shale.

5.11.1 Hazard Profile and Consequence Analysis

Table 5-35 represents the typical hazard profile associated with Landslides.

Table 5-35: Profile Risk Table Landslide/Mudslides

Period of occurrence:	Slope failures can occur in any season but are more likely to be triggered by weather events such as rain, snow, or freezing and thawing of soil water. With the exception of slope failures triggered by geologic processes, most slope failures occur between spring and fall. • In early spring, snowmelt can increase pore pressures in the soil, increasing the risk of slope failures. • During summer and fall, intense or prolonged rainfall can trigger slope failures. • Freeze-thaw events, which usually happen during spring and fall but also during warm winters, can increase the potential for slope failure.
Number of events:	6 (1993-2021)
Probability of events:	Frequent - Landslides are likely to occur within 25 years (>4% chance of occurrence in any given year)
FEMA Risk Rating/Score:	Relatively Low - Score 10.53
Warning time:	None to weeks to months, depending on inspection for weaknesses in rock and soil. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.
Potential of injury or death:	Low. Landslides have a low potential for injury or death in Louisville. There have been no reported injuries and/or deaths.
Possible Extent:	While there is no recent published data on possible landslide extent in the Louisville Metro area, using recent information from a surrounding county allows for possible comparisons. In Trimble County, adjacent to the north, two landslides involving Grant Lake Limestone resulted in debris fields covering 40'x20' and 35'x25' respectively. These events, which covered 800 and 875 square feet each, represent the extent of a typical landslide. This is more than enough to cover a roadway and make travel difficult.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and Plan stakeholders, has been performed to better understand and outline the potential impacts that a significant landslide would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-36.

Table 5-36: Consequence Analysis Landslide/Mudslide

Subject	Impacts
Health and Safety of the Public	Landowners in certain areas are at risk to impacts from a landslide event. Impacts to the public include potential for injury or loss of life, and destruction and/or loss of land and property due to emergencies from soil movement
Health and Safety of Responders	First responders, such as fire and police, would be called to support specific incident area(s) across the Louisville Metro area dealing with landslides. For a landslide event, as with all disaster events, responders face the risk of personal injury while performing necessary job functions.
Vulnerable Populations	While landslides are more likely to occur in rural areas than cityscapes, they still will have an increased effect on vulnerable populations. Vulnerable populations are at particularly at risk from landslides because they likely do not have the financial means to recovery from significant incidents. Although insurance may cover some losses, studies show that people from lower income levels do not have sufficient coverage to address total structure losses. In addition, the loss of transportation routes typically effect those from lower economic circles due to the inability to work remotely.
Continuity of Operations (including delivery of services)	The impacts on continuity of operations would be limited, unless a facility or critical infrastructure component is within the area of movement zone associated with a landslide. Delivery of services may be slowed or halted in adjacent areas if key roadways become impassable due to debris blockages or loss of structural integrity.
Property, Facilities, and Infrastructure	Home and landowners within landslide zones may experience damage to or loss of property depending upon the severity of movement in the area. Infrastructure may experience impacts in the form of damage to roads and bridges, temporary closure of transportation routes, the potential inability of the stormwater system to handle floodwaters, and loss of power.
Environment	Erosion and debris flows would be the major impact to the environment during a significant landslide incident.
Economic Conditions	Much of the economic loss associated with landslides is borne by Federal, state, and local agencies responsible for disaster assistance, 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. According to the "Geologic Context of Landslide/Sinkhole and Rockfall Maintenance Costs for Kentucky Transportation District 5—2002 to 2009" report issued in 2020, there have been a total of 2,442 landslide work-order miles occurred in District 5 (which includes the Louisville Metro area). Landslide maintenance repairs average $169 per mile per year in this district. This makes landslides costly from a transportation perspective, but not from a property loss perspective.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively Louisville Metro responds to a landslide event.

5.11.2 Significant Louisville Metro Landslide Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in the Louisville Metro area specifically related to landslides. However, of the six Declared Disasters related to "Sever Storms," two mention "Mud and Rock Slides." These two events are discussed in the Severe Storms section.

As depicted on the figure below, the Kentucky Geological Survey has data on six landslides that have occurred in the Louisville Metro Area.

Each of the occurrences is further discussed below:

Landslide 488: This occurred at the northeastern corner of the intersection of Route I-265 (Gene Snyder Freeway) and Route 65 at the foot of the South Park Hills. Both the Kentucky Geological Survey and the USGS report that a "consequential landslide" occurred at this location (Kentucky Geological Survey, Kentucky Geologic Map Service; USGS Landslide Hazard Program, U.S. Landslide Inventory).

Landslide 671: This occurred at the southwestern corner of the intersection of Route I-265 (Gene Snyder Freeway) and Route 155/Taylorsville Road southeast of Riggs Lake, at the toe of the hills along the western side of Floyd's Fork Park. Both the Kentucky Geological Survey and the USGS report that a "consequential landslide" occurred at this location.

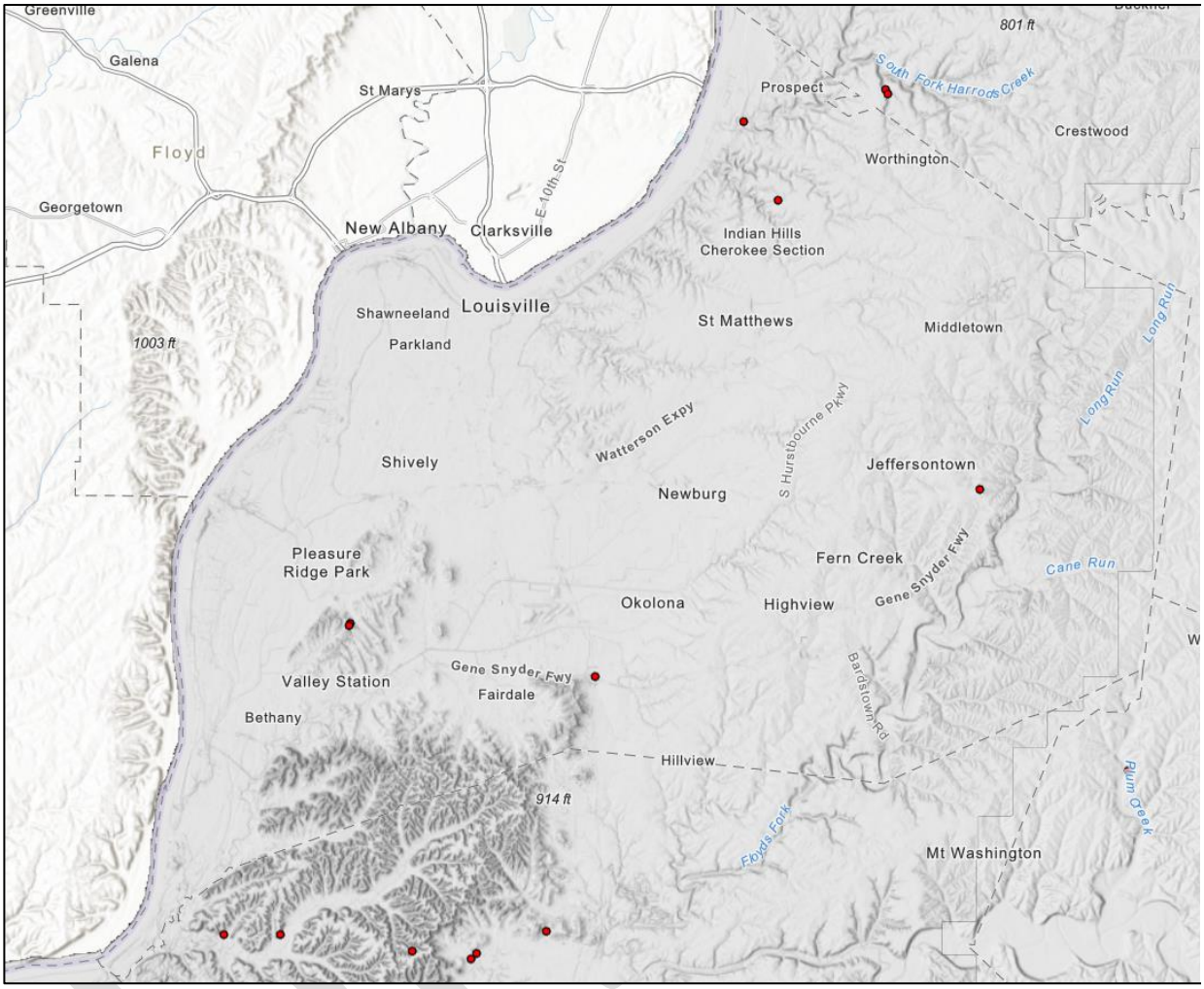
Landslide 4224: This occurred along Marina Drive on the banks of Harrods Creek. U.S. Landslide Inventory data indicates that there was a "likely landslide" at this location below the road near the bottom of the slope by Harrods Creek (Source: USGS Landslide Hazard Program, U.S. Landslide Inventory).

Landslide 6205: This occurred just north of landslide 6206, along Waverly Park Road in Waverly Park (the Waverly Hills) near the toe of a steep slope. This was a transitional landslide composed of soil rock that occurred above and below the road (Source: USGS Landslide Hazard Program, U.S. Landslide Inventory).

Landslide 6206: This occurred just south of landslide 6205, along Waverly Park Road in Waverly Park (the Waverly Hills) near the peak of the hill. The landslide occurred above and below the road, and the detritus was mainly soil and rock (Kentucky Geological Survey, Kentucky Geologic Map Service; USGS Landslide Hazard Program, U.S. Landslide Inventory).

Landslide 10913: This occurred along Route 71 east of where Goose Creek crosses Route 71, and west of where Barbour Lane crosses Route 71, at the toe of a gentle rise/low hill in the eastern portion of the Glenview Hills. The landslide occurred in 2021. This is not depicted on the USGS U.S. Landslide Inventory Map, which was last updated in 2019.

Figure 5-38: Landslide Locations in the Louisville Metro Area

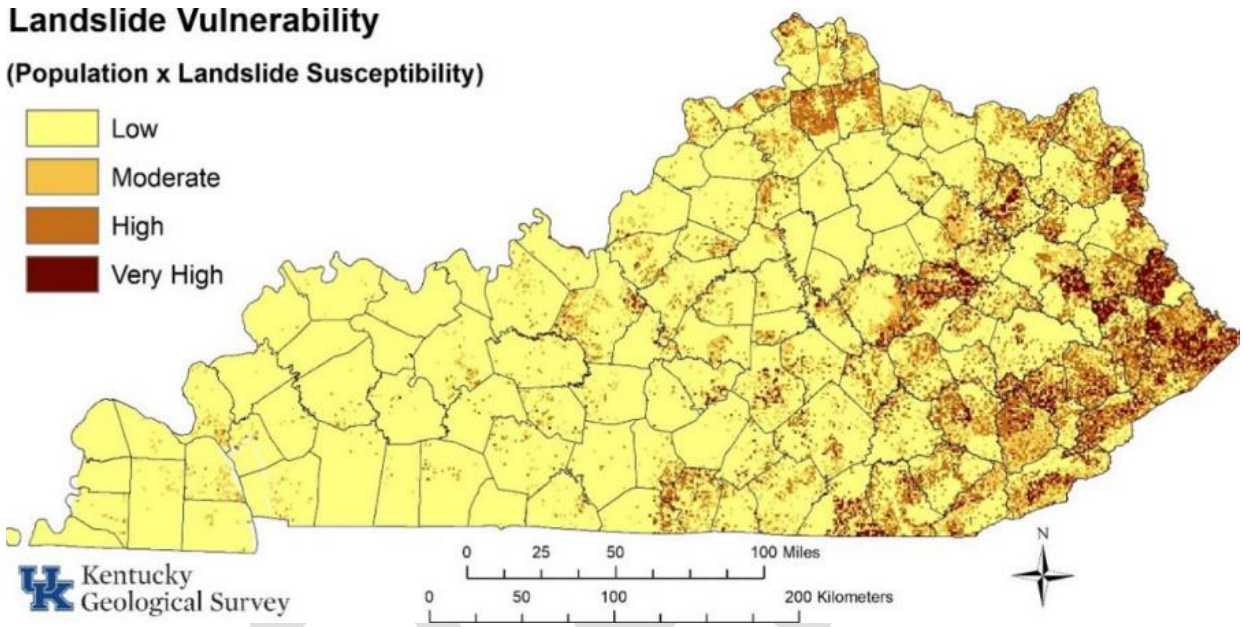


Source: Kentucky Geological Society, 2020

5.11.3 Assessing Vulnerability

Landslide vulnerability was obtained from maps maintain by the KGS. Critical facility and infrastructure data was then overlain with KGS maps to determine those properties that are most at risk from landslides. This information is presented in Appendix E.

Figure 5-39: Landslide Vulnerability in Kentucky Map



Source: Kentucy Geological Survey

5.11.4 Climate Assessment

Climate change affects the stability of natural and engineered slopes and has consequences on landslides. In general, increases in precipitation are associated with reduced stability, while decreases in precipitation are associated with a reduction in landslide activity. In the Louisville Metro region, precipitation has been increasing in recent years, with the three highest years on record occurring in the last decade. In addition, the incidence of heavy precipitation (large storms) has increased throughout the eastern U.S., indicating a larger regional trend. Both the total amount of precipitation and the intensity of storms are expected to affect landslide risk.

Also contributing to landslide potential is warmer temperatures. According to the Fourth National Climate Assessment, 2018,[58] increasing heat across the Southeast generates more frequent and longer summer heat waves. Coupled with rising temperatures is an increase in the duration and intensity of drought, which in turn is expected to increase the risk of wildfire.

[58] https://nca2018.globalchange.gov/

Wildfire destroys vegetation keeping soil together and makes soil hydrophobic. After a wildfire, the destabilized slopes and hydrophobic soil, when coupled with intense rain events, can result in erosion, mudslides, and landslides

Climate Risk

Based on the best available scientific information and trends, it is likely that landslide risk will worsen in Louisville over the coming century. The geographic distribution of this risk is not expected to change with climate change, but the total counts could increase over time with larger, more frequent, and/or more severe storms. Increasing temperature and evaporation is expected to increase drought stress in Louisville, which in turn increases the risk of wildfire. Heavy rain after a wildfire event increases the likelihood of mudslides and landslides. Because the conditions are increasing for wildfires and rain events, the occurrence of mudslides and landslides will increase too. More information is needed before a quantitative assessment can be done.

5.12 Public Health Emergencies

A Public Health Emergency is defined as an occurrence or imminent threat of a widespread illness or health conditions that pose a substantial risk of significant human fatalities or permanent/long-term disabilities. Public health emergencies can be caused by an endemic, epidemic, pandemic, or outbreak, or a highly fatal biological agent or toxin release. Each is further defined below:

- *Endemic:* A disease that belongs to a population, environment, or region. Examples of an endemic include chicken pox, which occurs at a predictable rate among young school children in the United States, and malaria in sub-Saharan areas.
- *Epidemic:* An infectious disease that rapidly affects a large number of people within a community, population, or region. An example epidemic was the 2003 severe acute respiratory syndrome (SARS) event. Although this event took the lives of nearly 800 people, it did not result in a worldwide spread.
- *Pandemic:* An infectious disease outbreak that spreads across countries or continents. It affects more people and takes more lives than an epidemic. The World Health Organization (WHO) declared Covid-19 to be a pandemic when it became clear that the illness was severe and that it was spreading quickly over a wide area.
- *Outbreak:* When an illness happens in unexpectedly high numbers. It may stay in one area or extend more widely. An outbreak can last days or years. Sometimes, medical experts consider a single case of a contagious disease to be an outbreak. This is the case with tuberculous. Outbreaks also may involve an unknown disease, or a disease that has been absent from a community or population for an extended period. If it is not quickly controlled, an outbreak can become an epidemic, which in turn can become a pandemic.
- *Biological Agent/Toxin:* Biological agents and toxins are organisms or toxins that can kill or disable people, livestock, and crops. A biological agent or toxin attack is the deliberate release of germs or other biological substances. Examples of biological agents/toxins that can result in a public health emergency include a deliberate anthrax or ricin release, or food safety threats such as Salmonella or E. Coli.

Since the 2015 Hazardous Mitigation Plan update, the world has experienced the costliest public health emergency in modern times, the Covid-19 pandemic. Covid-19 is the disease caused by a coronavirus called SARS-CoV-2. The World Health Organization (WHO) first learned of this virus on December 31, 2019, following a report of a cluster of cases of 'viral pneumonia' in Wuhan, People's Republic of China[59]. According to WHO, as of August 24, 2022, there have been over 600,000,000 confirmed cases of Covid-19 throughout the world, with over 6,450,000 million deaths reported[60]. In the United States, the New York Times' daily Covid-19 Tracker

[59] https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub

[60] https://www.worldometers.info/coronavirus/

indicates there have been over 94,300,000 confirmed cases, resulting in over 1,042,000 deaths[61]. In Kentucky, the New York Times shows that over 1,551,500 confirmed cases have been reported, along with 16,679 deaths. Finally, in Louisville Metro, there have been 272,669 confirmed cases resulting in 2,486 deaths. The effects of Covid are still being felt in August 2022, with 90,300, 2,226, and 239 as the number of cases on average being reported each day for the United States, Kentucky and Louisville Metro, respectively.

All locations in Louisville Metro are at risk for public health emergencies. According to the CDC website, harder hit areas typically coincide with general population trends—the higher the population density, the more public health emergencies occur. And although there is a general correlation between public health emergencies and population, there is credible research indicating that certain incidents may affect regions differently. For example, both urban and rural areas face different challenges regarding public health emergencies related to outbreaks, endemics, epidemics, and pandemics. Long-standing systemic health and social inequities have put some rural residents at increased risk of becoming infected with disease or having severe illness. In general, rural Americans tend to have higher rates of cigarette smoking, high blood pressure, and obesity, as well as less access to healthcare, which can negatively affect health outcomes. Although the Louisville Metro mostly consists of urban and suburban areas, there are rural populations in the eastern and southern parts of county.

5.12.1 Hazard Profile and Consequence Analysis

Table 5-37 represents the typical hazard profile associated with Public Health Emergencies.

Table 5-37: Profile Risk Table Public Health Emergencies

Period of occurrence:	Anytime
Number of events:	Four major pandemics over the past 100 years, with numerous other smaller outbreaks, along with an ongoing opioid endemic.
Probability of events:	Frequent - Public Health Emergencies are likely to occur within 25 years (>4% chance of occurrence in any given year)
FEMA Risk Rating/Score	Not Applicable. FEMA does not include this hazard in the index.
Warning time:	Days to Months
Potential of injury or death:	High. The Covid-19 pandemic has wreaked havoc on communities across the Commonwealth, with over 2,200 reported deaths in the Louisville Metro area alone. Of all hazards identified in this plan, Public Health Emergencies have by far caused the most deaths and injuries in the Louisville Metro area.
Possible Extent:	While some hazards have widely used scales to measure relative magnitude and strength, public health emergencies are defined by the population affected, transmissibility, and the availability of countermeasures, including personal protective equipment, medical supplies, treatment options, and vaccines.

[61] https://www.nytimes.com/interactive/2021/us/kentucky-covid-cases.html

	The possible extent of a public health emergency can be measured by Covid-19, where in Kentucky, over 1.5M people have officially contracted the virus, resulting in over 16,600 deaths. In the Louisville Metro area, over 273,000 people have tested positive for the virus, with over 2,2000 reported deaths. It should be noted that these numbers only represent known cases. There are likely many more positive cases that go unreported to state and local health agencies.

Public Health Emergency Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, has been performed to better understand and outline the impacts that a public health emergency would have on the public; responders; vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-38.

Table 5-38: Consequence Analysis Pandemics/Public Health Emergencies

Subject	Impacts
Health and Safety of the Public	Individuals across the Louisville Metro area are at risk to impacts from a public health emergency Impacts to the public include potential for both short- and long-term sickness, including loss of life.
Health and Safety of Responders	First responders, such as fire and police, would be called to support specific incident area(s) across the Louisville Metro area, attend to sick, and respond to normal emergency requests. For a public health emergency, as with all disaster events, responders would face the risk of personal injury while performing necessary job functions. This was the case during the Covid-19 pandemic when first responders became the first line of defense in attempts at stopping the spread.
Vulnerable populations	During a serious public health emergency, older adults, individuals with compromised immune systems, children, people without health insurance, people who speak a language other than English, and people who are recent immigrants to the country are likely to be the most at-risk and typically suffer the worst impacts.
Continuity of Operations (including delivery of services)	The impacts on continuity of operations could range from minimal to severe, depending on the impacts to critical personnel and redundancy in staff for continuity of operations. Delivery of services may be slowed or halted in adjacent areas if significant populations of government personnel become sick.
Property, Facilities, and Infrastructure	Typically, properties facilities and infrastructure are not affected by public health emergencies. However, business and infrastructure owners may be required to install protective measures to combat community spread of viruses or other public health threats.

Subject	Impacts
Environment	Secondary impacts to the environment would be anticipated from a public health event, ranging from increased pollution from discarded personnel protective equipment to accidental spills of decontamination products.
Economic Conditions	Public health emergencies are costly for any community, with Louisville Metro being no exception due to the potential for business and government shutdowns. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively Louisville Metro respond to a public health emergency. As shown during the Covid-19, public policy decisions have far-reaching impacts on the public, to include schools, first responders and businesses. Navigating these sometimes conflicting interests is difficult, especially when decisions are often second-guessed.

5.12.2 Significant Louisville Metro Public Health Emergency Occurrences

According to FEMA's Data Visualization Tool, there have been two Declared Disasters in the Louisville Metro area related specifically to a "Biological" event. Both are related to the Covid-19 Pandemic, which is further described below:

Kentucky Covid-19 (EM-3469) and Kentucky Covid-19 Pandemic (DR-4497): The Covid-19 pandemic was confirmed to have reached Kentucky on March 6, 2020, when Governor Andy Beshear's office announced the first confirmed case, and declared a state of emergency to ensure all entities had the necessary response resources. Also at that time, the Kentucky government announced a series of restrictions and recommendations to help curb the spread of the disease. Schools, universities, and a range of businesses were broadly closed to the public. Public sporting events were closed or postponed, including the 2020 Kentucky Derby. In addition, a range of initiatives was put into place, many by executive order, including broader leeway for pharmacists, relaxing of standards for unemployment insurance, extensions of Kentucky driver licenses, the curtailing of non-essential police services in some areas, and moratoriums on evictions and utility shut-offs.

Most Covid-19 restrictions were in place until June 11, 2021, when Governor Beshear issued an executive order lifting most coronavirus restrictions throughout Kentucky. This included all capacity restrictions, Healthy at Work requirements, and the statewide mask mandate, in most cases. Although restrictions have been lifted, Covid-19 still remains a concern in the Louisville Metro area, with over 1,880 new cases reported for the week ending August 29, 2022.[62]

[62] https://chfs.ky.gov/agencies/dph/covid19/Covid19DailyReport.pdf

As of September 1, 2022, 2,972,262 Kentuckians had received at least one Covid-19 vaccine dose, equivalent to 67% of the population. Louisville Metro was one of the top five counties in terms of vaccination rate, with 584,809 people, or 76.27% of the population having received at least one vaccine dose.[63]

Additional Public Health Emergencies of Note

Additional public health emergencies, including pandemics, have occurred throughout history, but only in the last century have proper records been kept regarding their cause and origins. According to the CDC, aside from Covid-19, the three most serious nationwide public health emergencies involved influenza virus endemics and viral pandemics. These occurred in 1918, 1957, and 2009, and are described below.

1918 Spanish Flu Pandemic: In the late summer and early fall of 1918, the many military installations across the United States tended to be hit first and hardest with epidemic influenza. Just a few streetcar stops down the line from Louisville was Camp Zachary Taylor. The camp was enormous, encompassing 1,530 buildings sprawled across 3,376 acres and accommodating over 45,000 enlistees and officers. At the time, it was the largest World War I Army training camp in North America. On September 24, local Louisville newspapers reported over one hundred soldiers at the camp were ill with influenza. Just a day later, that number had more than doubled to 262. By the end of the month, the camp hospital was caring for more than 2,100 cases of influenza.[64]

Camp officials acted as quickly as they could to contain the disease. On September 27, they enacted a partial quarantine of the camp. Unfortunately, influenza was already circulating amongst Louisville residents. By September 20, a week before these measures were put into effect, some 50 civilian cases had been reported to the health department; by October 7, it was clear that Louisville's nascent influenza epidemic was spreading. Between September 26 and November 16, 1918, Louisville physicians reported a total of 6,736 cases of influenza to the health department, of which 577 resulted in death.

2009 H1N1 "Swine" Flu Pandemic: In March 2009, the H1N1 virus was first detected in the United States. The virus spread quickly across the country and then the world, and made headlines as the swine flu. By April 2009, a public health emergency was declared in the United States. On June 11, 2009, the WHO signaled that a global pandemic of 2009 H1N1 influenza was under way.

Over the next few months, numerous Louisville schools closed, and daily statewide monitoring of patients with influenza-like illness began. By April 2010, over 2,092cases of swine flu were

[63] https://dashboard.chfs.ky.gov/views/KYPublicFacingDashboard_16191000580170/KentuckyCovid-19Vaccination?%3Aiid=1&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

[64] "Influenza Rampant," Louisville Times, 24 Sept. 1918, 8; "Flu Cases Increase," Louisville Times, 25 Sept. 1918, 1; "Steps Taken to Prevent Flu Spread," Louisville Times, 28 Sept. 1918

reported in Kentucky, resulting in at least 41 deaths, including four in Jefferson County.[65] The pandemic ended in 2010 due to widespread deployment of a vaccine.

2017 (Ongoing) Opioid Crisis: Opioid deaths impact every county throughout Kentucky. On August 3, 2021, the Kentucky Justice and Public Safety Cabinet and Office of Drug Control Policy (ODCP) announced that the 2020 Overdose Fatality Report indicates more than 1,964 Kentuckians died from drug overdoses in 2020, a 49% increase in drug overdose deaths compared with the year prior. The national number of overdose deaths for 2020—more than 93,000—is the highest number of overdose deaths ever recorded in a 12-month period.[66] Kentucky currently is ranked fifth in the United States for opioid overdose deaths, and has suffered through the opioid epidemic since its inception.[67] Not only are these numbers staggering, they are likely underestimated—they also fail to capture the full extent of the damage of the opioid crisis, which reaches across every domain of family and community life—from lost productivity and economic opportunity, to intergenerational and childhood trauma, to extreme strain on community resources, including first responders, emergency rooms, hospitals, and treatment centers. Annual data trends indicate a startling increase in fatalities related to opioids, and the impacts of the concurrent public health crisis—Covid-19—have further exacerbated the crisis. Jefferson County saw more than 600 overdose deaths in 2020— a 62% increase from 2019.

There are numerous initiatives to address this crisis, and on August 31, 2022, Louisville Metro Mayor Greg Fischer announced the city will receive an estimated $31.8 million in opioid settlement funds to buoy the city's efforts to help people with substance abuse disorders. This is just one of many efforts to stem the tide of opioid additions.

Other outbreaks: Other, minor public health emergencies related to biological agents and toxins occur rather frequently. For example, as of September 8, 2022, there were 21,504 cases of Monkeypox reported in the U.S., including 34 in Kentucky. E. Coli outbreaks happen frequently, including in 2022, when tainted lettuce at Wendy's resulted in over 100 sick. In September 2020, two separate outbreaks of Salmonella were being monitored by CDC officials. These outbreaks resulted in close to 1,400 illnesses and over 100 hospitalizations. In November 2019, an outbreak of E. Coli associated with Romaine lettuce made national news, and resulted in 102 people from 23 states becoming ill. Of these, 58 required hospitalizations. No deaths have been reported with any of these outbreaks.

5.12.3 Assessing Vulnerability

Public health emergencies affect populations and demographics differently, and sometimes disproportionately. A January 2022 report published by the AARP titled "Health Outcomes and Root Causes for those 50+ in Louisville" addresses some of the most significant poor health

[65] https://healthalerts.ky.gov/SiteCollectionDocuments/H1N1%20Surveillance%20Final%20Report_%2006_22_10.pdf

[66] https://kentucky.gov/Pages/Activity-stream.aspx?n=Justice&prId=62

[67] https://kentuckycan.uky.edu/your-gifts-at-work/your-gifts-work/opioid-regulatory-decisions#:~:text=More%20than%202%20million%20Americans,opioid%20epidemic%20since%20its%20inception.

outcomes and leading causes of death experienced by Louisville's population of individuals 50 years and older. According to this report, health inequities in older adults are a result of a lifetime of compounding inequities in the root causes of health (housing, transportation, food access, income, and employment, etc.). [68]

Although vulnerabilities are still being studied, a public health emergency's impact can be measured. These events can shut down large segments of the population for long periods of time, which can have far-reaching impacts on diverse segments of society. For example, "Work from Home" policies cause the commercial real estate and energy industry to experience decreased demand. In the medical field, a widespread public health emergency can result in medical personnel quickly becoming overtaxed, and hospitals and medical facilities may be unable to handle the explosion of cases because of space and equipment limitations. And finally, voluntary and forced shutdowns of businesses, travel, and schools result in billions of dollars in losses at the state level, and trillions of dollars at the federal level. These impacts, along with many others that likely will emerge, make public health emergencies one of the most damaging hazards.

5.12.4 Climate Assessment

According to the Fourth National Climate Assessment's Health Chapter, "A comprehensive assessment of the impacts of climate change on human health in the United States concluded that climate change exacerbates existing climate-sensitive health threats and creates new challenges, exposing more people in more places to hazardous weather and climate conditions."[69]

The health and well-being of Louisville Metro residents are already affected by climate change, with the adverse health consequences projected to worsen with additional climate change. Climate change affects human health by altering exposures to heat waves, floods, droughts, and other extreme events; vector-, food- and waterborne infectious diseases; changes in the quality and safety of air, food, and water; and stresses to mental health and well-being.

Climate change, together with other natural and human-made health stressors, influences human health and disease in numerous ways. Some existing health threats will intensify, and new health threats will emerge. Not everyone is equally at risk. Important considerations include age, economic resources, and location.

In the U.S., public health can be affected by disruptions of physical, biological, and ecological systems, including disturbances originating here and elsewhere. The health effects of these disruptions include increased respiratory and cardiovascular disease, injuries and premature deaths related to extreme weather events, changes in the prevalence and geographical distribution of food- and water-borne illnesses and other infectious diseases, and threats to mental health.

Climate Risk

[68] AARP Kentucky: Health outcomes and root causes for those 50+ in Louisville. January 2022

[69] https://nca2018.globalchange.gov/chapter/14/

More frequent and/or more intense extreme events, including drought, wildfires, heavy rainfall, floods, storms, and storm surge, are expected to adversely affect population health.[70] These events can exacerbate underlying medical conditions, increase stress, and lead to adverse mental health effects. Further, extreme weather and climate events can disrupt critical public health, healthcare, and related systems in ways that can adversely affect health long after the event.

[70] Dodgen, D., D. Donato, N. Kelly, A. La Greca, J. Morganstein, J. Reser, J. Ruzek, S. Schweitzer, M. M. Shimamoto, K. Thigpen Tart, and R. Ursano, 2016: Ch. 8: Mental health and well-being. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment., U.S. Global Change Research Program, Washington, DC, 217–246. doi:10.7930/J0TX3C9H.

5.13 Severe Weather/Thunderstorms

Severe weather, also known as severe thunderstorms, 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. Because this often times happens at various locations and at various times, 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. The NWS considers a thunderstorm as severe if it develops ¾-inch hail or produces 50-knot (58 mph) winds.[71]

Storm Clouds over Jeffersontown April 13, 2022
Source: WLKY

In addition to wind, all thunderstorms also contain lightning, which may occur singly, in clusters, or in lines. 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 in the clouds or between the clouds and the

[71] https://www.weather.gov/bgm/severedefinitions

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. Lightning is a component of all thunderstorms. 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. 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. Overall, there are four different types of lightning:

- Cloud to sky (sprites)
- Cloud to ground
- Intra-cloud
- Inter-cloud

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.

Radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms.

All thunderstorms are dangerous and capable of threatening life and property in localized areas. Although thunderstorms and lightning can be found throughout the U. S., they are most likely to occur in the central and southern states. Thunderstorms can also produce large, damaging hail, which causes billions in damage to property and crops annually. Thunderstorms are also capable of producing tornadoes, wind, and heavy rain that can lead to flash flooding. Hail, floods, and tornado hazards are addressed as individual hazards in this Plan.

Types of Thunderstorms

There are four main types of thunderstorms: single-cell, multi-cell, squall line, and supercell. The type that forms depends on the instability and relative wind conditions at different layers of the atmosphere ("wind shear"). Single-cell thunderstorms form in environments of low vertical wind shear and typically last only 20 to 30 minutes. Multi-cell and squall line systems can have longer life cycles because they form in environments of significant vertical wind shear, which aids the development of stronger updrafts as well as various forms of severe weather. The super cell is the strongest of the thunderstorms, most commonly associated with large hail, high winds, and tornado formation. Each is further defined below:

- *Single Cell (Pulse Storms):* Typically last 20 to 30 minutes. Pulse storms can produce severe weather elements such as downbursts, hail, some heavy rainfall, and occasionally weak tornadoes. This storm is lightly to moderately dangerous to the public, and moderately to highly dangerous to aviation.
- *Multicell Cell:* These storms consist of a cluster of storms in varying stages of development. Multicell storms can produce moderately sized hail, flash floods, and

weak tornadoes. This storm is moderately dangerous to the public and moderately to highly dangerous to aviation.

- *Squall 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 moderately sized hail, occasional flash floods, and weak tornadoes. This storm is moderately dangerous to the public and moderately to highly dangerous to aviation.
- *Supercell:* 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.

Wind Speeds

One of the first scales to estimate wind speeds and the effects was created by Britain's Admiral Sir Francis Beaufort (1774-1857). He developed the scale in 1805 to help sailors estimate the winds via visual observations. The scale starts with 0 and goes to a force of 12. The Beaufort scale is still used today to estimate wind strengths. The scale is presented below.

Force	Speed (mph)	Description	Specifications for use on land
0	0-1	Calm	Calm; smoke rises vertically.
1	1-3	Light Air	Direction of wind shown by smoke drift, but not by wind vanes.
2	4-7	Light Breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
3	8-12	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	13-18	Moderate Breeze	Raises dust and loose paper; small branches are moved.
5	19-24	Fresh Breeze	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25-31	Strong Breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32-38	Near Gale	Whole trees in motion; inconvenience felt when walking against the wind.
8	39-46	Gale	Breaks twigs off trees; generally impedes progress.
9	47-54	Severe Gale	Slight structural damage occurs (chimney-pots and slates removed)
10	55-63	Storm	Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	64-72	Violent Storm	Very rarely experienced; accompanied by wide-spread damage.
12	72-83	Hurricane	see Saffir-Simpson Hurricane Scale

Derechos

A derecho is a widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. Although a derecho can produce destruction similar to the strength of tornadoes, the damage typically is directed in one direction along a relatively straight swath. As a result, the term "straight-line wind damage" sometimes is used to describe derecho damage. By definition, if the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho.[72]

5.13.1 Hazard Profile and Consequence Analysis

Table 5-39 represents the typical hazard profile associated with Severe Weather.

Table 5-39: Profile Risk Table Severe Weather

Period of occurrence:	Typically, spring, summer and fall. However, recent events show severe weather can happen any time of year. The Midwest and Great Plains regions of the U.S. average between 40 and 60 days of thunderstorms per year. These two regions are prone to some of the most severe thunderstorms on Earth.
Number of events:	Hundreds have occurred in the Louisville Metro area since 1960. The Louisville Metro area has seen six Declared Disasters associated with Severe Weather events, making it bar far the most common type of event receiving this designation.
Probability of events:	Annually – Hazard event likely to occur every year.
FEMA Risk Rating/Score:	Lightning: Relatively High - Score 40.01 Strong Winds: Relatively High - Score 24.19
Warning time:	Typically, severe weather can be predicted days in advance; however, due to the volitive nature of these events, it is likely the severity can vary from minutes to hours based on local conditions.
Potential of injury or death:	Medium. Severe storms have the ability to cause death and injury; however, many times these are the result in subset hazards (i.e., flooding).
Possible Extent:	In 2008, remnants of Hurricane Ike caused 80 mile-per hour winds causing power outages for over 300,000 people, tore down over 1,300 power lines, blocked 130 roads, and resulted in over $6.6 million in FEMA Project Worksheets.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and Plan stakeholders, has been performed to better understand and outline the impacts that a severe storm would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and

[72] https://www.weather.gov/lmk/derecho

public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-40:

Table 5-40: Consequence Analysis Severe Weather

Subject	Impacts
Health and Safety of the Public	Home and landowners throughout the Louisville Metro area are at risk to impacts from a thunderstorm event in the form of high winds and lightning. High winds have the ability to topple structures, destroy roofs, damage trees and shrubbery and fell power lines. Lightning is very dangerous, even when observed at several miles away. As such, members of the public should seek shelter immediately. Strong winds and lightening have the ability to cause power outages.
Health and Safety of Responders	First responders, such as fire and police, would be called to the incident area(s) to evacuate people, close roads due to fallen trees and/or debris blockages, and attend to any injured. For a thunderstorm event, as with all disaster events, responders face the risk of personal injury while performing necessary job functions.
Vulnerable populations	Power loss associated with severe thunderstorms will have the largest effect on vulnerable populations. Power loss can create significant issues, including lack of transport capabilities, medical equipment failure and simply extreme heat due to air conditioning loss.
Continuity of Operations (including delivery of services)	The impacts on continuity of operations would be limited unless a government facility is directly adversely affected by lightning or straight line winds caused by a thunderstorm. Delivery of services may be slowed or halted in affected areas as a result of temporary losses in power and communications.
Property, Facilities, and Infrastructure	Home and landowners throughout the Louisville Metro area may experience damage to property depending upon the amount of lightning strikes and severity of wind in the area. Infrastructure may experience impacts in the form of fire caused by lightning strikes, roof and crop damage from strong winds, and interruptions to above-ground power and communication systems.
Environment	Lightning and wind impact the environment primarily from wildfire caused by lightning and crop damage caused by wind.
Economic Conditions	A major thunderstorm event would be costly for Louisville Metro government because of the potential for damages associated with property, debris generation, and loss of power. Some of the costs could be recouped through federal grant reimbursements is the storm receives a formal Presidential Declaration. However, of the hundreds of storms that have occurred over the past 50 years, only a six have received this designation.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively Louisville Metro prepares for and responds to a severe thunderstorm event.

5.13.2 Significant Louisville Metro Severe Winter Weather/Thunderstorm Occurrences

According to the NCEI Storm Events Database, over the last 60 years, there were 321 severe storms recorded for the Louisville Metro area. Six of these events resulted in a Presidentially

Declared Disaster designation (and all have happened in the last 25 years). Each of these events, as well as several others, are described below:

Mar 1997 Kentucky Severe Storms/flooding (DR-1163-KY): A large, powerful storm system over the Great Plains drew warm, moist air northward out of the Gulf of Mexico. The air had 200% of the normal amount of moisture for that time of year. When this air interacted with a subtle stationary front over Kentucky, heavy showers and thunderstorms broke out. Because the front in Kentucky was nearly stationary, the showers and storms continued to re-generate until the larger cold front, stretching from Minnesota to Texas, pushed the wet weather off to the east. Over a four-day period, significant flooding, damaging tornadoes, straight-line winds and damaging lightning strikes were reported throughout both Louisville Metro and Kentucky. The Ohio River rose to the highest levels since March of 1964, with navigation on the river stopped completely due to the locks being flooded. Also, because this occurred in early March, run-off was maximized since vegetation had not yet begun to hold.

In the Louisville Metro area, about $200,000,000 in damage was attributed to the flooding, with 50,000 dwellings affected. Interstates 64 and 65 were closed. Along with Jefferson County, 92 other counties in Kentucky and 14 counties in southern Indiana were declared disaster areas. Tens of thousands of people were evacuated from their homes, with total damage across the region estimated to be above $400,000,000. In addition, 19 deaths occurred in Kentucky, making this one of the deadliest storms in the Commonwealth's history.

May 2003 Kentucky Severe Storms, Flooding, Mud and Rock Slides, and Tornadoes (DR-1471-KY): On June 3, 2003, a Presidential declaration of a major disaster for the Commonwealth of Kentucky was issued. This was directly the result of the severe storms, flooding, mud and rock slides, and tornadoes occurring on May 4-27, 2003. Jefferson County was one of 32 counties to be eligible for FEMA Individual and Public Assistance, and all counties in Kentucky became eligible to apply for assistance under the Hazard Mitigation Grant Program.

May 2004 Kentucky Severe Storms/flooding DR-1163-KY: On the afternoon of Sunday May 30, 2004, a warm front was draped across east Kentucky, creating a boundary between warm and moist air over the region and cooler, drier air to the northeast. These ingredients created the perfect environment for numerous supercell thunderstorms to track along this boundary, causing tree damage, and dumping very heavy rain over the region. Initially, flash flooding was the concern; however, another wave of storms moved through the region as a powerful cold front swept through on the evening of Monday, May 31. This new round of rainfall, combined with the rain from the previous afternoon and evening, was too much to handle, and very serious flash flood, areal flood, and river flood conditions occurred. To top this all off, widespread thunderstorm wind damage was reported along with six confirmed tornadoes. Overall, an estimated $33,000,000 in property damage was caused by the flooding alone, with additional impacts due to wind and tornado damage. Shortly after the event through June 2, all three forks of the Kentucky River flooded, with crests anywhere from 1 to 3 feet over flood stage. Overall, 31 of the 33 counties in the Jackson NWS's jurisdiction, including Jefferson County, were declared Federal Disaster Areas, mainly as a result of this storm.

September 2008 Kentucky Severe Wind Storm Associated with Tropical Depression Ike (DR-1802-KY): The largest severe windstorm since the 1974 tornado outbreaks was caused by a

Tropical Depression from Hurricane Ike, which hit the area with 80-mile-an-hour winds effecting 1.8 million residents. Major Disaster Declaration number DR 1802 was declared on October 9, 2008. The impacts of the storm included extended power outages and extensive damage to trees and roofs. However, the impact to the electric distribution system was unprecedented. In the Louisville area, over 300,000 people lost power, which was a new record for the city. Over 1,400 power lines were torn down, hundreds of power poles snapped, and 130 roads blocked by debris. Four people were killed by the storm.

2009 Kentucky Severe Storms/flooding DR-(1163-KY): On August 4, 2009, a slow-moving cluster of thunderstorms descended from central Indiana into south-central Indiana and north-central Kentucky. As it entered the region at the head of a cold front, the storm strengthened significantly and began producing hail, strong winds, and heavy rain. As the storm moved into the Louisville Metropolitan Area, it continued to strengthen as a torrential downpour inundated the area. Within a one-hour period, more than 6 inches of rain fell on parts of the region, breaking all previous rainfall records for a one-hour period. By the end of the day, more rain fell than is normal for the entire month of August. Downtown Louisville, New Albany, Jeffersonville, and Clarksville were particularly hard hit, with water depth surpassing 4 feet in some areas, resulting in the first-ever flash flood emergency being issued. Creeks and streams quickly flooded many neighborhoods, and flash floods rendered numerous streets and areas impassable. Severe lightning and wind that accompanied the storm led to more widespread damage.

The Louisville International Airport was closed for hours after a Northbound Northwest Airlines flight, traveling from Knoxville to Minneapolis, passed through the storm over Louisville and experienced severe turbulence, injuring two passengers and forcing the plane make an emergency landing at Lexington.

From a transportation perspective, underground levels of city parking garages were completely underwater, destroying hundreds of automobiles. TARC, the city's public transportation system, was paralyzed, with most buses abandoning their routes due to impassible roadways. Partly due to debris washing onto the roadways, numerous automobile accidents, and people abandoning their vehicles because of rising waters, portions of I-71, I-64, I-65, and part of the Watterson Expressway (I-264) and The Gene Snyder Freeway (I-265) were shut down.

Early damage estimates were in the hundreds of millions of dollars. The University of Louisville and the Louisville Public Library's main branch each sustained millions of dollars in damage. The University of Louisville, which was closed and evacuated because of rising water on the campus, was among the worst hit. The university sustained over $15 million in damages, with five campus buildings sustaining significant flood damage and at least four others sustaining minor damage. The main branch of the Louisville Public Library was under 3 feet of water, destroying tens of thousands of books. The library sustained just over $5 million in damage, and was closed for a month of repairs.

At least 20,000 LG&E customers had power service disrupted. Most LG&E power terminals were underground, and at least a dozen were flooded, including the terminal powering their headquarters. The National Weather Service’s building in Louisville was struck by lightning, halting all operations at the location. The local emergency broadcast tower was also hit, briefly

stopping all emergency communication in the city. Lightning also struck an apartment complex in the Hurstborne neighborhood, starting a fire that consumed most of the 16-unit building. A second apartment in the western end of Louisville was struck by lightning and destroyed by the fire caused by the strike.

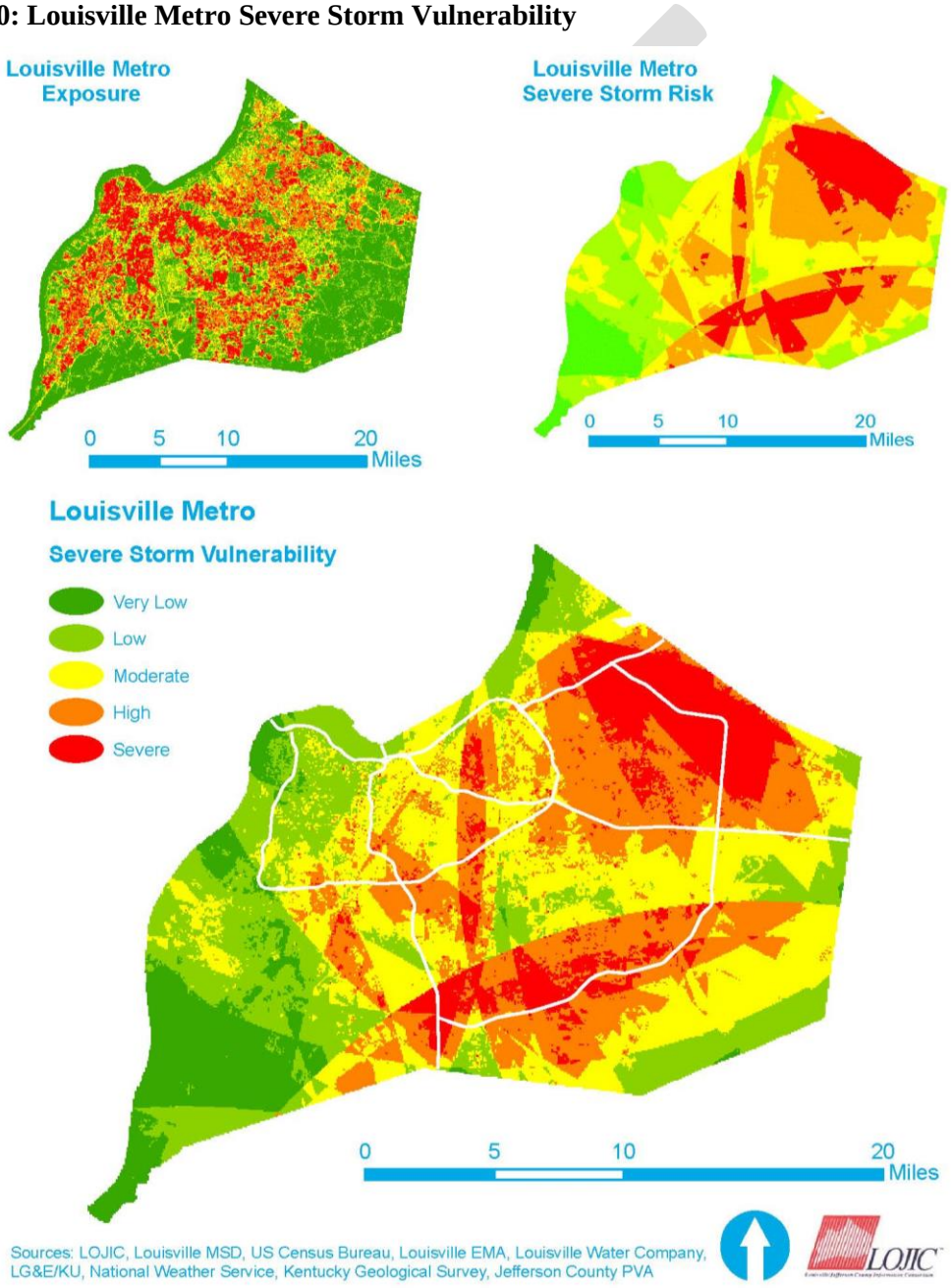
On August 12, Governor of Kentucky Steve Beshear requested the federal government declare all of Kentucky a major disaster area.

2011 Kentucky Severe Storms, Straight-line Winds, and Flooding DR-1855-KY: On May 4, 2011, President Obama declared a major disaster existed in Kentucky, and ordered federal aid to supplement Commonwealth and local recovery efforts in the area struck by severe storms, tornadoes, and flooding, beginning on April 22, 2011, and continuing through April 28, 2011. Although the Louisville Metro community was spared direct damage, a number of storm cells delivered strong winds and heavy rains.

5.13.3 Assessing Vulnerability

To determine structures that are vulnerable and estimated to be damaged during a severe storm event, the Hazard Boundary Overlay methodology was used. The hazard boundary used as the overlay was the grid cells that were determined to have the highest level of risk to severe weather. This was the same as the 2016 plan methodology, except events from 1950-2021 were considered. A listing of critical facilities and infrastructure highly vulnerable to severe storms is presented in Appendix E.

Figure 5-40: Louisville Metro Severe Storm Vulnerability



5.13.4 Climate Assessment

Severe thunderstorms are one of the primary causes of catastrophic loss in the U.S. Data from the Coupled Model Intercomparison Project, Phase 5 (CMIP5) indicate that conditions supporting the development of severe thunderstorms are expected to increase over the eastern U.S. in response to continued greenhouse gas emissions.[73] The most severe events are expected to increase in likelihood due to increasing convective potential energy and strong low-level wind shear. Spring exhibits the largest absolute increase, as well as the most consistent response across the different global climate models.

Although important uncertainties about storm-scale processes still exist, the fact that the projected increases in conditions that support severe storms are robust across a suite of climate models and are consistent even with lower emissions suggests that severe thunderstorm occurrence is highly likely to increase, thereby increasing the risk of thunderstorm-related damage.

A NASA study indicates heavy rainstorms will become more common with climate change.[74] When applied to a future with double the current carbon dioxide and a surface that is 5°F warmer than current conditions, their model indicated more storms would be expected to resemble the strongest storms that we experience today. Specifically, in the southeastern U.S., there is expected to be an increase in the most violent and severe storms that arise when strong updrafts combine with horizontal winds, which are a major source of weather-related casualties.

The term “atmospheric rivers” (ARs) refers to the relatively narrow streams of moisture transport that often occur within and across midlatitudes, in part because they often transport as much water as in the Amazon River. They account for a substantial fraction of the precipitation, and therefore water supply, often delivered in the form of an extreme weather and precipitation event. Under climate change conditions, ARs may be altered in a number of ways; namely, their frequency, intensity, duration, and locations. In association with landfalling ARs, any of these would be expected to result in impacts on hazards and water supply. The 4th National Climate Assessment reported high confidence that the frequency of AR storms will increase in association with rising global temperatures.

Climate Risk

Based on the best available scientific information and trends, it is highly likely that severe storms will worsen over the coming century. According to the Fourth National Climate Assessment, “Compared to damages from other types of extreme weather, those occurring due to thunderstorm-related weather hazards have increased the most since 1980, and there is some indication that, in a warmer world, the number of days with conditions conducive to severe thunderstorm activity is likely to increase.”

[73] https://www.wcrp-climate.org/wgcm-cmip/wgcm-cmip5

[74] https://climate.nasa.gov/ask-nasa-climate/2956/how-climate-change-may-be-impacting-storms-over-earths-tropical-oceans/

5.14 Severe Winter Weather

A winter storm is a combination of heavy snow, blowing snow, and/or dangerous wind chills. A winter storm is life-threatening.[75]

For the purposes of this plan, a severe winter storm is defined as an event that drops 4 or more inches of snow during a 12-hour period, or 6 or more inches during a 24-hour span. Severe winter storms are fueled by strong temperature gradients and an active upper-level cold jet stream. Some winter storms may be large enough to affect Kentucky along with other states, while others may affect a much smaller geographical boundary. Most winter storms are accompanied by low temperatures and blowing snow, which can severely reduce visibility.

Kentucky's location makes it vulnerable to heavy snowfall due to the state's proximity to the Gulf of Mexico, which 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 Kentucky 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 Kentucky. Sometimes, however, storms turn and move along the western margin of the Appalachian Mountains. With cold air in place over Kentucky, these storms bring moisture from the Gulf of Mexico and can dump heavy snow.

Severe Winter Types

- *Blizzards* are by far the most dangerous of all winter storms. They are characterized by temperatures below 20°F 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 0.25 mile or less for at least 3 hours. With high winds and heavy snow, these storms can punish residents throughout much of the U.S. during the winter months each year.
- *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 32ºF or below. In extreme cases, ice may accumulate that is several inches thick, although just a thin coating is often enough to do severe damage. Ice storms have been identified by Louisville Gas and Electric (LG&E) as the biggest threat to their electrical grid. Freezing rain can result in extensive damage to utility lines and buildings while making any type of travel extremely dangerous. The results are sometimes devastating: entire states can be almost entirely without electricity and communication for several weeks.

[75] https://www.nssl.noaa.gov/education/svrwx101/winter/types/

Winter storms can paralyze a community by shutting down normal day-to-day operations. Heavy snow can also lead to the collapse of weak roofs or unstable structures. Storm effects can cause hazardous conditions and hidden problems, including the following:

- Power outages result when snow and ice accumulate on trees, causing branches and trunks to break and fall onto power lines. Power lines can also get covered by ice and break away from poles. Blackouts vary in size from one street to an entire city. Loss of electric power during a severe winter weather event means loss of heat for many customers, which in turn poses a significant threat to human life, particularly for the elderly.
- A "snowmelt" flood may occur after snow and ice melts. A flood is considered a snowmelt flood when melting snow is a major source of the water involved. Unlike rainfall, which reaches the soil almost immediately, snow stores the water for some time until it melts, delaying the arrival of water at the soil for days, weeks, or even months. In addition, snow packs and ice chunks may block normal drainage passageways such as storm sewers or culverts, leading to localized flooding.
- Snow and ice accumulation on roadways can cause severe transportation problems in the form of extremely hazardous roadway conditions. This is typically the first impact noted during severe winter storm events.
- Extreme cold temperatures may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold, resulting in frostbite.

Everyone is potentially at risk during severe winter storms. In terms of death due to severe winter storms, 70% of the deaths are related to automobile accidents; 25% of those deaths occur when people are caught out in the storm and die from exposure. Of all the deaths related to exposure to cold, 50% are people over 60 years old, over 70% are males, and 20% occur at home.[76]

According to the National Weather Service, the Louisville Metro area receives on average 15.7 inches of snow per year. In 1978, the area received 50.1 inches, and in 1989, the area received just 0.9 inch. These figures represent both the most and least snowfall amounts recorded in the last 72 years. Annual snowfall totals as measured at the Louisville Muhammad Ali International Airport are presented in Table 5-41.

Table 5-41: Annual Snowfall Totals Louisville, KY

Years	Inches	Years	Inches	Years	Inches
1949-1950	1.5	1973-1974	9.2	1997-1998	29.0
1950-1951	34.4	1974-1975	16.5	1998-1999	9.4

[76] https://www.weather.gov/otx/Winter_Storms

Years	Inches	Years	Inches	Years	Inches
1951-1952	9.2	1975-1976	4.1	1999-2000	11.2
1952-1953	14.3	1976-1977	24.0	2000-2001	19.3
1953-1954	7.5	1977-1978	50.1	2001-2002	9.0
1954-1955	8.0	1978-1979	20.3	2002-2003	24.2
1955-1956	13.6	1979-1980	18.3	2003-2004	12.2
1956-1957	5.0	1980-1981	2.9	2004-2005	16.2
1957-1958	15.1	1981-1982	11.0	2005-2006	5.7
1958-1959	7.6	1982-1983	5.2	2006-2007	3.4
1959-1960	34.8	1983-1984	13.5	2007-2008	19.9
1960-1961	25.9	1984-1985	18.9	2008-2009	12.1
1961-1962	20.1	1985-1986	11.6	2009-2010	21.3
1962-1963	11.5	1986-1987	18.2	2010-2011	17.7
1963-1964	30.1	1987-1988	8.5	2011-2012	7.0
1964-1965	21.4	1988-1989	0.9	2012-2013	9.8
1965-1966	20.1	1989-1990	14.7	2013-2014	26.0
1966-1967	31.2	1990-1991	6.1	2014-2015	27.6
1967-1968	31.0	1991-1992	3.2	2015-2016	14.9
1968-1969	13.1	1992-1993	18.9	2016-2017	2.7
1969-1970	34.4	1993-1994	29.9	2017-2018	19.1
1970-1971	21.5	1994-1995	4.0	2018-2019	11.2
1971-1972	11.6	1995-1996	35.1	2019-2020	3.4
1972-1973	8.5	1996-1997	5.4	2020-2021	19.4
Mean	15.7 inches				
Max	50.1 inches - 1978				
Min	0.9 inches - 1989				

Unlike rain, winter storm precipitation requires government-led clean-up. The nearly 300-member Louisville Metro Snow Team is led by Public Works and also includes employees

of Metro Parks, Codes & Regulations, and Fleet Services. The Snow Team uses 160 pieces of equipment to clear 1,362 miles of road in Louisville.

5.14.1 Hazard Profile and Consequence Analysis

Table 5-42 represents the typical hazard profile associated with Severe Winter Weather.

Table 5-42: Profile Risk Table Severe Winter Weather

Period of occurrence:	Snow and ice are threats to most of the U. S. during the northern hemisphere's late fall and ends in middle spring. During the early and late months of the winter season, snow becomes warmer, giving it a greater tendency to melt on contact or stick to the surface. The beginning and end of the winter season also brings a greater chance of freezing rain and sleet.
Number of events:	Hundreds have occurred in the Louisville Metro area since 1960. The Louisville Metro area has seen six Declared Disasters associated with Severe Weather events, making it bar far the most common type of event receiving this designation.
Probability of events:	Annually – Hazard event likely to occur every year
FEMA Risk Rating/Score:	Cold Wave:: Relatively High - Score 39.89 Ice Storm: Relatively High - Score 35.31 Winter Weather: Relatively High - Score 25.65
Warning time:	Days for major snow storms Minutes to hours for major ice storms Minor events can occur anytime the temperature falls below freezing.
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.
Potential of injury or death:	Medium. Severe Winter Storms have a medium potential for injury or death, mostly related to extreme cold temperatures or accidents on icy/snowy roadways.
Possible Extent:	Snowfall levels in excess of two feet could occur, leading to power outages, resource shortages, injuries and deaths. Winter storms have the potential to result in states of emergency and Presidentially-declared disasters. As for ice storms, measurements of up to 0.25-inches can be expected, making travel treacherous and possibly leaving large swaths of the area without power for extended periods of time,

Consequence Analysis

A consequence analysis, derived from interviews with public officials and plan stakeholders, has been performed to better understand and outline the impacts that a severe winter storm would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic

conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-43.

Table 5-43: Consequence Analysis Severe Winter Weather

Subject	Impacts
Health and Safety of the Public	All residents within the Louisville Metro area are vulnerable to impacts from severe winter weather events. Impacts to the public include the potential for freezing temperatures, resulting in dangerous road conditions, accidents, and injury or loss of life. Secondary effects such as power loss and supply chain disruptions can also significantly impact the health and safety of the general public.
Health and Safety of Responders	Emergency responders, such as fire and police, could be called to evacuate people, close roads due to dangerous conditions, perform wellness checks, and attend to injured personnel. Power representatives would likely be asked to work extended hours to repair electric lines, often times relying on mutual aid agreements with other utilities in an effort to quickly restore services after ice storms. And during a severe winter weather event, as with all hazard events, responders face the risk of personal injury while performing necessary job functions.
Vulnerable populations	Slippery conditions, power and transportation loss and associated with severe winter weather can have the largest effects on vulnerable populations. While anyone can slip on icy and snow covered surfaces, those over 50 suffer the worst effects due to lower bone density. Power loss can create significant issues, including lack of heat and medical equipment failure. And the loss of transport capabilities can lead to missed medical appointments and general isolation.
Continuity of Operations (including delivery of services)	Severe winter weather tends to affect whole regions, and sometimes an entire state. Consequently, continuity of operations may be affected depending upon the geographic extent and severity of the winter weather event. Delivery of services may be slowed or halted in affected areas as a result of freezing temperatures, snow and ice accumulations, dangerous road conditions, and/or momentary losses in power and communications.
Property, Facilities, and Infrastructure	Home and landowners throughout the Louisville Metro area may experience varying levels of damage to property depending upon snow and ice loads, though damage is usually minimal. Infrastructure may experience impacts in the form of damage to roadways (particularly during snow removal), and interrupt ions to above-ground power and communication systems.
Environment	Severe winter weather impacts the environment by damaging vegetation and tree limbs. Major ice storms can result in downed trees due to the weight ice brings. Additionally, rapid snowmelt may also lead to flash flood events, which causes further environmental impacts.

Subject	Impacts
Economic Conditions	A major severe winter weather event such as a blizzard or major ice storm would be costly for both the Louisville Metro government, utilities, and residents. Louisville Metro could be responsible for repairing damages associated with government property and storm cleanup, while Louisville Gas and Electric would be responsible for repairing damaged power lines. Although some of the costs could be recouped through federal reimbursements (if the event is large enough to received federal aid), Louisville Metro would likely still feel the fiscal impact of a major event. Residents could be hit cleanup costs associated with snow/ice removal, downed trees, spoiled food due to power loss and property damage.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively Louisville Metro and utilities are able to remove snow and ice and how fast power, if lost, is resumed.

5.14.2 Significant Louisville Metro Severe Winter Weather Occurrences

According to FEMA's Data Visualization Tool, there have been three Declared Disasters in the Louisville Metro area related specifically to severe winter weather. Two of these declarations are associated with the same event. Each event is described below.

February 3-6, 1998 Snowstorm: Although the storm system looked like a typical Nor'easter for this time of year, taking a path from the Gulf Coast to the northeast along the Atlantic Coast, it was packed with strength and very slow-moving. With these two factors, enough moisture was pulled into the system from the Atlantic Ocean (not the Gulf of Mexico, as is usually the case) and the Appalachian Mountains proved no barrier for bringing the moisture farther west than a normal Nor'easter. Heavy snows started on the evening of February 3 in the southeast portions of the Louisville Metro area, then traveled north, reaching the Louisville metropolitan area shortly before sunrise on February 4. Areas of 10+-inches of snow accumulations stretched all the way to the Ohio River by the evening, with some areas experiencing up to 25 inches. Power lines were down across most of the Louisville Metro area, roads became covered, slick, hazardous, and even impassible in some cases.

By February 6, 36 of the 49 counties in the Kentucky area surrounding the Louisville Metro area had at least 10 total inches of snow on the ground. Louisville itself broke its all-time storm total snowfall, reaching 22.4 inches (previous record: 15.9 inches on January 16-17, 1994). Over the next three days, three people lost their lives in weather-related traffic accidents across the state, and another four were injured. States of emergency were declared for most counties in Kentucky.

January 26-28, 2009 Ice Strom: On January 26, 2009, a severe winter storm began with snow which changed to freezing rain. Up to 6 inches of snow accumulated before the storm switched from snow to rain. Freezing rain then continued over western and southern Kentucky for hours. On Tuesday the 27, ice over 1 inch thick was reported in many locations from the freezing rain. Tuesday night, freezing rain and sleet continued over southern Indiana, freezing rain transitioned to rain over the Louisville Metro area. Then on the morning of Wednesday, January 28, precipitation changed over to snow again, with about 3 to 4 inches of additional snow accumulation piled up on top of the snow and ice already received. This was followed by periods

of strong winds. By storm's end, there was a snow/ice accumulation 2 to 10 inches, and statewide power outages of more than 769,000. In Louisville Metro, there were power outages for over 404,000 people. It took up to 10 days to get the power restored. Area school systems were closed for an entire week. Several emergency shelters were set up across the affected region.

Governor Steve Beshear called the storm the 'Worst natural disaster in the history of Kentucky.' On January 29, 2009, President Obama announced an Emergency Declaration for Kentucky. In total, 101 out of 120 counties were declared a state of emergency, and the President issued a Presidential Disaster Declaration on February 5 (DR 1818). The Kentucky Department of Emergency Management and FEMA estimated damage at more than $214 million. Kentucky issued the first ever call-up of Kentucky National Guard with 4,100 personnel/troops. The storm caused Kentucky's worst death toll, with 36 storm-related deaths.Additional Severe Winter Storms of Note

Great Ice Storm of '51: Between January 29 and February 2, 1951, an extremely strong high-pressure system started making its way into the region, pulling harsh, cold, polar air in with it. In the meantime, a strong low-pressure system was moving through areas farther south along a cold front, stretching from the Gulf of Mexico and up into the Northeast. The cold front caused temperatures to drop, so that on the evening of January 30, temperatures for Nashville, Tennessee, were only at 18 degrees Fahrenheit (-8 degrees Celsius). However, temperatures just above the surface at 5,000 feet were actually above freezing, registering at 48 degrees Fahrenheit (9 degrees Celsius). This was the perfect set up for the development and occurrence of freezing rain and sleet.

In Louisville, almost 3 inches of snow and sleet had covered the city by morning of January 31, causing roads to become almost impassable. By noon, the snow had turned to rain due to the above-freezing warmer air aloft; however, on the surface, temperatures had only risen to 28 degrees Fahrenheit. This caused the rain to freeze on impact, worsening the traffic situation.

Then a turn for the worse occurred yet again. By the next morning, on February 1, temperatures started dropping dramatically. Before the day was over, temperatures below zero had been recorded, and another several inches of snow had fallen. Travel by this point was virtually impossible, causing major delays for airlines, busses, and trains throughout the state. Damage was reported throughout the region as tree limbs cracked and fell onto power lines due to the dense ice packed onto them.

The cold only continued. At 4:45 a.m. February 2, Louisville recorded a temperature of -20 degrees Fahrenheit, the coldest official temperature ever recorded in February up to that time. The precipitation continued as well, leaving behind 9 inches of snow and sleet on the ground in Southern Kentucky. Crews were working around the clock to restore both power and phone lines. Water pipes burst under the extreme cold, transportation remained halted, temperatures remained unbearable, and ten days later the area, had yet to recover from the ice and snow.

The Great Ice Storm of 1951, as it came to be known, covered the south in a linear path of ice from Louisiana to Ohio. Heaviest accumulations fell in a line from Memphis to Nashville, Tennessee, and northeastward into Lexington, Kentucky. It was the costliest winter on record for the time, causing an estimated $100 million in damage. The impact on forest, livestock, crops,

and fruit trees was responsible for $64 million of that total. It is estimated that 25 people lost their lives across the areas affected by the storm, and another 500 were injured.

2004 Christmas Snowstorm: Between December 22-23, 2004, a winter storm dropped snow onto sections of southern Indiana and counties bordering the Ohio River in Kentucky, with accumulations up to 30 inches, causing drifts of 2 to 5 feet. At times, the snow fell at a rate of 4 inches per hour, with highest accumulations measuring 32 inches. Most roads in these areas were considered dangerous and impassible. In the Louisville Metro area, the winter storm began with freezing rains, then changed to sleet and snow over parts of the region. In some areas, ice was ½ inch thick; in others, ice was up to a full inch, not to mention the addition of sleet and snow amounting anywhere from 1 inch to 4 inches, and in some places even up to 10 inches.

Many residents were left without power for a long period of time. Over 33,000 Louisville Metro homes experienced power outages for at least two days, where a total of 6 inches of sleet fell before the snow ever hit. Trees and limbs snapped at the weight of the ice across the state, cluttering the roads, which at this point were still impassible.

Perhaps the most crippling aspect of this event was its timing. Because it occurred right before the Christmas holidays, airlines suffered significantly and businesses lost millions of last-minute customers. It is said that the local businesses lost a significant percentage of their expected holiday sales during the storm.

2007 Easter Freeze: Between April 5-10, 2007, and after an unusually warm streak the last ten days of March, with temperatures topping out in the 70s and 80s each day, a cold front made its way into the Ohio Valley Region. With the cold front came extensive severe weather, and afterwards replaced the once high temperatures with an immense area of cold Canadian air. Temperatures dipped into the 20s and 30s in the mornings between the 5th and the 10th throughout Kentucky and Southern Indiana. Louisville and Lexington both recorded impressive lows, with Louisville reporting 25 degrees on the 7th, and Lexington 22 degrees for both the 7th and 8th.

Before the cold streak, the spring crops and plant growth were getting an early start with the excessive warmth for the time of season. However, as the cold air set in for the week, the below-freezing temperatures took advantage of the blooming vegetation. Nearly all crops suffered losses, including most of the state's peaches. Half the wheat crop was destroyed, estimated at $63,000,000 million in losses. The same went for the area's corn crop, which reported $5,000,000 in losses. And $16,000,000 in damages was reported for a $20,000,000 million dollar fruit industry, nearly crippling it. Total losses throughout the Kentucky and southern Indiana region were well over $130,000,000.

February 11, 2008: Four inches of snow fell the evening of February 11. Approximately 1/4 inch of ice early on the 12th glazed roads and brought about minor tree damage. Tree branches falling on power lines bought about a power outage to 4,000 residents in the Louisville metropolitan area. Snow developed during the late afternoon on February 11th, and continued until late evening. A swath of 3- to 4-inch accumulations fell across Jefferson County along Interstate 64 through the northern Bluegrass region. Freezing rain later developed across northern Kentucky during the pre-dawn hours on February 12th. Ice accumulations ranging from 1/4 inch to just

under 1/2 inch were common until temperatures rose above freezing by late morning. Ice accumulations brought minor tree damage. The snow and freezing rain led to numerous school and activity cancellations.

March 7, 2008: A snowstorm developed during the early morning hours Friday, March 7. Snow and some sleet fell intermittently over the next 28 hours. Snowfall totals were highest along the Ohio River, where accumulations varied from 10 to 12 inches. Farther south, snow started later in the day and accumulations were lower. Snow totals varied widely across the Bluegrass region, ranging from 8 inches in Frankfort to less than 4 inches south and east of Lexington. Sleet with occasional thunder fell across the eastern Bluegrass region late on the 7th,with 1 to 2 inches of sleet accumulating. Across south-central Kentucky, snowfall ranged from over 8 inches north of Bowling green to just under 4 inches along the Kentucky-Tennessee border.

December 23, 2008: Slick roads due to light freezing rain lead to several injury-causing accidents and one fatality in the Louisville metropolitan area. The fatality occurred when a driver lost control of his vehicle. Another accident on the Gene Snyder Expressway injured two emergency workers who were providing aid to a driver hurt in an earlier crash. The three were taken to University Hospital with injuries that did not appear to be life-threatening. Emergency workers in Louisville responded to as many as 40 calls about accidents between 2 and 5 p.m. due to the icy conditions. Light freezing rain developed during the afternoon of December 23rd. Ice accumulation on roads across the northern portions of Kentucky lead to numerous traffic accidents and several fatalities.

January 7, 2010: Three to four inches of snow fell countywide. Officially, 3 inches were measured by observers at Standiford Field in Louisville. The local newspaper reported very slick roads and numerous traffic accidents. An upper-level trough and a weak surface low moved across central Indiana during the day. Snow began near dawn and continued on an intermittent basis through late afternoon. Snow accumulations ranged from 3 to 4 inches across the northern Bluegrass Region and areas adjacent to the Ohio River, to around 1 inch near the Tennessee border. Precipitation remained all snow, despite the northerly track of the surface low and light southerly winds. Due to antecedent cold temperatures, snow accumulated readily on roads and bridges, causing many accidents and travel problems.

January 29, 2010: Officially, 3.6 inches of snow fell at the Louisville International Airport. Four and one half inches of snow fell at the NWS forecast office. Traffic was severely hampered early Saturday morning. An upper-level disturbance moved east from the southern plains through the Tennessee Valley late on a Friday night. This storm spread a broad swath of heavy snow extending from Oklahoma eastward across the Tennessee Valley and across the southern Appalachians through the Mid-Atlantic states. Snow slowly moved northeast into south-central Kentucky by mid-afternoon Friday, January 29th. Light to moderate snow continued across central Kentucky before ending shortly after dawn on Saturday. Due to antecedent dry air, snow did not develop across north central Kentucky and the Bluegrass Region until late Friday evening. Four to eight inches of snow fell across the southern tier of counties adjacent to Tennessee. This amount of snow had not been seen in this area for several years. Farther north, 4 to 6 inches of snow fell across central Kentucky along and south of a line from Louisville

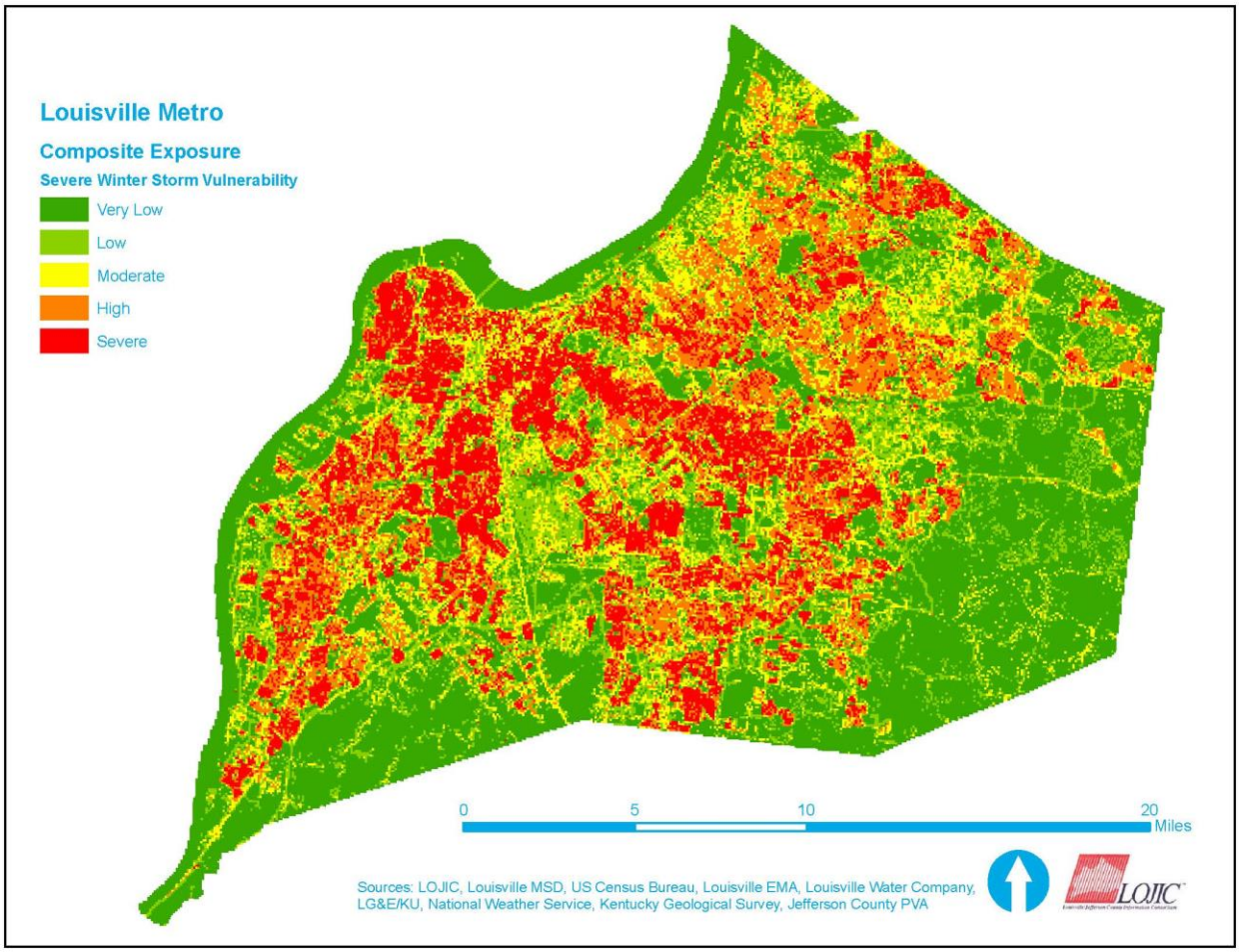
through Lexington. Other locations along the Ohio River northeast of Louisville and across the northern Bluegrass received 1 to 4 inches.

February 8, 2010: Just over 6 inches of snow fell at Standiford Field (Louisville International Airport) in Louisville. The National Weather Service Forecast Office measured 6.3 inches of snow. An inverted trough moving across Tennessee combined with an upper low sliding south across the upper Midwest brought a mixture of heavy snow, sleet, and rain across central Kentucky Tuesday morning, February 9. Snow began during the evening hours across south-central Kentucky and moved north of Interstate 64 by midnight. By the early morning, snow had turned to sleet and rain south and east of a line from Breckinridge County through Henry County. Along the Ohio River, banded precipitation brought intermittent bursts of heavy snow around 8 to 9 am. The heaviest snow totals fell along the Ohio River, where 4 to 7 inches of accumulation were common. Sleet and rain limited snowfall amounts to 1 to 3 inches across south central Kentucky and the Bluegrass Region.

5.14.3 Assessing Vulnerability

To determine structures that are vulnerable and estimated to be damaged during a severe winter weather event, the Hazard Boundary Overlay methodology was used. The hazard boundary used as the overlay was the grid cells that were determined to have the highest level of risk to severe weather. As with the severe weather section above, this was the same as the 2016 plan methodology, except events from 1950-2021 were considered. A listing of critical facilities and infrastructure highly vulnerable to severe weather is presented in Appendix E.

Figure 5-41: Louisville Metro Severe Winter Storm Vulnerability Map



Identifying individual structures and estimating potential losses from severe winter weather is a challenging endeavor. Without any current spatial data that truly identifies severe winter weather hazard boundaries, it is assumed that the entire county has equal vulnerability and the potential to be damaged. That being stated, it is assumed that each structure in Louisville Metro has an equal chance of being affected by a Severe Winter Storm.

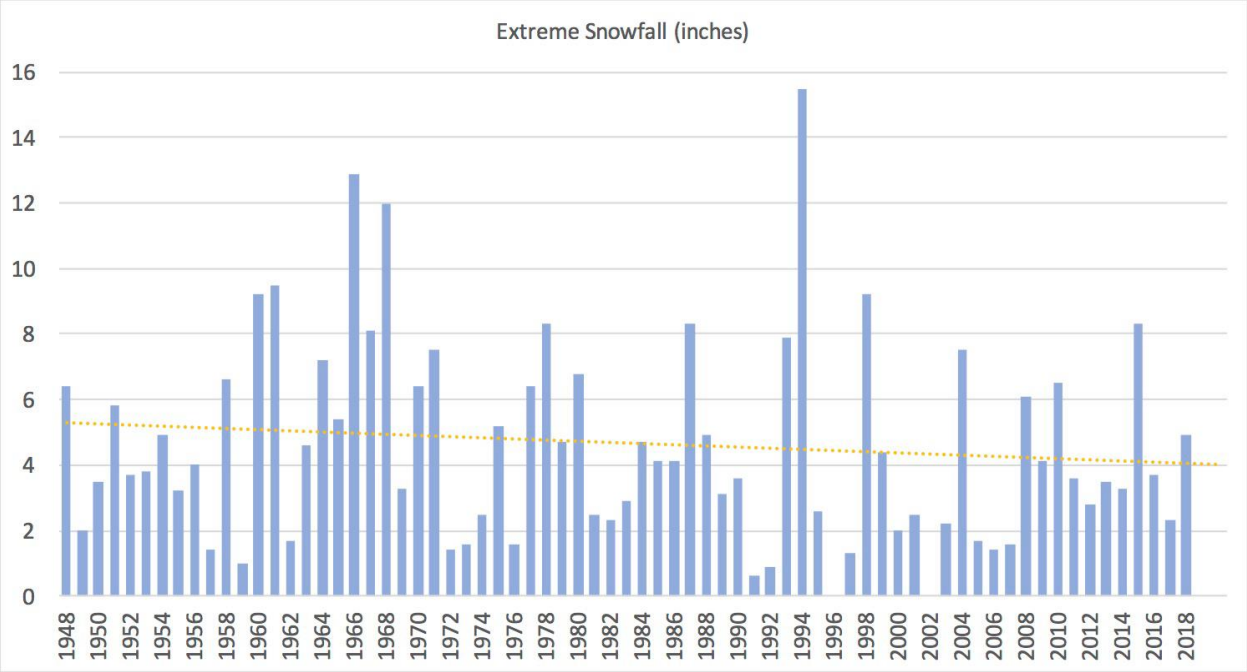
5.14.4 Climate Assessment

Analysis of storm tracks indicates that there has been an increase in winter storm frequency and intensity since 1950. There were more than twice the number of extreme regional snowstorms throughout the eastern U.S. from 1961-2000, compared to the previous 60 years. These extreme storms occurred in colder and wetter snow seasons than average. For the next few decades, even with warming temperatures, record storms will continue to be possible.

Contrary to the larger regional trends, extreme snowfall in Louisville has declined from 1948-2018. Average extreme snowfall has declined by 20%, in a comparison of the most recent 30-year period (1989-2018) to the historical period of 1961-1990. As Figure 5-42 shows,

extreme snowfall (over 6 inches) in Louisville Metro (as measured within a 24- hour period at the Louisville International Airport weather station) has been decreasing over the past 70 years.

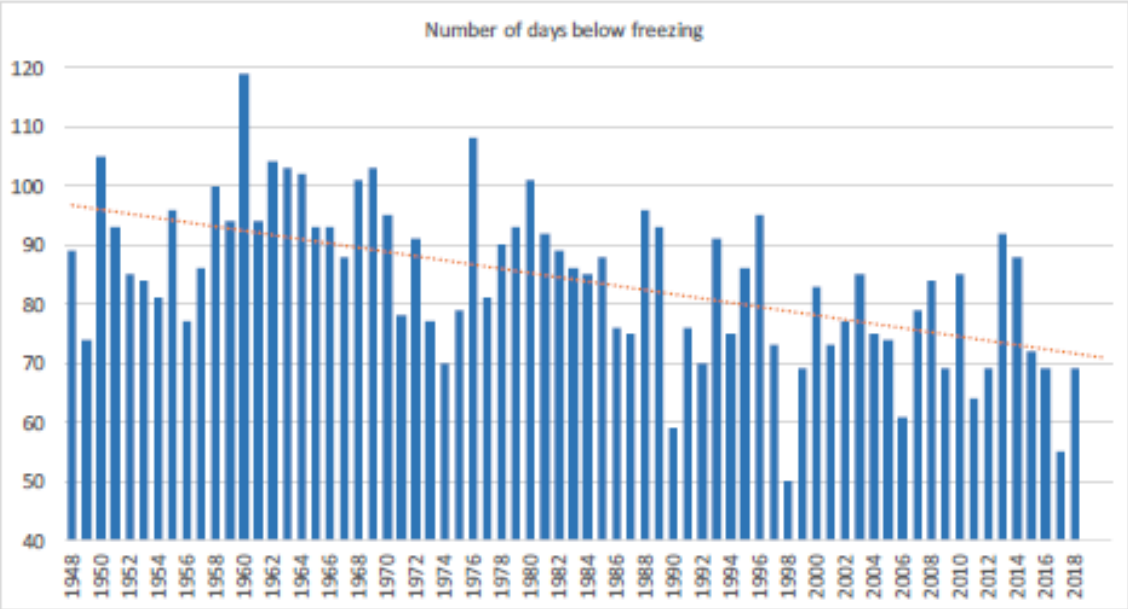
Figure 5-42: Louisville Extreme Snowfall by Year



Assuming continued higher greenhouse gas emissions, model projections estimate that snowfall in Louisville will decline by 61 to 77% by 2045-2069, and by 77 to 91% by 2070-2099, as compared to historical averages from 1961-1990. This indicates that, while rainstorms are expected to increase in severity, severe snowstorms could become increasingly rare.

Also, as Figure 5-43 shows, the number of days below freezing (as measured at the Louisville International Airport weather station from 1948-2018) in Louisville Metro has been declining over time.

Figure 5-43: Louisville Number of Days Below Freezing



Model projections indicate that the number of days below freezing is expected to continue to decline, with 46 fewer days per year, on average, below freezing by 2040-2069, and 64 fewer days by 2070-2099. This represents 25 to 40% fewer freezing nights by mid-century, and 38 to 53% fewer by late-century, as compared to the historical period of 1961-1990.

In general, models indicate that as the climate warms, the number of severe winter storms will decline in the Louisville Metro area over time.

Climate Risk

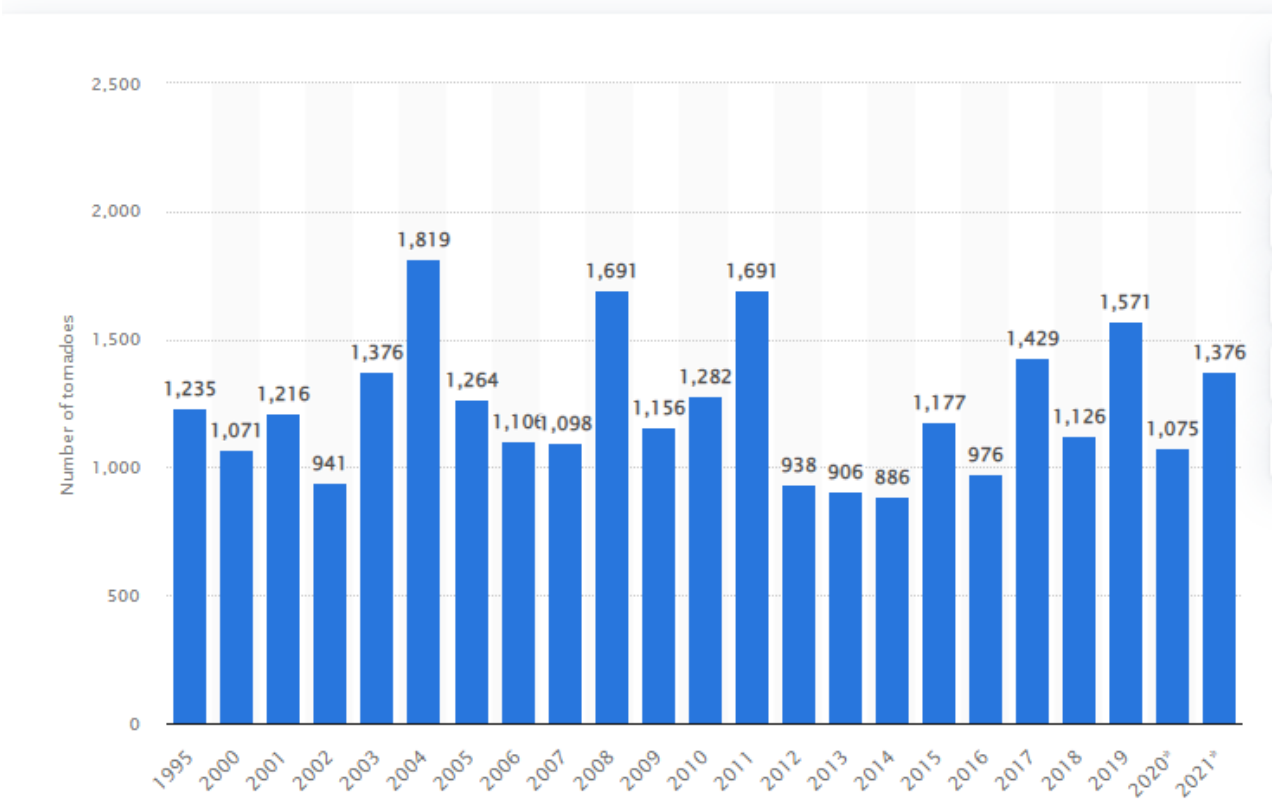
Based on the best available scientific information and trends, it is likely that severe winter storms will lessen over the coming century, but extreme winter storms will still occur. The temperature conditions amenable to the formation of ice storms could become 25 to 40% less common over the next 30 years. Similarly, snowfall is expected to continue to decline by 61 to 77% over this time period. However, individual storms are also expected to become larger. Severe winter storms are expected to affect the County equally across the geographic area, but some populations may benefit more than others by warmer temperatures and less snow and ice.

5.15 Tornado

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. 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 and wind-blown debris with paths that can be in excess of 1 mile wide and 50 miles long. Tornado season is generally March through August, although as recent data suggest, tornadoes can occur at any time of year. They tend to occur in the afternoons and evenings, because over 80 percent of all tornadoes strike between noon and midnight. As Figure 5-44 shows, over the past 25 years, there have been on average approximately 1,253 tornadoes reported in the United States per year[77]. Of these years, 2004 showed the highest levels (1,819), and 2014 showed the lowest (886).

Figure 5-44: Average Number of Tornadoes in the U.S. Per Year 1995-2021

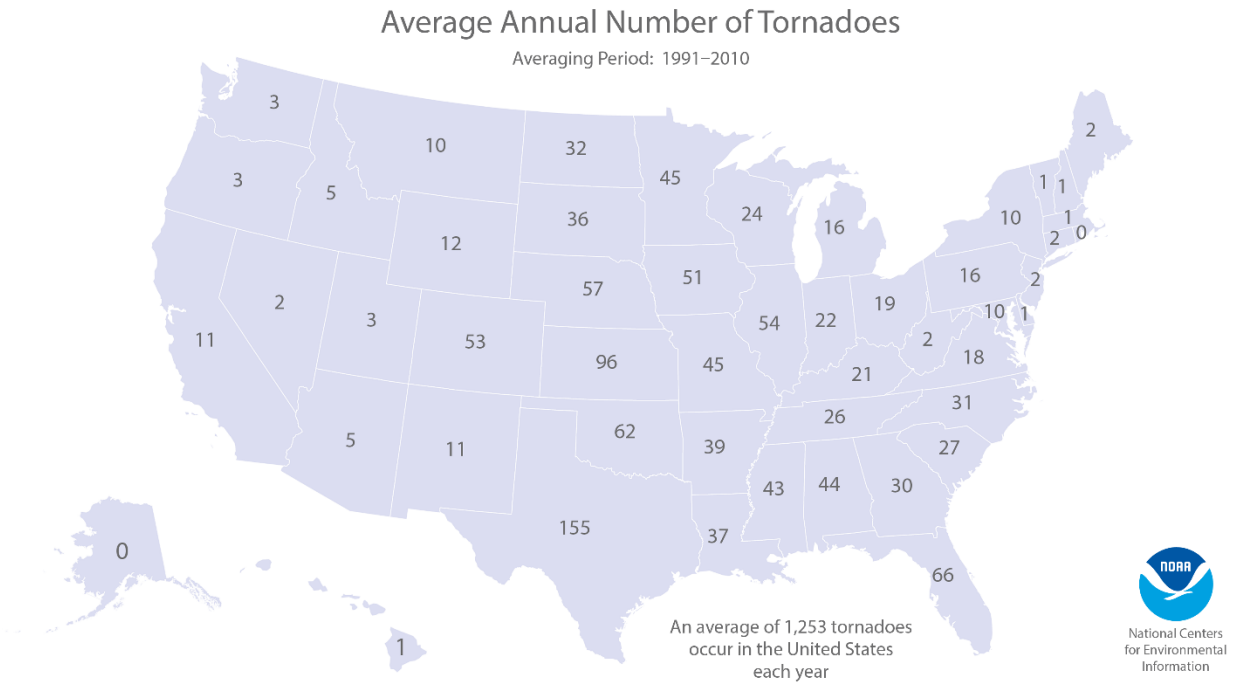


Using NOAA data from 1991-2010 (Figure 5-45), Texas is by far America's most active state for tornadoes, averaging 155 events each year. In a distant second place is Kansas, with an annual average of 96 tornadoes. Rounding out the top five are Florida, averaging 66, Oklahoma, with an

[77] https://www.statista.com/statistics/203682/number-of-tornadoes-in-the-us-since-1995/

average of 62, and Nebraska, which averages 57. Between 10 and 28 tornadoes are considered average for parts of the Ohio Valley, Great Lakes, mid-South, and Southeast. Kentucky averages 21 tornados per year. [78]

Figure 5-45: Average Annual Number of Tornadoes in the U.S. by State



Based on data published by the Courier Journal detailing tornado activity in Kentucky for the years 1950-2022[79], 1,315 tornados are registered as having occurred in the state, resulting in 3,715 injuries and 222 deaths. Over this 72-year period, property losses associated with tornado damage were estimated to be in excess of $1B, with crop damages to be excess of $2M. Of note, of the top 10 years for tornado occurrences Kentucky, 8 have occurred within the last 20 years.

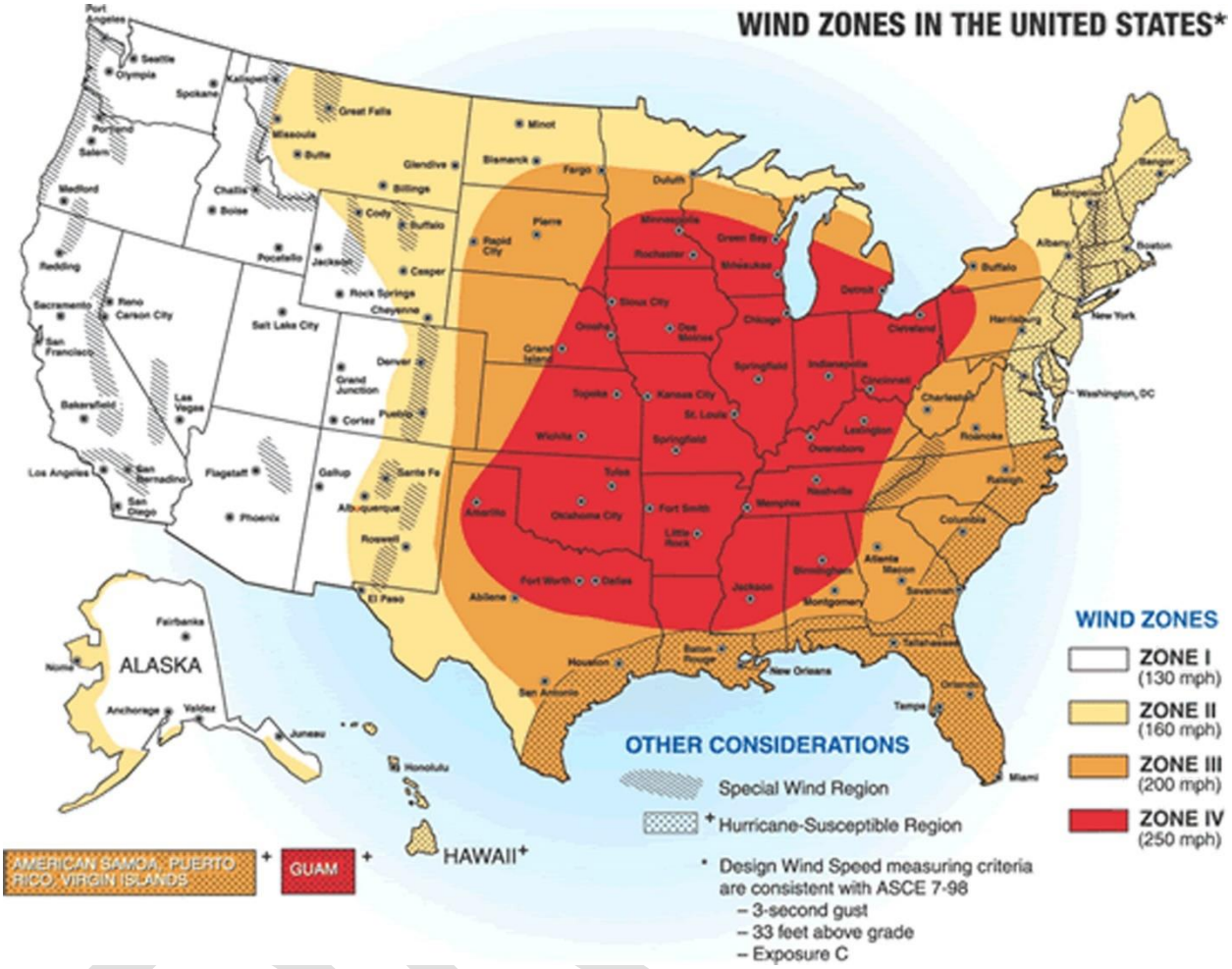
According to the National Institute of Science and Technology (NIST), Kentucky is situated in Wind Zone IV. Figure 5-46[80] shows how the frequency and strength of extreme windstorms vary across the United States. Wind speeds in Zone IV (red), where the risk of extreme windstorms is greatest, can be as high as 250 miles per hour.

[78] https://www.climate.gov/sites/default/files/2021-08/DatasetGallery_Average-Annual-Number-of-Tornadoes-United-States-Map_thumb_16x9.png

[79] https://data.courier-journal.com/tornado-archive/

[80] https://www.nist.gov/image/windzonemapjpg

Figure 5-46: NIST Wind Zone Map



Tornado Types

Most tornadoes are just a few dozen yards wide and touch down only briefly; however, highly destructive tornadoes may carve out a path over a mile wide and several miles long. The destruction caused by tornadoes may range from light to catastrophic, depending on their intensity, size, and duration. Effects of tornadoes may include crop and property damage, power outages, environmental degradation, injury, and death. Tornadoes are known to blow off roofs, move cars and tractor-trailers, and demolish homes.

The original Fujita Scale (F) was developed in 1971 by Dr. T. Theodore Fujita. Over the years, National Weather Service personnel recognized that improvements to the scale were necessary due to some limitations. The primary limitations were the lack of damage indicators, no account of construction quality and variability, and no definitive correlation between damage and wind speed. This sometimes resulted in inconsistent ratings of tornadoes, and in some cases, an overestimate of tornado wind speeds.

The Enhanced Fujita Scale, or EF Scale, became operational on February 1, 2007. This scale is a precise way to assess the damage from a tornado. It classifies tornado damage (EF0-EF5) as calibrated by those from the meteorological and engineering communities. The Enhanced Fujita Scale is a set of wind estimates, not measurements, based on damage. It uses a 3-second gust estimated at the point of damage. The damage is based on a judgment of up to 12 levels of damage or Degrees of Damage (DOD), to 28 Damage Indicators (DI). Examples of Damage Indicators are buildings, structures, and trees. By observing the Degree of Damage to each Indicator, the person conducting the survey can assign an estimate of wind speed. The estimated wind speed then determines the EF-Scale category appropriate for the observed damage. Table 5-44 shows how tornadoes are measured. It should be noted that the Operational Scale uses round numbers for easier reference.

Table 5-44: Tornado Measurement Scales

Fujita Scale (F)			Derived EF Scale		Operational EF Scale	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

The typical damage associated with a specific type of tornado, according to NOAA, is presented below in Table 5-45[81]:

Table 5-45: Tornado Damage by Type

EF Number	Typical Damage
0	*Light Damage:* Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
1	*Moderate Damage:* Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
2	*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.

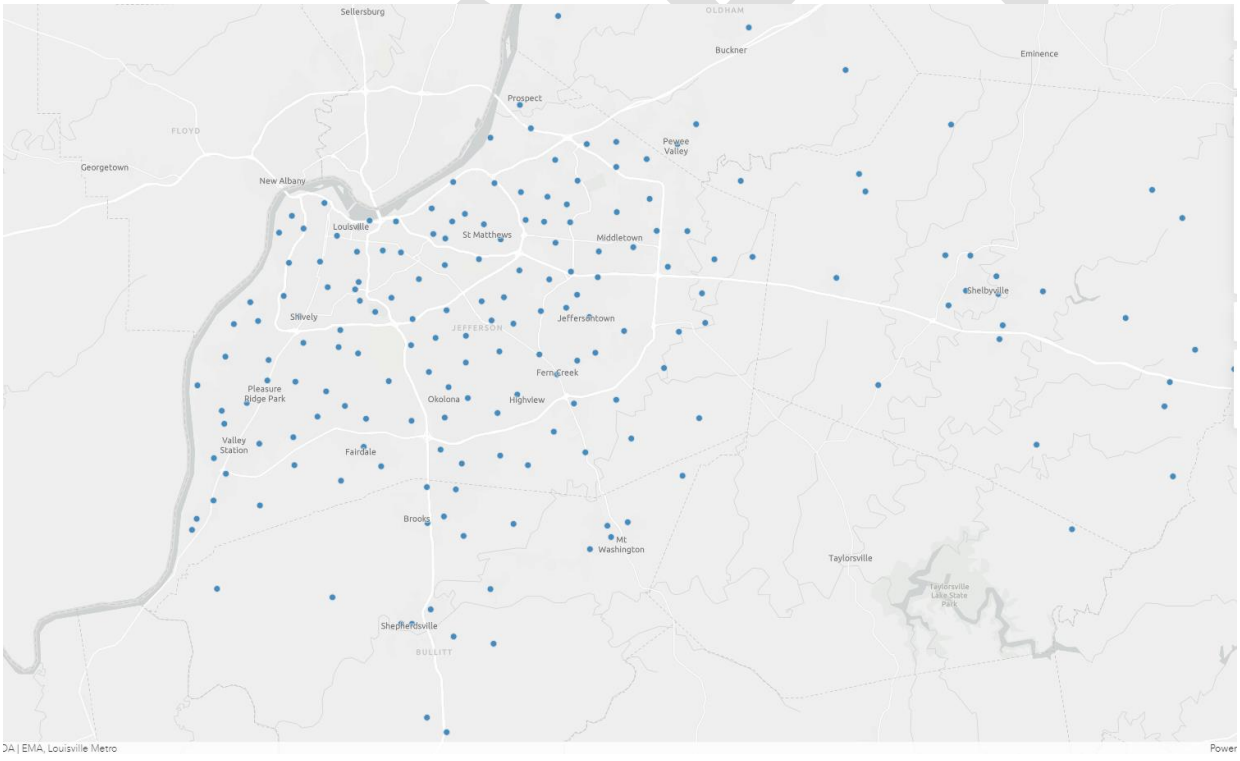
[81] https://www.spc.noaa.gov/faq/tornado/f-scale.htm

EF Number	Typical Damage
3	*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.
4	*Devastating Damage:* Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
5	*Incredible Damage:* Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.

Tornado Warning Sirens

As depicted on the map below, Louisville Metro maintains 192 Community Warning Sirens in Jefferson, Oldham, Bullitt, and Shelby Counties[82]. These sirens, coupled with emergency notifications delivered via cell carrier texts, provide early warnings for potential tornadoes, and are tested at noon on the second Tuesday of each month by Louisville Metro Emergency Services.

Figure 5-47: Louisville Metro Community Warning Sirens Map



Source: Lojic

[82] https://www.lojic.org/outdoor-warning-sirens

5.15.1 Hazard Profile and Consequence Analysis

The table below represents the typical hazard profile associated with Tornados.

Figure 5-48: Profile Risk Table Tornado

Period of occurrence:	Year-round, primarily during March through August. The month of May normally produces the greatest number of tornadoes in the Louisville Metro area.
Number of events:	24 (1964-2022)
Probability of events:	Frequent - Tornado events are likely to occur within 25 years (>4% chance of occurrence in any given year).
FEMA Risk Rating/Score:	Very High - Score 61.93
Warning time:	Minutes to hours. Over 80 % of all tornadoes strike between noon and midnight.
Potential of injury or death:	High. Tornadoes have a high potential to cause injuries and death. Although there have been just three reported deaths attributed to tornadoes in Louisville Metro, in December 2021, one of the deadliest tornadoes in U.S. history struck western Kentucky, resulting in a confirmed death toll of over 80, with many more injured.
Possible Extent:	On April 3, 1974, an F4 tornado caused 3 fatalities, 225 injuries, and damaged or destroyed over 900 homes in the Louisville Metro area.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and Plan stakeholders, was performed to better understand and outline the impacts that a significant tornado (F2+) would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-46.

Table 5-46: Consequence Analysis Tornado

Subject	Impacts
Health and Safety of the Public	Home and landowners throughout the Louisville Metro area are at risk to impacts from tornado events. Impacts to the public include potential injury or loss of life, and destruction of property due to rotating vortex and/or straight - line winds.
Health and Safety of Responders	First responders, such as fire and police, would be called to the incident area(s) to evacuate people, close roads because of fallen trees and/or debris blockages, and attend to any injured. For a tornado event, as with all disaster events, responders face the risk of personal injury while performing necessary job functions.

Subject	Impacts
Vulnerable populations	Vulnerable populations are at higher risk for the effects of tornados. For example, elderly populations typically have more difficulty with mobility, putting them at greater risk of injury in the event of a tornado strike. Lower-income populations likely live in structures that are more suspectable to high wind damage. Rural populations are farther from public services and may not hear Tornado warning sirens. These are just some of the many examples of how vulnerable populations are at greater risk.
Continuity of Operations (including delivery of services)	The impacts on continuity of operations would be limited unless a facility is directly within the path of destruction of a tornado. Delivery of services may be slowed or halted in affected areas as a result of downed trees, blocked roadways, and/or momentary losses in power and communications.
Property, Facilities, and Infrastructure	Community-wide impacts include utility damage and outages, infrastructure damage (transportation and communication systems), structural damage to homes and businesses, and damaged or destroyed critical facilities. Tornadoes can also cause severe transportation problems and make travel extremely dangerous. Home and landowners throughout the Louisville Metro area may experience varying levels of damage to property depending upon the severity of winds in the area.
Environment	Tornados, much like other high wind events, impact the environment by potentially spreading debris and pollution; damaging sewer and wastewater treatment plants; and disturbing wildlife and natural areas.
Economic Conditions	A major tornado event would be costly for the Louisville Metro area because of the potential for damages associated with property, debris generation, and loss of power. Some of the costs could be recouped through insurance and federal grant reimbursements, but Louisville Metro would still feel the fiscal impact of a major event.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively Louisville Metro prepares for and responds to a tornado event.

5.15.2 Significant Louisville Metro Tornado Occurrences

Tornados occur rather frequently in the Louisville Metro area; however, only one event has resulted in a Presidentially Declared Disaster Designation. This event was part of the "1974 Tornado Super Outbreak," where in just under 24 hours, 148 tornadoes caused 315 fatalities and injured over 5,000 people across 13 states. This outbreak set the precedent for tornado research and forecasts, and is further described below:

April 3, 1974 Kentucky Tornadoes (DR-420-KY): An outbreak of 20+ tornadoes and numerous severe thunderstorms caused more deaths, injuries, and property damage than any other tornadoes in Kentucky history to that point. Seventy-five people were killed, and over 1,250 people were injured. Total property damage was estimated at over $110M in 1974 dollars (equivalent to $661,062,070 today).

In the Louisville Metro area, a supercell thunderstorm spawned an F4 tornado that touched down at The Kentucky Fair and Exposition Center, and destroyed the majority of the horse barns at the center and part of Freedom Hall (a multipurpose arena) before it crossed Interstate 65, scattering several vehicles on the expressway. The tornado continued its 22-mile journey northeast, where it demolished most of Audubon Elementary School and affected the neighborhoods of Audubon, Cherokee Triangle, Cherokee-Seneca, Crescent Hill, Indian Hills, Northfield, Rolling Fields, and Tyler Park. Numerous homes were destroyed in residential areas, including a few that were leveled. The tornado ended near the junction of Interstates 264 and 71 after killing three people, injuring 207 people, destroying over 900 homes, and damaging thousands of others. Cherokee Park, a historic 409-acre municipal park located at Eastern Parkway and Cherokee Road, had thousands of mature trees destroyed.

1974 Tornado, Downtown Louisville, KY
Photo: Bill Luster, The Courier-Journal

Dick Gilbert, a helicopter traffic reporter for radio station WHAS-AM, followed the tornado through portions of its track, including when it heavily damaged the Louisville Water Company's Crescent Hill pumping station, and gave vivid descriptions of the damage as seen from the air. A WHAS-TV cameraman also filmed the tornado when it passed just east of the Central Business District of Louisville.

WHAS-AM broke away from its regular programming shortly before the tornado struck Louisville and was on-air live with John Burke, the chief meteorologist at the National Weather Service's Louisville office at Standiford Field, when the tornado first descended. The station remained on the air delivering weather bulletins and storm-related information until well into the early morning hours of April 4. Because electrical power had been knocked out to a substantial portion of the city, the radio station became a clearinghouse for vital information and contact with emergency workers, not only in Louisville but across the state of Kentucky, due to its 50,000-watt clear-channel signal and the fact that storms had knocked numerous broadcasting stations in smaller communities. Then-Governor Wendell Ford commended the station's personnel for their service

1974 Tornado, Kentucky Fair and Exposition Center
Photo: Bill Luster, The Courier-Journal

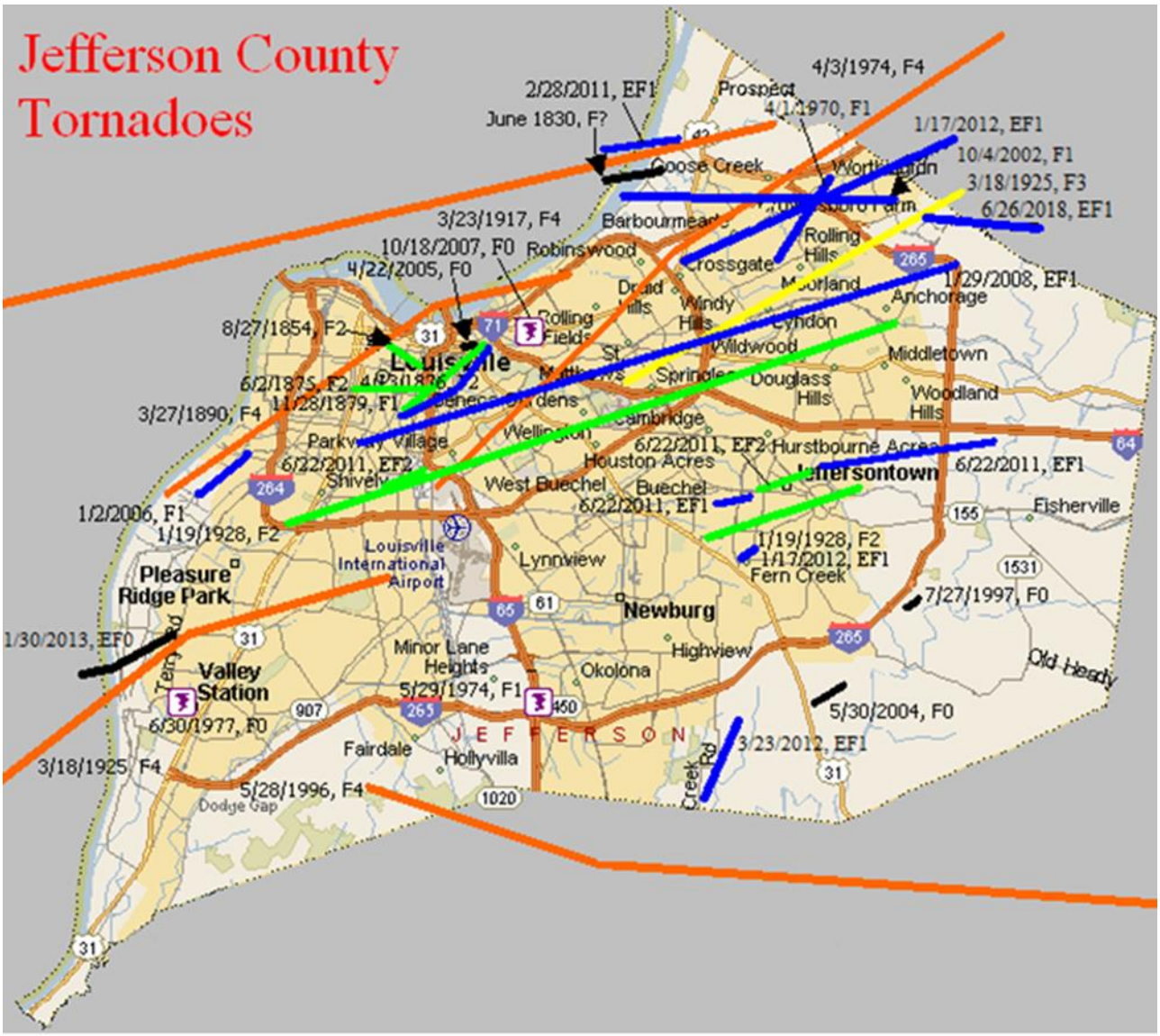
to the community in the time of crisis, and Dick Gilbert later received a special commendation from then-President Richard Nixon for his tracking of the tornado from his helicopter. To date, this tornado remains the costliest in Louisville Metro history.

Additional Tornado Events of Note

Numerous other Louisville Metro tornadoes have occurred dating back to the 1800s. The table below captures data from NOAA's National Storm Event database on tornado activity dating back to 1950 for Jefferson County, while the figure below depicts major tornado paths.

NOAA NATIONAL STORM EVENT DATABASE TORNADO OCCURRENCES – JEFFERSON COUNTY, KY						
Date	**F_Scale**	**Deaths**	**Injuries**	**Property Damage**	**Length (miles)**	**Width (Feet)**
3/25/1964	F2	0	1	$250,000	10.3	33
3/25/1964	F2	0	0	$250,000	4.7	33
4/1/1970	F1	0	0	$25,000	2.3	50
4/3/1974	F4	3	225	$0	14.2	33
5/29/1974	F1	0	0	$25,000	0	33
6/30/1977	F0	0	0	$25,000	2	100
5/28/1996	F1	0	0	$0	1.8	575
7/27/1997	F0	0	0	$0	0.5	75
10/4/2002	F1	0	0	$150,000	6	50
5/30/2004	F0	0	0	$100,000	0.3	30
4/22/2005	F0	0	0	$100,000	0.3	50
1/2/2006	F1	0	0	$250,000	1.5	34
10/18/2007	EF0	0	0	$3000	0.04	10
1/29/2008	EF1	0	0	$3,000,000	16.38	100
2/28/2011	EF1	0	0	$2,000	0.91	100
6/22/2011	EF2	0	0	$400,000	1.2	120
6/22/2011	EF1	0	0	$150,000	1.9	150
6/22/2011	EF2	0	0	$175,000	1.6	100
6/22/2011	EF1	0	0	$75,000	3.5	60
1/17/2012	EF1	0	1	$300,000	7.92	250
1/17/2012	EF1	0	0	$50,000	0.5	90
3/23/2012	EF1	0	0	$300,000	2.44	70
1/30/2013	EF0	0	0	$75,000	2.23	215
6/26/2018	EF1	0	0	$500,000	1.66	150
4/13/2022	EF1	0	0	$0	7.2	175

Figure 5-49: Jefferson County Tornado Map



Significant events are described below based on data obtained from the National Weather Service "Complete Tornado Listing" for Kentucky[83].

June 1830: The first known tornado in Jefferson County reportedly moved east, crossing the Ohio River about 6 miles "north" of Louisville, knocking down trees and fences.

August 27, 1854: This deadly storm touched down near the intersection of Jefferson and Twentieth Streets and traveled in an east-southeasterly direction. Seventeen houses were damaged along Walnut Street from Fifteenth to Seventeenth Streets, a home was severely damaged near the corner of Madison and Thirteenth Streets, and a factory was damaged at the

[83] https://www.weather.gov/lmk/tornado_list/https://www.weather.gov/lmk/tornado_list2

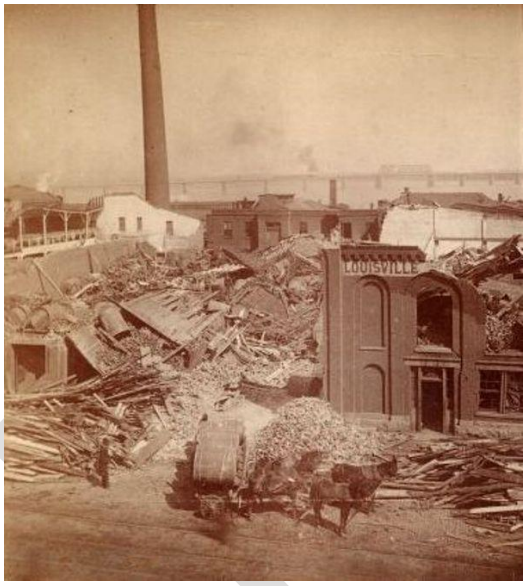
corner of Chestnut and Twelfth Streets. However, the most catastrophic damage occurred when the tornado destroyed the Third Presbyterian Church at Walnut and Eleventh Streets. At a quarter past noon during Sunday services, the tornado struck the church, causing it to collapse. The death toll in the church was between 18 and 20. Moving on from the church, the tornado tore off rooftops along Tenth, Ninth, and Eighth Streets between Chestnut Street and Broadway. This tornado was the worst disaster seen in Louisville up to that time. At least a hundred buildings were affected. Mayor James Speed ordered all businesses in the city closed the next day.

June 2, 1875: This storm swept through the southern half of Louisville, with the primary damage swath a mile wide. The tornado moved from west to east, generally bounded by Kentucky Street on the north and Oak Street on the south. Hundreds of homes were destroyed during this event.

April 13, 1876: A tornado touched down west of present-day University of Louisville and moved to the north-northeast across eastern sections of the city. The tornado struck the brand new baseball park, located where Saint James Court is today, built to host Louisville's new National League baseball team, the Louisville Grays. The Park was badly damaged, just 12 days before the season's Opening Day.

November 28, 1879: A tornado, which possessed a "wrenching, spiral motion" according to witnesses and was described in the newspaper as "whirling and tossing about like a monster in pain" moved northeast through the southeastern part of Louisville, damaging over a hundred buildings. A warehouse containing five hundred barrels of whiskey was destroyed.

March 27, 1890: One of the most devastating tornadoes to ever strike Kentucky started in Harrison County, Indiana. When the tornado entered the city of Louisville, it was 200 yards wide and grew to 500 yards wide as it plowed through the central business district downtown. Multi-story downtown buildings were hit by the tornado and subsequently collapsed. At least 44 deaths occurred at the Falls City Hall (today known as 1124 West Market Street). The building collapsed with 200 people inside. This was one of the highest tornado death totals in a single building ever recorded in the United States. The tornado destroyed five churches, seven railroad depots, two public halls, three schools, ten tobacco warehouses, 32 manufacturing plants, and 532 dwellings. Damage estimates in Jefferson County totaled $2.5 million in 1890 dollars ($81,394,505 in today’s dollars).



Louisville Tornado of 1890

March 18, 1925: An F4 tornado moved to the east-northeast from Mauckport to just south of Louisville. Up to a mile wide, this very intense tornado swept away entire farms as it passed one mile north of Laconia and two miles south of Elizabeth. Furniture from Indiana was later found in yards in Pleasure Ridge Park, Kentucky. Jefferson County locations that were struck by the tornado or its parent thunderstorm included Orell, Greenwood Station, Kerrick Station, Blanton Station, Saint Helens, South Park, Iroquois Park, and Senning's Park. The worst damage was on Eighteenth Street Road (likely today's Dixie Highway) from Lakeland to Blanton Station (the Pleasure Ridge Park/Dixie Manor Shopping Center area today), where three people were killed. Nothing was left standing from the river to Blanton Station in a swatch two blocks wide. Hail up to 2 inches in diameter fell with the storm. The day after the storm, the head of the Louisville weather service office, J. L. Kendall, surveyed the damage. He noted that the width of the tornado was 100 yards where it crossed Eighteenth Street and widened to 500 yards as it entered Iroquois Park.

January 19, 1928: An unusual January F2 tornado touched down southwest of Shively and moved east-northeast, cutting a narrow path through the southern suburbs of Louisville, where about a hundred homes were unroofed or damaged. The tornado proceeded to the northeast across the southeastern section of Churchill Downs, where the tornado came just yards away from destroying the racetrack's twin spires.

March 25, 1964: An F2 tornado skipped east-northeast from just east of Standiford Field to Smithfield and New Castle. The "bounding" tornado, and accompanying high winds unroofed or damaged multiple homes, barns, and buildings. The tornado then touched down on the eastern side of Louisville International Airport at the intersection of Standiford Lane and Preston Highway, where it lifted and blew a car 40 feet, depositing it on its roof. The tornado grew to about two blocks wide and tore roofs off houses before it receded.

April 22, 2005: An F2 tornado first touched down near the intersection of Campbell and Market Streets, where the roof on a business was destroyed, and a telephone pole was snapped. An empty trailer was flipped over near this location. The Stockyard Farm Supply Company on South Johnson Street sustained roof damage.

January 2, 2006: A tornado touched down near the corner of Bramers and Campground roads. Many homes along the damage path had roof damage. A large, well-constructed barn was destroyed. Numerous trees and power lines were downed, and one tree was blown onto a house. The local Moose Lodge building had significant damage. The tornado lifted around 3:27pm near the intersection of Campground Road and Ralph Avenue.

January 29, 2008: A fast moving tornado briefly touched down four times in Louisville. The tornado was on the ground for about 1.5 miles over the course of its 16-mile-long skipping track.

The first touchdown was in an industrial area just off Millers Lane west of Dixie Highway. The tornado stayed on the ground for 1 mile before lifting, heavily damaging a church on Dixie Highway, as well as uprooting and snapping several trees and damaging numerous homes. The tornado then dipped to earth again on the western side of the University of Louisville campus, breaking out many windows in a large residence hall and nearby building, and damaging several vehicles parked nearby. The next touchdown occurred in Saint Matthews near the intersection of Shelbyville Road and Interstate 264, where extensive damage was suffered by many businesses and private properties. The fourth and final touchdown was in Anchorage, where many trees were damaged, blown over, and uprooted; roofs were damaged; and a large outbuilding at a training school was destroyed.

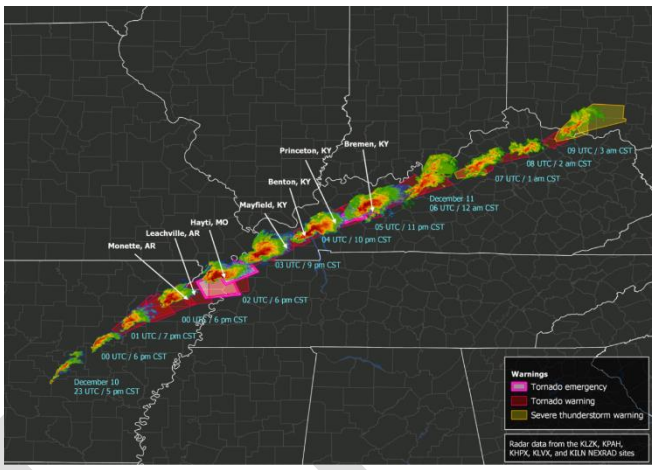
June 22, 2011: This tornado touched down at Churchill Downs with EF-1 strength and wind speeds of up to 105 mph. Five barns at the race track had large sections of their roofs blown off and cinder block walls buckled or collapsed. Christ Church on Churchill Downs had some roof and siding damage. As the tornado moved east it strengthened to EF-2 intensity near the intersection of Floyd Street and Central Avenue, where a large industrial building was heavily damaged. Numerous trees were uprooted and snapped along the storm's path. Near the intersection of Crittenden Drive and Central Avenue, a Super 8 Motel had minor roof damage. There was also structural damage and roof damage at the Good Samaritan Society Nursing Home at 3500 Good Samaritan Way, where two vehicles in the parking lot were thrown about 20 yards and flipped over.

January 17, 2012: A line of storms exhibited bowing segments and occasional vortices that brought several tornadoes and scattered wind damage to the Louisville Metro area. During this storm event, nine tornadoes were reported across both central Kentucky and southern Indiana, making this episode the most prolific regional January tornado outbreak recorded. An EF-1 tornado with estimated winds of 95 mph did considerable damage along a nearly 8-mile path across the northeastern suburbs of Louisville. The twister first touched down just east of the intersection of Interstate 264 and Brownsboro Road. It did considerable roof damage to many homes to the south of Brownsboro Road and snapped numerous large trees, which toppled onto the heavily traveled roadway near Ten Broeck Way. After briefly lifting over a shopping complex near the intersection of Brownsboro and Hurstbourne Roads, the tornado touched down again, tearing a large exterior wall from an indoor tennis facility, then flipped two semi-trailers as it crossed Interstate 265, injuring the driver of one. After crossing the interstate, it continued to skip northeast for another 4 miles into Oldham County, doing primarily roof damage, in addition to snapping and uprooting taller trees.

April 13, 2022: A tornado initially touched down just east of Beulah Church Road, near Adams Run Road, which is just south of I-265. The tornado became very intermittent along Cedar Creek Road to Gentry Lane, with tops of pine and cedar trees sheared off and with shingle and sporadic roof damage on homes. Winds were 75 to 80 mph in this area. The tornado increased to EF1 in the Glenmary Reserves subdivision, with winds estimated at speeds greater than 90 mph in this area. The tornado continued towards the entrance of the Glenmary Reserves subdivision off Bardstown Road. The tornado continued in the Glenmary subdivision with numerous homes having shingle and roof damage, along with numerous downed trees. At the far eastern part of the Glenmary subdivision, the weakened tornado lifted. However, it again touched down on the

eastern entrance of Turkey Run Park, and especially along Echo Trail Road. Winds in this area were 90 mph EF1 with a width of 75 yards.

2021 Western Kentucky tornado



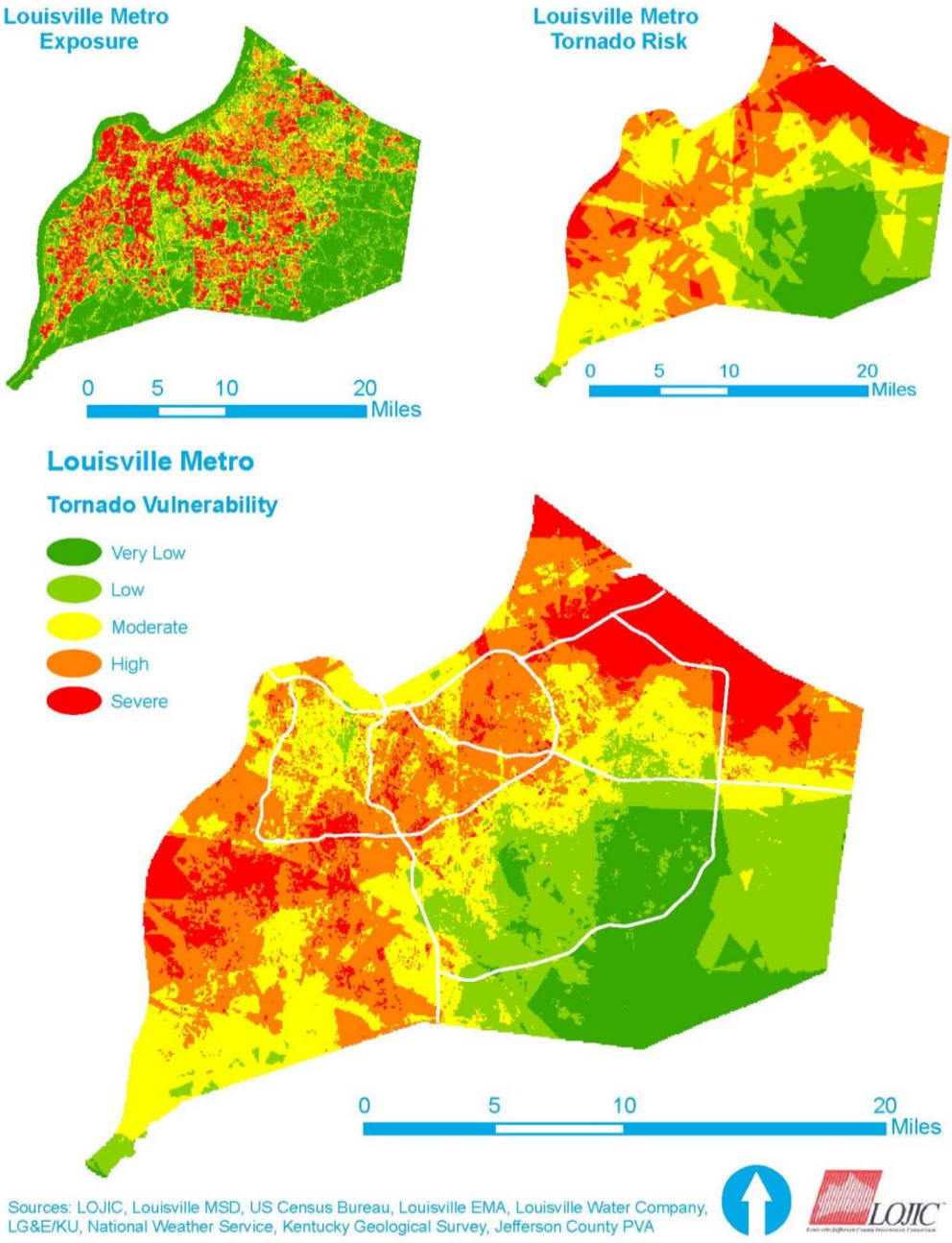
Although not directly affecting the Louisville Metro area, during the late evening of Friday, December 10, 2021, a violent, long-tracked tornado moved across Western Kentucky, producing severe to catastrophic damage in numerous towns, including Mayfield, Princeton, Dawson Springs, and Bremen. The tornado was on the ground for nearly three hours, tracking 165.6 miles from Woodland Mills to Rough River Dam State Resort Park. The path was the ninth longest in recorded history, and is depicted in the graphic to the right. It was rated high-end EF4, with an estimated peak wind speed of 190 mph. With a confirmed death toll of 57, it was the deadliest single tornado in the United States since the Joplin, Missouri tornado on May 22, 2011, ten years earlier. A 58th fatality was the result of a heart attack while clearing debris, and is listed as indirect.

On December 11, President Joe Biden approved a federal emergency disaster declaration for the affected areas of Kentucky. Earlier that day, Governor Andy Beshear declared a state of emergency for parts of western Kentucky.

5.15.3 Assessing Vulnerability

To determine structures that are vulnerable and estimated to be damaged during a tornado event, the Hazard Boundary Overlay methodology was used. The hazard boundary used as the overlay was the grid cells that were determined to have the highest level of risk to tornados. This was the same as the 2016 plan methodology, except events from 1950-2021 were considered. A listing of critical facilities and infrastructure highly vulnerable to tornados is presented in Appendix E.

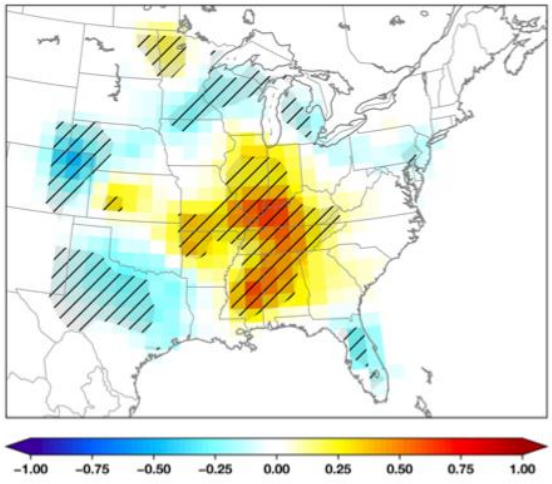
Figure 5-50: Louisville Metro Tornado Vulnerability Map



5.15.4 Climate Assessment

The link between tornadoes and climate change is currently unclear. Long-term records for tornadoes in the U.S. are not widely available, so it is difficult to detect changes or trends. Many tornadoes in the early part of the 20th century went undetected, because there were fewer people, and most tornadoes are detected as sightings by witnesses. Improved technology, such as advanced radar, also helps us "see" tornadoes that may not have been detected decades ago, thereby muddying long-term datasets.

In addition to a lack of historical data, researchers are still learning how atmospheric instability and wind shear are expected to respond to climate change. It is likely that a warmer, wetter world will lead to increased climatic instability. However, climate change could also lessen chances for wind shear, shift the timing of tornadoes, or shift the regions that are most likely to be hit, causing high uncertainty for any specific location.



In a study published in 2018, researchers found that since 1979, the number of tornadoes has been rising in Mississippi, Alabama, Arkansas, Missouri, Illinois, Indiana, Tennessee, and Kentucky. The number of tornadoes has been falling in the traditionally tornado-prone states of Texas, Colorado, and Oklahoma. It appears that Tornado Alley is shifting eastward. The figure to the left shows areas with more tornadoes (warm colors) and fewer tornadoes (cooler colors) based on a Theil-Sen slope analysis of annual tornado reports from 1979-2017.

In addition to the spatial shift, a seasonal shift in tornado activity was detected. March, April, and May had the greatest increases in tornado detections for the eight-state region called "Dixie Alley." In fact, the deadliest tornado outbreak took place in Dixie Alley in 2011, with more than 350 tornadoes and 324 deaths. Another recent study found that the frequency of tornado outbreaks is increasing, with more extreme outbreaks increasing fastest. In this study, however, it was unclear whether this trend was related to climate change, and whether it would continue, thereby contributing to the uncertainty for future projections.

The National Climate Assessment states with medium confidence that the number of days with tornadoes is actually decreasing in the U.S., but the number of tornadoes on days when they occur is increasing. Also, models project changing conditions that would be expected to support an increase in frequency and intensity of tornadoes and other severe storms.

Tornadoes tend to form under a very specific combination of conditions, including wind shear, differences in wind speed and direction, atmospheric instability, and moisture. There is reason to believe that climate change is making the combination of those conditions increasingly likely to

be ripe for tornadoes. This can increase the opportunity for tornadoes, but does not guarantee that they will occur.

Climate Risk

Based on the best available scientific information and trends, it is likely that tornado frequency will increase over the coming decades, but remain highly variable. The number of days with many tornadoes (e.g., more than 30) is expected to continue to increase with climate change. There is not enough information at this time to do a quantitative assessment of the potential change in tornado frequency based on climate projections, and uncertainty of the impact of climate change on this hazard remains high. Because of the high risk, high potential to cause death, and high cost of damages, preparedness is vital.

5.16 Wildfires

A wildfire is an unplanned fire, which includes grass fires, forest fires, and scrub fires either man-made or natural in origin. There are three different classes of wildland fires. A wildfire is an uncontrolled burning of grasslands, brush, or woodlands.

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.

Wildfires become significant threats to life and property along what is known as the "wildland/urban interface." The wildland/urban interface is defined as the area where structures and other human development meet or intermingle with undeveloped wild land or vegetative fuels.

Nationwide data compiled by the National Interagency Coordination Center (NICC) indicate that the number of annual wildfires is variable, but has decreased slightly over the last 30 years; and the number of acres affected annually, while also variable, generally has increased. Since 2000, throughout the U.S., an annual average of 70,072 wildfires has burned an annual average of 7.0 million acres. The acreage figure is more than double the average annual acreage burned in the 1990s (3.3 million acres), although a greater number of fires occurred annually in the 1990s (78,600 average). From 2012 to 2021, there was an average of 61,289 wildfires annually, and an average of 7.4 million acres impacted annually. In 2021, 58,968 wildfires burned 7.1 million acres. As of September 2, 2022, nearly 48,500 wildfires have impacted about 6.2 million acres this year.[84]

Although more acres of land are being consumed by wildfires, not all areas share the same risk. The potential for wildfire depends on available fuel, weather conditions, recent climate conditions, topography, and fire behavior.

Weather is the most variable, and impacts fire behavior most often. The main weather factors that have an effect on fire behavior are temperature, wind, and relative humidity. Wind increases the rate and direction of fire spread. Relative humidity and temperature mainly affect fuel moisture. Changes in the weather, such as an approaching cold front, can greatly affect wind speed and direction, temperature, and relative humidity, which in turn can greatly affect wildfire behavior. It is critical that firefighters understand the relationship of weather to fire behavior and keep abreast of any weather changes.

Wildfire 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

[84] https://sgp.fas.org/crs/misc/IF10244.pdf

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.

Fuel Types

The prediction of fire behavior is valuable for assessing potential fire damage to resources. A quantitative basis for rating fire danger and predicting fire behavior became possible with the development of mathematical fire behavior fuel models. Fuels have been classified into four groups: grasses, brush, timber, and slash. The differences in these groups are related to the fuel load and the distribution of the fuel among the size classes. Size classes are: 0 to 1/4 inch (1-hour fuels), 1/4 to 1 inch (10-hour fuels), 1 to 3 inches (100-hour fuels), and 3 inches and greater (1,000-hour fuels). The table below provides a description of Fuel Models used in Fire Behavior.

Table 5-47: Fuel Models Used in Fire Behavior

Fuel Model Typical Fuel Complex	Fuel Loading Tons/Acre				Fuel Bed Depth in Feet
	1 Hr.	10 Hr.	100 Hr.	Live	
Grass And Grass-Dominated					
1-Short Grass (1 Ft.)	0.74	0.00	0.00	0.00	1.0
Timber (Grass and Understory)	2.00	1.00	0.50		1.0
Tall Grass (2.5 Ft.)	3.01	0.00	0.00	0.00	
Chaparral and Shrub Fields					
Chaparral (6 Ft.)	5.01	4.01	2.00	5.01	6.0
Brush (2 Ft.)	1.00	0.50	0.00	2.00	2.0
Dormant Shrub and Hdwd. Slash	1.50	2.50	2.00	0.00	2.5
Southern Rough	1.13	1.87	1.50	0.37	2.5
Timber Litter					
Closed Timber Litter	1.50	1.00	2.50	0.00	0.2
Hardwood Litter	2.92	0.41	0.15	0.00	0.2
Timber (Litter and Understory	3.01	2.00	5.01	2.00	1.0
Slash					
Light Logging Slash	1.50	4.51	5.51	0.00	1.0
Medium Logging Slash	4.01	14.03	16.53	0.00	2.3
Heavy Logging Slash	7.00	23.04	28.05	0.00	3.0

A description of the fuel models used in fire behavior is presented below.

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

Local Forestry Characteristics

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.

In the Louisville Metro area, the Jefferson Memorial Forest is the nation's largest municipally owned urban forest. This forest has approximately 6,600 acres of steep slopes covered with mature, second-growth hardwood trees.

Within the Commonwealth, 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 1,000 wildland fires annually. These fires burn more than 30,000 acres per year.[85]

According to Kentucky Division of Forestry (KDF), wildfires are categorized into "Classes." These "Classes" represent types of wildfires, and also represent an illustration of "extent," i.e., a measurement of how bad a wildfire can get, preferably in terms of a scale. Table 5-48 below describes each "Class" of wildfire and its overall extent.

Table 5-48: Kentucky Department of Forestry Classes of Wildfire as Distinguished by Acres Burned

Class A	Less than 0.25 Acres Burned
Class B	0.25 to 9 Acres Burned

[85] https://eec.ky.gov/Natural-Resources/Forestry/Documents/10-Year%20Summary%20of%20Number%20of%20Fires%20and%20Acres%20Burned.pdf

Class C	10 to 99 Acres Burned C
Class D	100 to 299 Acres Burned
Class E	300 to 999 Acres Burned
Class F	1,000 to 4,999 Acres Burned
Class G	5,000 or More Acres Burned

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. The remaining causes are presented in the table below.

Table 5-49: Kentucky Department of Forestry Wildfire Causes-Ten Year Summary (2010-2019)

Causes	Number	Percent
Lightning	40	0.4%
Campfire	72	0.7%
Smoking	46	0.4%
Debris Burning	2,291	22.3%
Arson	6,672	64.9%
Equipment Use	249	2.4%
Railroad	20	0.2%
Children	35	0.3%
Miscellaneous	855	8.3%
Totals	10,280	100%

5.16.1 Hazard Profile and Consequence Analysis

Table 5-50 represents the typical hazard profile associated with Wildfires.

Table 5-50: Profile Risk Table Wildfire

Period of occurrence:	Primarily in the late-spring to early summer months (May-October)
Number of events:	Seven between 2000-2016; however, wildfires outside the Louisville Metro area can still effect the area through smoke and air quality issues.
Probability of events:	Frequent - Wildfires are likely to occur within 25 years (>4% chance of occurrence in any given year). However, these events will likely be small and contained rather quickly.
FEMA Risk Rating/Score:	Very Low - Score 0.91

Warning time:	None, unless related to drought. Humans, through negligence, accident, or intentional arson, have caused approximately 90% of all wildfires in the last decade.
Potential of injury or death:	Low. Based on historical data, Wildfires have a low potential for injury or death in the Louisville Metro area.
Possible Extent:	To date, all reported wildfires have been small (the largest being a three acre fire in 2010). However, because Louisville Metro has the largest urban forest within its borders (Jefferson Memorial Forest), it is possible that all 6,600 acres could catch fire and burn uncontrollably.

Consequence Analysis

A consequence analysis, derived from interviews with public officials and Plan stakeholders, has been performed to better understand and outline the impacts that a major (1,000+ acres) fire would have on the public, responders, and vulnerable populations; continuity of operations, including delivery of services; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in local Louisville Metro governance. The results of the consequence analysis are shown in Table 5-51.

Table 5-51: Consequence Analysis Wildfire

Subject	Impacts
Health and Safety of the Public	Home and landowners surrounding high wildfire risk zones are most vulnerable to impacts from a wildfire event. Impacts to the public include destruction of property, injuries related to burns and smoke inhalation, and road closures.
Health and Safety of Responders	First responders, such as fire and police, would be called to the incident area(s) to evacuate people from the fire area, close roads, create fire breaks, and attend to any injured. During a wildfire event, as with all disaster events, responders face the risk of personal injury while performing necessary job functions.
Vulnerable populations	Because wildfires by definition occur in unpopulated areas, their effect on vulnerable populations would be minimal. However, one of the primary impacts associated with wildfire is from air quality associated with smoke. Smoke can cause eye and respiratory illness, especially among children and the elderly.
Continuity of Operations (including delivery of services)	The impacts on continuity of operations would be limited unless a facility is directly within the path of destruction of a wildfire. Delivery of services may be slowed or halted in affected areas as a result of blocked roadways, and/or momentary losses in power and communications caused by destroyed infrastructure.
Property, Facilities, and Infrastructure	Home and landowners within a wildfire area may experience varying levels of damage to property depending upon the severity of the fire and the amount of decline in air quality within the hazard area. Infrastructure may experience impacts in the form of interruptions to above ground power and communication systems, and road detours and closures.

Subject	Impacts
Environment	Wildfires impact the environment by spreading pollution, creating health problems by reducing air quality from the spread of ash and smoke, and disturbing or destroying wildlife and natural areas.
Economic Conditions	A major wildfire in the Jefferson Memorial Forest could significantly impact Louisville Metro finances. This is because the park serves as a local tourist attraction, as well as supporting 35 miles of hiking trails, horseback riding trails, playgrounds and pavilions, fishing, tent camping, and as a resource for environmental education.
Public Confidence in Louisville Metro Governance	Public confidence would largely depend upon how effectively both the state and Louisville Metro prepare for and respond to a wildfire event.

5.16.2 Significant Louisville Metro Wildfire Occurrences

According to FEMA's Data Visualization Tool, there have been no Declared Disasters in Louisville Metro area related to wildfire events. According to wildfire data provided by the Kentucky Division of Forestry, there have been seven identified wildfires in Louisville Metro from 2006 to 2015. These were small-scale events on the following dates:

- February 27, 2006
- March 12, 2007
- October 12, 2010
- November 22, 2010
- April 10, 2011
- April 3, 2013
- March 14, 2014

Local data also show that on October 12, 2010, a small campfire in the Pleasure Ridge Park area ignited a fire with 20-foot-high flames and burned across 3 acres. It happened off of St. Andrews Church Road, just across from Doss High School, and very close to an apartment complex. The remaining events were all less than 0.25 acre in size, and were put out quickly.

Although fires within the Louisville Metro are the main focus of this section, fires outside of the area can also effect the local population. For example, in July 2021, a haze floated over the city for several days due to smoke coming from wildfires burning in the Pacific Northwest. This smoke made Louisville's air dangerous for some vulnerable populations, and the Louisville Air Pollution Control District (APCD) issued air quality alerts for several days. During this period, Louisville Metro's air quality index fell in the orange range, meaning that being outside for prolonged periods could be unhealthy for sensitive groups. That included people with lung conditions such as asthma and COPD, along with children and the elderly.

Although western wildfires are not uncommon, they do not typically cause a smoke concern to descend on cities thousands of miles away. But that week, unique meteorological conditions

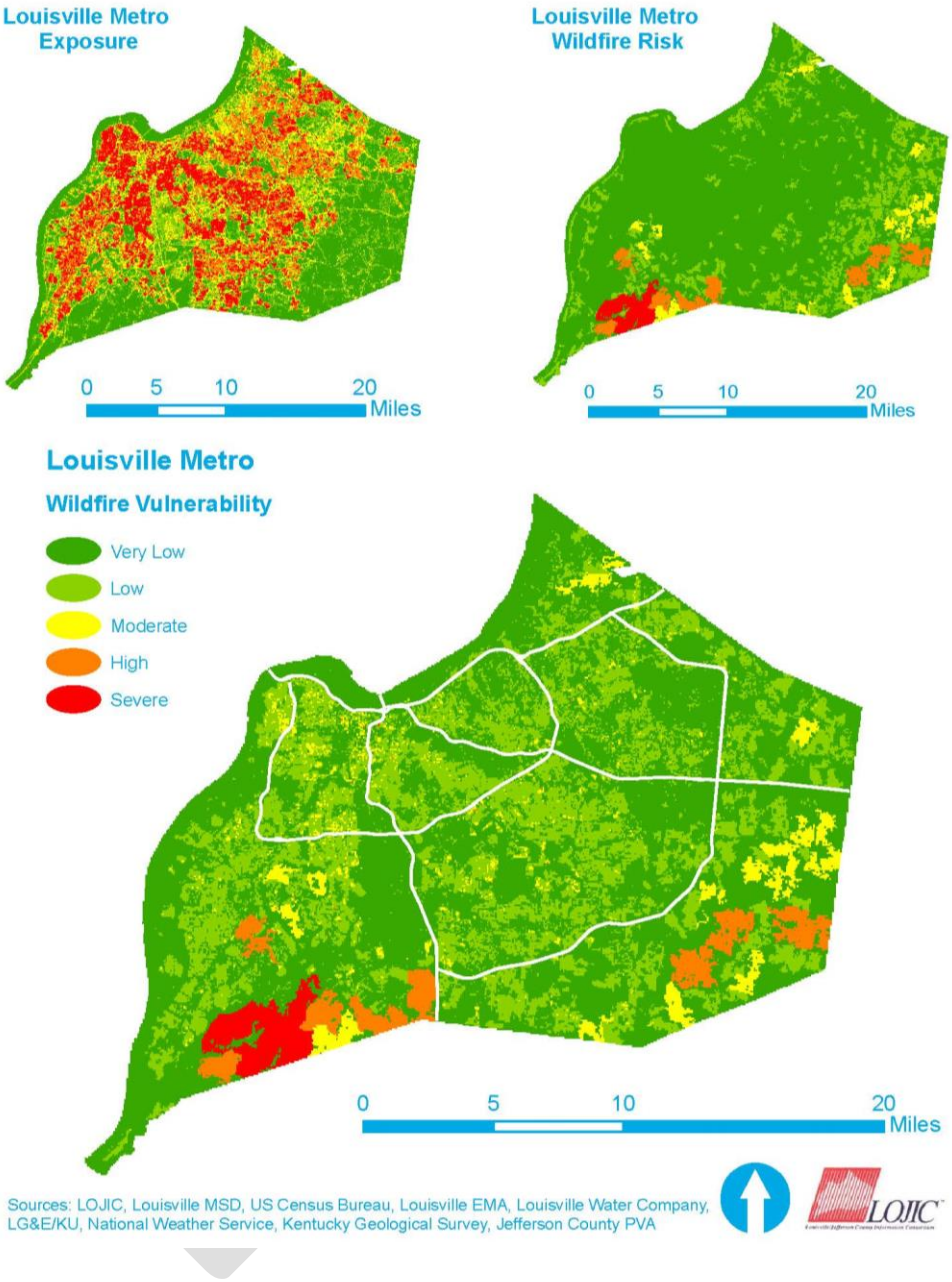
resulted in the smoky skies across the Ohio Valley. Mr. Matt Mudd, Communications Coordinator for the APCD, told Spectrum News 1 that the smoke brought "a very obvious visual anomaly" along with "fine particle pollution," that if breathed in large enough concentrations, can inflame lungs or get into bloodstreams."

A light haze hung over Louisville for several days this week.
Source: Spectrum News 1 KY/Adam K. Raymond)

5.16.3 Assessing Vulnerability

To determine structures that are vulnerable and estimated to be damaged during a wildfire, the project staff used the Hazard Boundary Overlay methodology. The hazard boundary used as the overlay was the grid cells that were determined to have the highest level of risk to wildfire. Jefferson County KY Tree Canopy Areas (2019 datset) was also used. Acres over 3 acres were considered a risk, per the forestry department determination, with the highest risk being the very largest tracts. A listing of critical facilities and infrastructure highly vulnerable to wildfires is presented in Appendix O.

Figure 5-51: Louisville Metro Wildfire Vulnerability Map



5.16.4 Climate Assessment

Large wildfires in the United States burn more than twice the area they did in 1970, and the average wildfire season is now much longer than it was just 30 years ago. Research shows that changes in climate, especially earlier snowmelt due to warming in the spring and summer, have led to hot, dry conditions that boost this increase in fire activity in some areas. Although land use and firefighting tactics can play a role in lowering or raising risks, observed and anticipated changes in climate are expected to continue to increase the area affected by wildfires.

Although the Southeast has the largest proportion of area burned by prescribed fire, rising temperatures and increases in the duration and intensity of drought are expected to increase wildfire occurrence, and also reduce the effectiveness of prescribed fire. A combination of drought and increased fire activity is expected to transform the forests of the Southeast. However, little information is available on the future expected trends in wildfire in the eastern U.S., making it difficult to determine the change in wildfire risk specific to Louisville.

Climate Risk

Wildfires impact communities throughout the United States each year. In addition to threatening individual safety and property, wildfire can worsen air quality locally, and in many cases, throughout the surrounding region, with substantial public health impacts, including increased incidence of respiratory illness. As the climate warms, projected increases in wildfire frequency and area burned are expected to drive up costs associated with health effects, loss of homes and infrastructure, and fire suppression. Increased wildfire activity is also expected to reduce the opportunity for and enjoyment of outdoor recreation activities, affecting quality of life as well as tourist economies.

6 Mitigation Strategies

The primary focus of this plan update was the development of comprehensive, operationally viable hazard mitigation strategies and the establishment of a capability to supervise and promote their implementation. Plan strategies were developed using the following structure:

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 participation enables the development of mitigation actions that are supported by various stakeholders and reflect the needs of the Louisville Metro community.

The Mitigation Action Plan responds to the Risk Assessment with projects and activities to mitigate Louisville Metro's natural and man-made hazards. The Action Plan outlines projects covering the next 5 years that will allow Louisville Metro to make informed future decisions to meet the 2022 Louisville Metro Mitigation Plan goals as stated in Section 1 and repeated here:

1. Minimize the loss of life and injuries that could be caused by multi-hazards.
2. Facilitate a sustainable economy by protecting agriculture, business, and other economic activities from multi-hazards.
3. Facilitate the strengthening of public emergency services, its infrastructure, facilities, equipment, and personnel to multi-hazards.
4. Develop a community-wide mitigation effort by building stronger partnerships between government, businesses, and the general public.
5. Increase public and private understanding of multi-hazard mitigation through the promotion of mitigation education and awareness of multi-hazards.
6. Enhance existing or design new policies and technical capabilities that will reduce the effects of multi-hazards.
7. Enhance existing technical and GIS data and capabilities that will reduce the effects of multi-hazards.
8. Promote the development of policies, programs, initiatives, and projects that prioritize diversity, equity, and environmental justice.

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. Louisville Metro has been very successful to-date with mitigation activities, including regulatory and legislation actions.

Mitigation strategies are specific to exposure and impacts from each hazard, and list prioritized hazard mitigation projects that best meet Louisville Metro's needs for multiple hazard damage reduction. The mitigation strategies are based on the best available data and provide a blueprint for reducing the potential losses identified in the risk assessments, which are the factual basis for the mitigation strategies.

This section reviews the problems and common issues in Louisville Metro and details how the Steering Committee and stakeholders adjusted objectives to meet Hazard Mitigation Plan goals.

The federal, state of Kentucky, and Louisville Metro's Capability Assessment outlines state and local ordinances, statues, and regulations, and reviews funding mechanisms. Ongoing programs are outlined in this section, which helped stakeholders develop a 5-year Action Plan.

6.1 Federal Mitigation Funding and Technical Assistance Sources

Various federal government agencies offer a wide range of funding and technical assistance programs to help with mitigation efforts. Table 6-1 and Table 6-2 include information on FEMA grant funding and technical assistance programs available to states and local communities for mitigation activities.

Table 6-1: FEMA Funded Hazard Mitigation Assistance Grant Programs

Grant Name	Purpose	Hazard Mitigation Application	Competitive (y/n)
Building Resilient Infrastructure and Communities (BRIC)	Through BRIC, FEMA provides federal funds to state, local, tribal and territorial governments for hazard mitigation activities, including capacity and capability activity types and hazard mitigation projects. For Fiscal Year (FY) 2022, FEMA will distribute up to $2.295 billion for the BRIC program.	The Fiscal Year 2022 BRIC program's priorities are to incentivize natural hazard risk reduction activities that mitigate risk to public infrastructure and disadvantaged communities, incorporate nature-based solutions, including those designed to reduce carbon emissions, enhance climate resilience and adaptation and increase funding for the adoption and enforcement of the latest published editions of building codes.	Combination of set aside funds (FY22 - $1M per state) and competitive. FEMA chooses recipients based on the applicant's ranking of the project and the eligibility and the project's benefit cost-effectiveness.
Flood Mitigation Assistance (FMA)	Through FMA FEMA helps states and communities plan and carry out activities designed to reduce the risk of flood damage to structures insurable under the NFIP.	Funds projects that will mitigate flood damage to at least 50% of structures included in the subapplication that meet the definition of a Severe Repetitive or Repetitive Loss properties.	Competitive. FEMA chooses recipients based on the applicant's ranking of the project and the eligibility and cost-effectiveness of the project.
Hazard Mitigation Grant Program (HMGP)	Through HMGP, FEMA provides funding to state, local, tribal and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities. When requested by an authorized representative, this grant funding is available	The program provides planning, project and technical assistance grants for mitigation activities that are technically feasible and cost effective.	No. Federal mitigation money is provided to the state. The state reviews community requests and decides what to fund.

Grant Name	Purpose	Hazard Mitigation Application	Competitive (y/n)
	after a presidentially declared disaster.		
HMGP – Post Fire	The primary goal of the HMGP- Post Fire program is to help communities implement hazard mitigation measures after wildfire disasters.	Activities that benefit communities through wildfire hazard mitigation projects such as defensible space measures, ignition resistant construction, hazardous fuels reduction, erosion control measures, slope failure prevention measures, or flash flood reduction measures.	No
PDM	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.	No. Right now PDM funding is earmarked through congress. FY22 68 projects (combination of both old and new) were selected for funding.

Table 6-2: Mitigation Technical Assistance Programs

MITIGATION TECHNICAL ASSISTANCE PROGRAMS	
Hazard Mitigation Technical Assistance Program (HMTAP)	This is the largest technical assistance program associated with mitigation. Under this program, FEMA provides communities with numerous programs related to mitigation. Program areas include grant application support, including benefit-cost analysis, environmental and historic preservation support, post-event assessments, policy and regulatory analysis, publications, national floodplain insurance program support and community outreach.
Hazard Mitigation Assistance Helpline	FEMA operates a help line that allows states and communities call with questions related to various grant programs. Technical assistance is provided based on published documents and policies and procedures.
BRIC Direct Technical Assistance (DTA)	FEMA will provide support for mitigation planning, project and BRIC application-specific needs throughout the grant lifecycle from pre-application activities to closeout for DTA communities. DTA can provide holistic planning support at the earliest stages to communities that may not have the capacity to start on their own.
Consultants	A number of private consultants offer technical assistance for a fee. This assistance includes project planning, developing partnerships and writing grant applications.

6.2 State Capability Assessment

To set the stage for a mitigation strategy, it is imperative to know the capability of the Commonwealth to perform mitigation, regulate activities, and design outreach. Reducing hazards is a priority for both the Commonwealth of Kentucky and Louisville Metro. State regulations affect all of Kentucky, and each local community is subject to them. However, state regulations form baselines; communities may adopt laws that are even more restrictive.

The following subsections outline hazard mitigation activities listed in the 2018 State Hazard Mitigation Plan[86] that evaluates state regulations, policies, and state-funded or administered programs. Following this description of state capabilities there is a similar description of Louisville Metro's capabilities.

The intent in listing both the state and local capabilities is to present regulatory authorities for comprehensive planning and building codes; the jurisdiction evaluates its capabilities and ordinances to accomplish hazard mitigation actions through existing mechanisms. In addition, an analysis of the regulatory functions with respect to mitigation and hazard planning is imperative to good planning.

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.

6.2.1 Kentucky Pre- and Post-Disaster Legislation

The Kentucky Revised Statutes (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, KRS 39A.010 established the KDEM, 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 additional sections in KRS that address the issues of emergency systems, hazard safety, and hazard mitigation. There are several statutes which specifically pertain to pre-disaster mitigation:

KRS 39A.050: This statute states that the KDEM shall coordinate for the Governor all matters pertaining to the comprehensive emergency management program and disaster and emergency response of the Commonwealth. KDEM shall be the executive branch agency of state

[86] https://kyem.ky.gov/recovery/Pages/2018-Kentucky-Hazard-Mitigation-Plan-.aspx

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 147A.029: This statute states that 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 149.400: This statute states that there are two official fire hazard seasons each year as established by the state legislature. The first runs from February 15 through April 30, while the second runs from October 1 through December 15. During the official fire seasons, the statute states that "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 [feet] (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 151.600: This statute states that the Energy and Environment Cabinet shall administer KRS 151 and establish the requirements for obtaining a floodplain development permit. 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. The public information program shall be designed to increase public awareness and community responsiveness toward floodplain management and shall include, but not be restricted to, the following:

(a) Floodplain information training workshops for local officials and citizens;

(b) Floodplain information booklets describing floodplain management, including flood warnings, overall preparedness, flood insurance, and flood proofing of buildings; and

(c) Model floodplain development ordinances for adoption by local governmental units.

KRS 158.163: This statute states that 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. 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 staff.
- 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.050: This statute states that the Uniform State Building Code must address issues concerning seismic and severe wind construction in response to the Commonwealth's potential earthquake and wind threats. This code:

(a) Provides uniform standards and requirements for construction and construction materials.

(b) To the extent practicable, sets forth standards, specifications, and requirements in terms of performance objectives, so as to facilitate the use of new technologies, techniques, and materials. The code shall not discriminate in favor of particular suppliers' materials, techniques, or technologies.

(c) Protects the public health, safety, and welfare within the state.

KRS 211.855: This statute states that the Cabinet for Health and Family Services shall develop and conduct programs for evaluation and control of activities related to radon including laboratory analyses, mitigation, and measurements.

6.3 Legal Authority of Counties and Cities in Kentucky

Local governments in Kentucky have a wide range of tools available to them for implementing mitigation programs, policies, and actions. A hazard mitigation program can utilize any or all of the four broad types of government powers granted by the state of Kentucky, which are (a) Regulations; (b) Acquisition; (c) Taxation; and (d) Spending. Following is a summary of the four broad types.

6.3.1 Regulations

General Police Power: Local governments have been granted broad regulatory powers in their jurisdictions. Kentucky Revised Statutes assign general police power to local governments, allowing them to enact and enforce ordinances that define, prohibit, regulate or abate acts, omissions, or conditions detrimental to the health, safety, and welfare of the people, and to define and abate nuisances (including public health nuisances).

Since hazard mitigation can be included under the police power (as protection of public health, safety, and welfare), towns, cities, and counties may include requirements for hazard mitigation in local ordinances. Local governments may also use their ordinance-making power to abate "nuisances," which could include, by local definition, any activity or condition that threatens the general health and safety of the public. Louisville Metro has enacted and enforces regulatory ordinances designed to promote the public health, safety, and general welfare of its citizenry.

The Louisville Metro Police Department is actively mitigating against threats to its residents.

Building Codes and Building Inspection: Many structural mitigation measures involve constructing and retrofitting homes, businesses, and other structures according to standards

designed to make the buildings more resilient to the impacts of natural hazards. Many of these standards are imposed through the use of building codes. Jurisdictions have the opportunity and the power to develop and enforce building codes.

Construction in Louisville/Jefferson County, as well as the rest of Kentucky, is regulated by the Kentucky Building Code produced and promulgated by the state Department of Housing, Buildings, and Construction. The Kentucky Building/Residential Code has two components: the 2015 International Building/Residential Code and the Kentucky Amendments. The Kentucky Residential Code regulates one- and two-family residential structures and townhomes, while the Kentucky Building Code covers all other building types.[87]

Land Use: Regulatory powers granted by the state to local governments are the most basic manner in which a local government can control the use of its land. Through various land use regulatory powers, a local government can control the amount, timing, density, quality, and location of new development. All these characteristics of growth can determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, enacting, and enforcing zoning ordinances, floodplain ordinances, and subdivision controls.

The Louisville Metro Land Development Code (LDC) is a regulatory document that has been created to implement the goals, objectives, and policies set forth in Louisville Metro's comprehensive plan, Plan 2040.[88] The LDC, which was published in 2006 and is updated each year, provides requirements related to zoning, form districts, land use, building and site design, transportation, landscaping, and signage.

Specifically for new developments, the LDC states that *"Strong consideration should be given to preserving areas with environmental constraints or limitations such as steep slopes, dense vegetation, natural streams and drainage courses, sinkholes, floodplains, wetlands, or other significant natural features as natural open spaces."*

Some cities in Jefferson County have their own zoning authority, meaning they can choose which regulations to adopt into their local LDC. Louisville Metro/Jefferson County has 12 such cities.

Planning: Local jurisdictions have the authority to perform a number of duties related to planning, including making studies of the area; determining objectives; preparing and adopting plans for achieving those objectives; and developing and recommending policies, ordinances, and administrative means to implement plans.

The Louisville Metro Planning Commission oversees planning activities. The Louisville Metro Department of Planning and Design Services (PDS) is responsible for overseeing development activities and advises the Planning Commission.

[87] https://louisvilleky.gov/government/develop-louisville/building-code#land-use

[88] https://louisvilleky.gov/planning-design/document/louisville-metro-ldc-6922

Zoning: Zoning is the traditional and most common tool available to local governments to control the use of land. The statutory purpose for the grant of power is to promote health, safety, morals, or the general welfare of the community. Land "uses" controlled by zoning include the type of use (e.g., residential, commercial, industrial) as well as minimum specifications for use such as lot size, building height and setbacks, density of population, etc. The Louisville Metro Development Code is the basis for all zoning decisions in the Metro Area. The Planning and Design Services staff is responsible for review of all zoning cases within Louisville Metro, and the Planning Commission makes recommendations on whether or not they should be approved. The Louisville Metro Council is ultimately responsible for approval of all zoning requests except for zoning cases located within the boundaries of cities of the 4th Class and higher. In these cities, the appropriate city council makes the final decision.

Subdivision Regulations: Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls typically require that subdividers 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.

6.3.2 Acquisition

The power of acquisition can be useful for pursuing local mitigation goals. For example, local governments may find the most effective method for completely "hazard-proofing" a particular piece of property or area is to acquire the property (either in fee or a to lesser interest, such as an easement), thus removing the property from the private market and eliminating or reducing the possibility of inappropriate development occurring. The state of Kentucky legislation empowers cities, towns, counties, and other government entities, such as MSD and the Louisville Water Company to acquire property for public purposes.

Louisville Metro and MSD actively look to acquire properties that have a history of flooding.[89]

6.3.3 Taxation and Fees

The ability to levy taxes, fees and special assessments is an important power delegated to local governments by the state of Kentucky. The power of taxation extends beyond merely the collection of revenue, and can have a profound impact on the pattern of development in the community. Local governments can also raise funds by implementing special fees. For example, MDS charges various fees for services such as unusual discharge and connections.

[89] https://louisvillemsd.org/sites/default/files/inline-files/FEMA%20Grant%20FAQ%20Owners%20Rev05-2018.pdf

6.3.4 Spending

The fourth major power that has been delegated from the Kentucky General Assembly to local governments is the power to make expenditures in the public interest. Hazard mitigation principles can be made a routine part of all spending decisions made by the local government, including the adoption of annual budgets. According to FEMA, since 1989, Louisville Metro has initiated over $42M of hazard mitigation projects funded through various federal grant programs. While a significant amount of this figure is covered by the federal government, it still represents a major capital investment in mitigation projects. And this amount only covers funds associated with federal grant programs. Other projects funded directly by MSD or Louisville Metro add to this amount.

6.4 Louisville Metro Capability Assessment

The local Capability Assessment identifies actions Louisville Metro is currently using to mitigate hazards. The local Capability Assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. Identified capabilities are further discussed below.

6.4.1 Floodplain Management Ordinance

The purpose of the Floodplain Ordinance is to maximize the wise and safe use of Louisville Metro flood-prone areas, ensure that flood levels are not increased, and minimize public and private losses from flooding by:

1. Restricting or prohibiting uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities.
2. Requiring that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction.
3. Controlling the alteration of natural floodplains, stream channels, and natural protective barriers involved in the accommodation of floodwaters.
4. Controlling filling, grading, dredging, and other development that may increase flood damage or erosion.
5. Preventing or regulating the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards to other lands.

The Floodplain Ordinance for Jefferson County was originally adopted in 1978 as Article 13 of the Development Code and basically met the minimum FEMA requirements (except it included a 1-foot freeboard requirement). The ordinance was also adopted by the four cities affected within the county. The Water Management Division of the county Public Works Department was designated as the review and approval agency for all development in the floodplain in the county (including the four cities). A separate floodplain permit was not issued at that time. Instead, Water Management approved the plans, and those plans became part of the building permit issued by the county or the city. Enforcement was done by the agency issuing the building permit

in cooperation with Water Management. On January 1, 1987, MSD was designated as the review and approval agency as part of the new stormwater management program implemented by MSD, the county and the city of Louisville. MSD continued enforcement using the process in place at that time.

The Floodplain Ordinance was revised in 1989 in order to meet new FEMA requirements and also to reflect MSD's new role in the enforcement process. The new ordinance exceeded the FEMA minimum in several areas including the 1-foot freeboard and a requirement to base the substantial damage/improvement calculations on the cumulative cost over the life of the structure. Jefferson County and the city of Louisville joined the CRS at that time. Based on the higher regulatory standards and other programs implemented, Louisville Metro is currently a Class 3 CRS community. This provides a 35% discount for flood insurance for properties located within the 100-year floodplain.

In 1997, Jefferson County adopted Ordinance #23, Series 1997, Chapter 157 of the Jefferson County Code of Ordinances. The ordinance was the result of a community-wide effort to strengthen the floodplain regulations as a result of the impact of past flooding events. In particular, the flood of March 1997 was fresh in the minds of the community when the ordinance was adopted. Besides strengthening the regulations in several important areas, the new ordinance created a floodplain permit process administered by MSD and a Floodplain Board (the MSD Board) to oversee the process.

In 2005, a local task force worked with MSD staff and the Jefferson County Attorney's office to revise the 1997 ordinance to reflect the merger of the city and county and also to implement several changes intended to enhance the enforcement process. The revised Louisville-Jefferson County Metro Government Floodplain Management ordinance (Ordinance No. 125, Series 2005) was adopted by the Metro Council in December 2006.

The 2006 ordinance made MSD responsible for reviewing development plans in the floodplain, issuing floodplain permits, and enforcing the provisions of the ordinance. The Floodplain Board was responsible for appeals and variances. Appeals to the Floodplain Board's actions were sent to Jefferson County Circuit Court. Penalties for violation were also increased from the previous versions of the ordinance.

It should be noted that under the state regulations, specifically KAR 4:060, a separate state stream construction permit was also required for all development in the floodplain. Since the Louisville Metro ordinance was stricter than the state regulations, the local permit was enforced, but a state permit was also needed.

In 2017, the Louisville Metro Floodplain Management Ordinance was revised to improve community resiliency and make the regulations easier for the public to understand. This ordinance is found in Chapter 157 of Louisville Metro's Title XV: Land Usage.

6.4.2 National Flood Insurance Program (NFIP) Compliance

All Local Mitigation Plans approved by FEMA after October 1, 2008, must describe the jurisdiction's participation in the NFIP and must identify, analyze, and prioritize actions related

to continued compliance with the NFIP. Participation in the NFIP is based on an agreement between communities and FEMA. The NFIP has three basic aspects:

1. Floodplain identification and mapping
2. Floodplain management
3. Flood insurance

NFIP participation requires community adoption of flood maps. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed to administer floodplain management programs and to actuarially rate new construction for flood insurance. To be a participant, the NFIP requires communities to adopt and enforce minimum floodplain management regulations that help mitigate the effects of flooding on new and improved structures. Community participation in the NFIP enables property owners to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages.

The Louisville Metro area originally joined the NFIP in the late 1970s. In 2006, as part of the adoption of a new Flood Insurance Study (FIS), FEMA recognized the new Louisville Metro government structure and assigned one Community ID, 210120, to the entire Louisville Metro area.

Louisville Metro is a participant in FEMA's Community Rating System (CRS), which rewards communities that implement projects to mitigate the impacts of flooding with reductions in flood insurance rates. Louisville Metro is currently rated as Class 3, which puts it in the top 18 of communities nationwide. Class 3 results in a 35% reduction in flood insurance rates for homeowners in the floodplain.

Louisville Metro's NFIP compliance actions include adoption and enforcement of floodplain management requirements, including regulating all new and substantially improved construction in Special Flood Hazard Areas (SFHAs) and floodplain identification and mapping, including any local requests for map updates.

6.4.3 Flood Insurance Coverage Assessment

MSD requested updated flood insurance data from FEMA in 2019, 2020, and 2021, but the information has not yet been received. For this reason, the most recent flood insurance policy data provided by FEMA from 2017 and 2018 was used for detailed review, along with local GIS information. Overall, for buildings in the floodplain, the number of properties that carry flood insurance for building coverage rose from 2017 to 2018. Based on this data, approximately 41% of the buildings located in the FEMA floodplain had flood insurance coverage in 2017 and approximately 43.7% had flood insurance coverage in 2018. Flood insurance coverage of properties in the floodplain by each watershed can be found in Table 6-3 for both 2017 and 2018.

Table 6-3: Flood Insurance Coverage by Watershed

Watershed	# of Buildings in the Floodplain		# of Buildings in Floodplain w/Building Coverage		% of Buildings Covered		
	2017	2018	2017	2018	2017	2018	% Change
Cedar Creek	33	33	7	9	21.2%	27.3%	6.1%
City/Ohio River	612	600	227	222	37.1%	37.0%	-0.1%
Floyds Fork	193	194	42	54	21.8%	27.8%	6.1%
Goose Creek	125	125	46	40	36.8%	32.0%	-4.8%
Harrods Creek	115	115	78	88	67.8%	76.5%	8.7%
Middle Fork Beargrass Creek	175	177	84	89	48.0%	50.3%	2.3%
Mill Creek	1,315	1,315	547	643	41.6%	48.9%	7.3%
Muddy Fork Beargrass Creek	156	156	64	61	41.0%	39.1%	-1.9%
Pennsylvania Run	24	24	5	18	20.8%	75.0%	54.2%
Pond Creek	3,646	3,644	1,368	1,420	37.5%	39.0%	1.4%
South Fork Beargrass Creek	1,124	1,117	612	630	54.4%	56.4%	2.0%
Total	7,518	7,500	3,080	3,274	41.0%	43.7%	2.7%

In 2022, MSD determined the level of flood insurance coverage in Louisville/Jefferson County, available by reviewing available NFIP policy data. In 2021, there were at total of 4,411 policies, and 3,232 of those policies, or 73%, were in the SFHA.

6.4.4 Flood Insurance Coverage by Flood Zone

Another way to look at flood insurance coverage is by flood zone. In Louisville, flood zones are categorized by the following designations: A, AE, and X zones. X zones are further broken down to include areas of 0.2% annual chance flood, areas protected by the levee, and the 1% annual chance future conditions flood. Using those categories as shown on Louisville's Flood Insurance Rate Maps, Table 6-4 was created showing flood insurance coverage by flood zone.

Table 6-4: Insurance Coverage by Flood Zone

Flood Zone	# of Buildings w/ Building Coverage		% of Buildings Covered		
	2017	2018	2017	2018	% Change
0.2% Annual Chance Flood Hazard	59	27	10.8%	5.0%	-5.8%
1% Future Conditions	84	153	4.5%	8.2%	3.7%

Flood Zone	# of Buildings w/ Building Coverage		% of Buildings Covered		
	2017	2018	2017	2018	% Change
AE Zone	3,075	3016	49.0%	48.2%	-0.8%
A Zone	223	258	18.2%	21.0%	2.8%
X Zone	1,005	777	0.4%	0.3%	-0.1%
X Protected by Levee	177	94	0.6%	0.3%	-0.3%
Total	4,623	4,325	1.7%	1.6%	-0.1%

The coverage rate for insurance is highest in Zone AE for both 2017 and 2018, where flood insurance requirements are mandatory with a federally backed mortgage. Mandatory coverage is also required in Zone A, but the coverage rate was only 18.2% in 2017 and 21.0% in 2018. This could be because Zone A areas are generally older, established neighborhoods, and therefore are more likely to have homes that no longer carry a mortgage. Zone A mapping is also based on an approximate study, rather than a detailed study, so people may feel like they are less reliable in predicting actual risk, and therefore people are less likely to purchase flood insurance. The largest increase in flood insurance coverage was in Zone A, with an increase of 2.8%. The largest reduction in flood insurance coverage was 5.8% in the 0.2% annual chance flood hazard area. The overall percentage of homes with flood insurance decreased by 0.1%.

In areas where flood insurance is not required, coverage rates continue to be much lower. The areas designated as 1% future conditions have the highest rate among the Zone X areas, with 8.2% coverage in 2018. The 0.2% annual chance flood hazard area has the next highest percentage with 5.0% coverage in 2018. The areas with the lowest percentage of coverage are Zone X and Zone X protected by levee, both with 0.3% in 2018.

6.4.5 Flood Insurance Coverage for Repetitive Loss Properties

Repetitive loss property owners have been designated as one of the target audiences; therefore, flood insurance coverage for these properties were also examined. Repetitive loss properties are listed by flood zone in Table 6-5.

Table 6-5: Insurance Coverage for Repetitive Loss Properties

Flood Zone	# of Repetitive Loss Buildings		# of Repetitive Loss Buildings w/ Building Coverage		% of Buildings Covered		
	2017	2018	2017	2018	2017	2018	% Change
0.2% Annual Chance Flood Hazard	0	1	0	0	N/A	0.0%	N/A
1% Future Conditions	3	7	2	2	66.7%	28.6%	-38.1%
AE Zone	342	292	218	206	63.7%	70.5%	6.8%

Flood Zone	# of Repetitive Loss Buildings		# of Repetitive Loss Buildings w/ Building Coverage		% of Buildings Covered		
	2017	2018	2017	2018	2017	2018	% Change
A Zone	4	9	3	8	75.0%	88.9%	13.9%
X Zone	20	38	4	8	20.0%	21.1%	1.1%
X Protected by Levee	0	0	0	0	N/A	N/A	N/A
Total	369	347	227	224	61.5%	64.6%	3.1%

The majority of repetitive loss properties are located in Zone AE. Among repetitive loss properties in Zone AE, the percentage of flood insurance coverage was 66.7% in 2017 and 70.5% in 2018. These percentages are significantly higher than the overall percentage of homes in Zone AE with flood insurance coverage (49.0% in 2017 and 48.2% in 2018), indicating that previous flooding events encouraged homeowners to carry flood insurance. The overall number of homes that are considered repetitive loss went down in 2018 due to MSD's efforts to purchase and demolish repetitively flooded homes through FEMA grant programs; however, several new buildings were added to the list due to flooding in 2018. The percentage of flood insurance policies for repetitive loss buildings increased by 3.1% from 2017 to 2018.

6.4.6 Stormwater Management Regulations

Through the Watershed Management Plan, MSD Design Manual, Louisville Metro Floodplain Management Ordinance, and Louisville/Jefferson County Erosion Prevention and Sediment Control Ordinance, a watershed-by-watershed approach to regional management of stormwater drainage is taken. Other permits, such as the Kentucky Pollutant Discharge Elimination System (KPDES) General Permit for Stormwater Discharges Associated With Construction Activities and the MS4 permit also affect the stormwater policies in Jefferson County.

New development in Louisville Metro is required to mitigate proposed stormwater discharge rates to predeveloped conditions for the 2-, 10-, 25-, and 100-year storm events as detailed in the MSD Design Manual. The NRCS Type II, 24-hour rainfall distribution is required to be used for the modeling. In areas where adequate downstream facilities exist, especially in the lower portion of a watershed where peak flows from the new development will occur substantially prior to the overall peak of the stream, on a case-by-case basis, MSD allows increased runoff to be compensated using a regional facility fee. This regional facility fee is used to construct regional basins.

New development in the combined sewer area is restricted to detaining the post-developed 100-year flows to the pre-developed 10-year flows to help reduce the flows in the combined sewer system during rain events. Examples of mitigation techniques include building detention basins, oversizing on-site stormwater pipes, and using green solutions such as pervious pavement and rain gardens to reduce peak flows and overall runoff volumes.

Floodplain compensation is required throughout Jefferson County for any fill placed in the fully developed local regulatory floodplain as stated in the Louisville Metro Floodplain Management Ordinance. Floodplain compensation of 1.5 times the displaced storage capacity is required in nine watersheds.

As stated in the Louisville Metro Floodplain Management Ordinance, a natural 25-foot buffer on each side of the stream bank must be preserved on all perennial and intermittent streams as defined by the USGS 7.5-minute topographic maps. In addition, perennial and intermittent streams may not be relocated, channelized, or stripped, with the exception of public projects such as road crossings, utilities, and detention basins that have no other viable alternative.

A minimum buffer is also required by the Kentucky Division of Water through its KPDES General Permit for Stormwater Discharges Associated With Construction Activities (KYR10). A minimum 25-foot buffer is required for discharges to waters categorized as High Quality or Impaired Water (non-construction related impairment). A minimum 50-foot buffer is required for discharges to waters categorized as Impaired Waters (sediment impaired, but no TMDL).

In order to promote enhanced water quality and aquatic habitat, natural channel design techniques are the preferred method for the design of streams. Channel improvement projects in perennial streams should use natural or "soft" approaches where possible. MSD's Design Manual outlines natural channel design requirements in Section 10.3.6.

The MS4 permit requires all developments with a disturbed area equal or greater than 1 acre, including projects less than 1 acre that are part of a larger common plan of development equal to or greater than 1 acre, to treat the first 0.6 inches of runoff. This can be accomplished by infiltrating or treating the stormwater using post-construction water quality practices, which are detailed in Chapter 18 of the Design Manual.

The Louisville/Jefferson County Erosion Prevention and Sediment Control Ordinance requires developments with 2,000 square feet or more of disturbance and developments within 50 feet of a sensitive feature as defined by the ordinance to obtain a Site Disturbance Permit. The Site Disturbance Permit requires an EPSC plan to be developed that achieves 80% design removal of total suspended solids generated by the site. The design storm to be used is the 10-year, 24-hour SCS Type II storm event.

6.4.7 Hazardous Materials Ordinance

The purpose of the Louisville Metro Hazardous Materials Ordinance is the protection of public health and safety through the prevention and control of hazardous materials incidents and releases. It requires the timely reporting of releases and applies to all parties who manufacture, use, or store hazardous materials in quantities prescribed by the ordinance. The ordinance was discussed in detail in the Risk Assessment section under Hazardous Materials.

6.5 Ongoing Programs

Provided below are examples of Louisville Metro's emergency and mitigation program activities that demonstrate ongoing efforts to mitigate the effects of multi-hazards. As ongoing programs

are delivered, monitored, updated, and evaluated, mitigation strategies outlined in this Plan may be incorporated into these programs to further mitigation goals.

6.5.1 MSD Projects

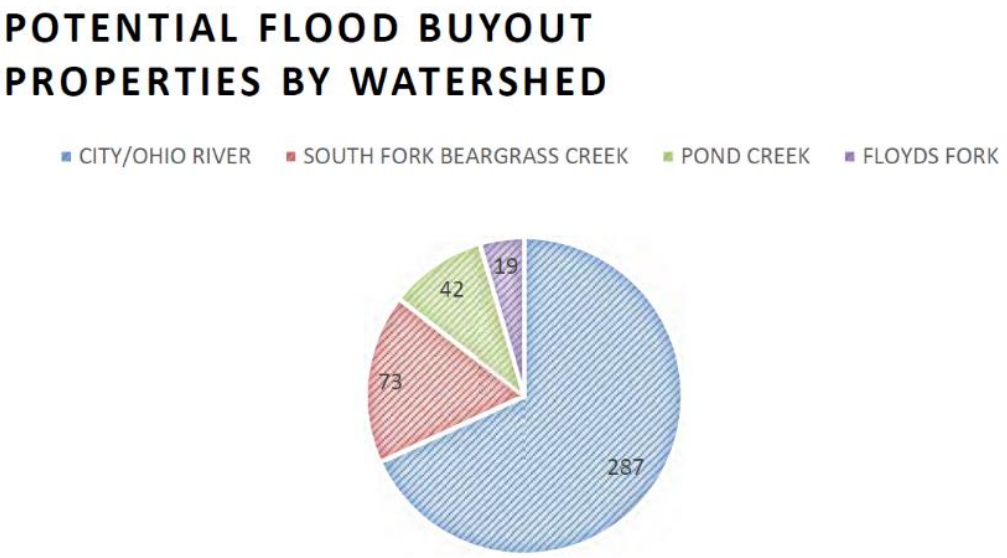
Risk MAP: As part of MSD's most recent Risk MAP project, updated FIRM Panels and FIS profiles were adopted in February 2021. Prior to the effective date of the 2021 flood maps, MSD incorporated the updated flood models into the Local Regulatory Floodplain. These changes were adopted in 2019. These updates modernized many flood studies and created limited detail flood models for most A zones in the county.

Floodplain Buyout Grant Prioritization: Where flooding occurs along the Ohio River, residents typically have 2 to 3 days' notice to evacuate. However, elsewhere in Jefferson County, flash flooding is a greater risk because of the suddenness and unpredictability of localized flooding events. This leaves residents with little or no time to evacuate since roadways in these areas are also at risk of flooding. It also creates risk to emergency personnel because boat rescues may be required.

For these reasons, there are limited opportunities to reduce flood risk by elevating or floodproofing structures, and MSD continues to pursue flooding risk mitigation through various FEMA Hazard Mitigation Assistance- and MSD-funded buyout programs.

Recently, MSD carried out a planning study to prioritize properties for future buyout programs that analyzed the Special Flood Hazard Area, Local Regulatory Floodplain, and First Street Foundation Flood Factor data. Flood Factor data was included because it provides flood information at the property level for future climate scenarios as well as risks associated with pluvial flooding that would not be included in riverine flood zone mapping. Based on this study, homes anticipated to experience 2 feet or more of flooding during a 100-year flood event will be prioritized for future buyout grant applications. Figure 6-1 shows the top four watersheds for potential residential floodplain buyout acquisitions.

Figure 6-1: Top Four Watersheds for Potential Residential Floodplain Buyout Acquisitions



MSD also has a long, established history of a partnership with the Louisville District Army Corps of Engineers. MSD has worked with the Army Corps of Engineers on floodplain modeling, Flood Insurance Studies (FISs), greenway projects, flood storage programs, and wetlands construction.

Post-Flood Response Program: The MSD Communications Department provides updated outreach materials regarding flood cleanup safety and the need for permits via website, local and social media. Buildings located in the Local Regulatory Floodplain that are deemed to be substantially damaged, which is defined as having damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred, are not permitted to be rebuilt unless they are reconstructed to be compliant with the Louisville-Jefferson County ocal Floodplain Management Ordinance. For example, in order to be complaint with the floodplain ordinance, the first floor of the structure and mechanical and electrical equipment must be elevated to the freeboard elevation. MSD Floodplain Permitting staff reviews permit applications for flood related repairs and is responsible for final approval of any properties deemed to be substantially damaged. MSD enforcement officers are responsible for enforcement actions listed in the floodplain ordinance, including issuing notices of violation and notices of citation for work done without a floodplain permit.

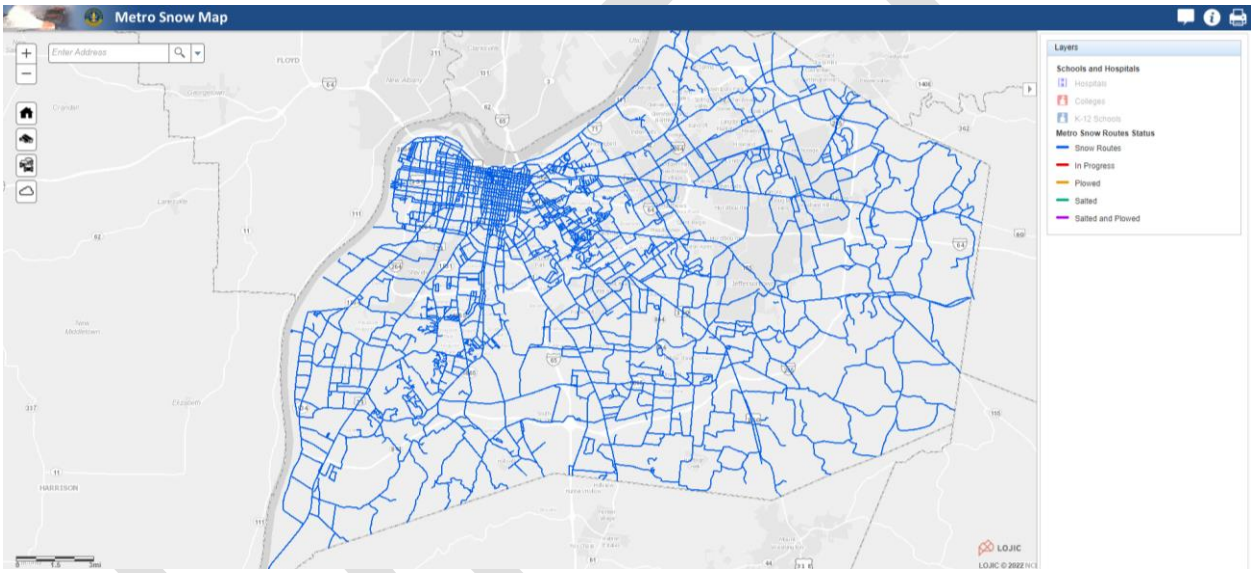
Ohio River Flood Protection System: MSD maintains Louisville Metro's Ohio River Flood Protection System, keeping the river at bay and out of the city. The system protects more than 200,000 people, 137,000 structures, and $34 billion in property throughout 110 square miles of Louisville Metro. It includes 26.1 miles of floodwall and earthen levee, 16 flood pumping stations, nearly 150 floodgates and 79 floodwall closures. Where creeks and storm drains pass through the floodwall, gates are closed to keep the river from flowing up the streams, and large pumps at the flood pumping stations lift the water from the creeks and pump it into the river.

Additional gates and pumping stations keep the river from backing up through storm drains and pipes, pumping the stormwater into the river.

6.5.2 Louisville Metro Snow Team

The nearly 300-member Louisville Metro Snow Team is led by Public Works and also includes employees of Metro Parks, Codes & Regulations, and Fleet Services. The Snow Team uses 160 pieces of equipment to clear 1,362 miles of road in the Louisville Metro area.[90] The Commonwealth of Kentucky is responsible for clearing the interstates, expressways, and highways. LOJIC and Metro Public Works have created an interactive snow routes map that allows citizens to enter their address to see the current information on the routes being cleared during a snow or ice event. The snow routes map is available on LOJIC's website at: http://www.lojic.org/snow/viewer.htm. A screen shot is provided in Figure 6-2 below.

Figure 6-2: Louisville Metro Snow Routes Map Snapshot



6.5.3 Kentucky Emergency Management Programs

Kentucky Emergency Management (KyEM) shares the Governor's vision to coordinate a system of mitigation, preparedness, response, and recovery and protect the lives, environment, and property of the people of Kentucky. Several programs specifically related to mitigation include:

Earthquake Program:[91] During the winter of 1811–1812, at least three powerful earthquakes (believed to be magnitude 8 or above) and thousands of aftershocks were felt along the New Madrid Seismic Zone. The zone impacts parts of eight states: Illinois, Indiana, Kentucky,

[90] https://louisvilleky.gov/government/public-works/services/snow-removal#:~:text=Snow%20Team,miles%20of%20road%20in%20Louisville.

[91] https://kyem.ky.gov/Preparedness/Pages/Earthquake.aspx

Tennessee, Alabama, Missouri, Arkansas, and Mississippi. The Earthquake Program is intended to provide helpful resources and preparedness guidelines to educate and assist the public in planning and preparing for a major earthquake event.

The Emergency Management Assistance Compact (EMAC):[92] This compact is a national system to quickly and effectively provide mutual aid to an impacted state with credentialed, certified, or sworn resources, with liability and insurance protection, as if they were responding within their own state.

Hazardous Materials Program:[93] This program provides Hazardous Materials training for a variety of disciplines such as fire, public works, clean up, emergency operations center, and emergency support functions.

Planning Program:[94] This program provides guidance to ensure that local, regional, and state Emergency Operation Plans meet federal and state requirements for standard content, format, and usability.

6.5.4 National Weather Service (NWS)

The NWS has several programs in the Louisville Metro area. The NWS' website for Louisville is at: https://www.weather.gov/lmk. The NWS provides forecast information, past weather data, safety information, education, and news related to weather events in the Louisville Metro area.

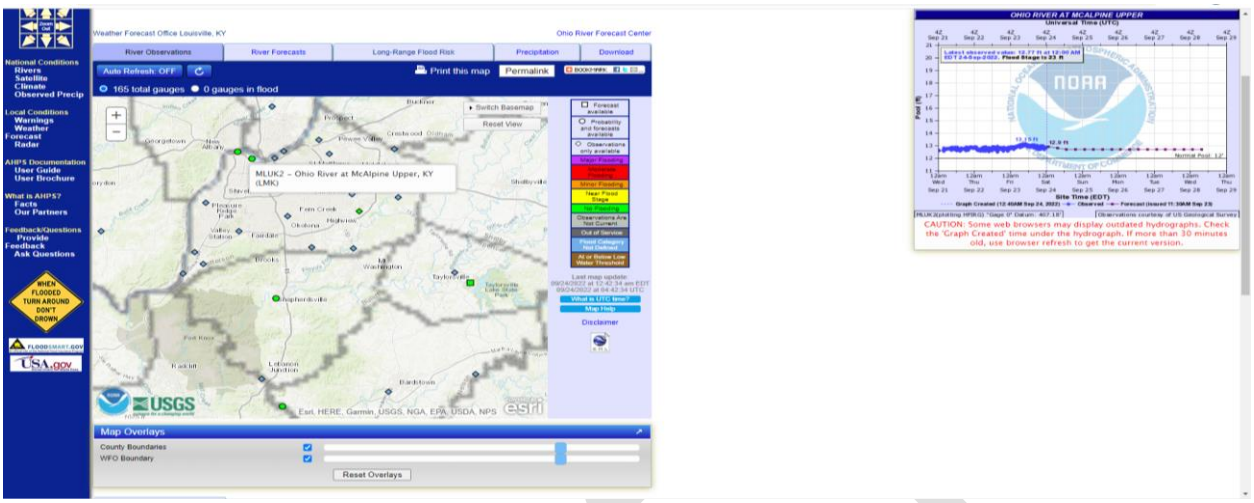
The NWS also operates a series of stream gauges in the Louisville Metro area. While not truly real-time, these gauges allow residents and officials to check stream and river levels within the current hour. In addition, by clicking on a desired location, it is easy to see how quickly the streams are rising or falling. Ongoing efforts from the NWS and USGS are determining the critical levels at which flooding of structures and roads begin. Figure 6-3 is a screenshot for the Ohio River at McAlpine Upper.

[92] https://www.emacweb.org/

[93] https://kyem.ky.gov/Preparedness/Pages/HazardousMaterials.aspx

[94] https://kyem.ky.gov/programs/Pages/Planning.aspx

Figure 6-3: Ohio River NWS Stream Gauge Snapshot



6.5.5 Louisville Metro Emergency Services

The Louisville Metro Emergency Services department consists of four divisions. Emergency Medical Services operates Louisville Metro's rescue vehicles and is the primary medical care provider during emergencies. MetroSafe 911 takes emergency calls and connects residents to the police, fire department, emergency medical assistance, and other first responders. It acts as Louisville Metro's primary emergency help line. Metro311 takes non-emergency calls and provides general government customer service. It serves as the main voice connection to city government. Finally, the Emergency Management Agency coordinates the work of 95+ agencies during disasters. It supports first responders with disaster preparation, response, recovery, and mitigation efforts. It is the main emergency response team for the entire community. Under the Emergency Management Agency, the following programs are managed:

Warning Systems: Louisville Metro EMA manages and coordinates the Outdoor Warning System, which consists of over 120 sirens in various locations around the Metro area. These devices are activated from the 24-hour 911 (MetroSafe) communication center with back-up activation capability at two communication centers. The system is tested monthly with weekly diagnostic tests performed silently, and SOPs for the siren operation are developed and reviewed annually. Other warning systems located at the 24-hour warning point include Emergency Alert System (EAS), MetroCall, 1610 AM radio, TRIMARC Transportation System, and the Cable Interrupt system. 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 Louisville Metro.

Emergency Operations Center: In the event of a large-scale emergency, the Emergency Operations Center is activated to coordinate activities such as public official alerts, care and shelter, evacuation, search and rescue, resource mobilization, and recovery. When activated, it is staffed by representatives from various city, regional, and federal agencies, and non-profit and private-sector partners. EOC staff have access to weather information, the status of healthcare facilities, and streams of information from regional, state, and media partners. They use

electronic incident management tools and integrated audio and visual technologies. The EOC serves primarily as a base of operations for city officials to coordinate activities, while leaving the direct command of resources to emergency services and first responders on the scene. The EOC also functions as a critical link with state and federal agencies during a catastrophic event. The mobile EOC (MEOC) is used in the absence of a staging area for first responders during emergencies and special events. The WebEOC system is used for information sharing.

LENSAlert Emergency Notifications: In 2016, Louisville Metro Emergency Services teamed up with Bullitt, Oldham, Nelson, and Washington Counties to create a regional emergency notification system—Louisville Emergency Notification System (LENSAlert). Its enhanced capabilities include using all communications modes to send alerts: mobile phones, landlines, email, text, social media, and IPAWS-OPEN. In addition to receiving notifications, individuals can create a Safety Profile for themselves and their household that can include any information they want 9-1-1 and first responders to have in the event of an emergency. When individuals make an emergency call, their Safety Profile is automatically displayed to the 9-1-1 call taker, allowing them to send the right responders to the right location with the right information. Information about medical history, allergies to medication, number of residents in a home, and even a picture of the family dog can all be added to a Safety Profile.

Hazardous Material Emergency Response: The Emergency Management program supports the Hazardous Materials Program by participating in the on-call rotation, attending training, and responding to chemical emergencies or other related events. The HazMat Training Program sponsors training for both the hazmat response community and LEPC personnel. Working in partnership with the Kentucky Emergency Response Commission, KyEM annually sponsors courses to support the OSHA training levels, such as Emergency Response Guidebook, Hazardous Materials Awareness, Hazardous Materials Operations, and NIMS 300/400 Compliance. KyEM works with a volunteer cadre of local hazmat instructors along with paid instructors from the State's Fire/Rescue Training Program to deliver HazMat Awareness and Operations training.

6.6 Incorporating Hazard Awareness into Existing Planning Mechanisms

The 2018 Kentucky State Hazard Mitigation Plan was reviewed and incorporated into its Mitigation Strategy, as appropriate. Mitigation-specific materials were also reviewed and incorporated into this plan as appropriate. Mitigation-specific materials included existing planning documents, LOJIC data, studies, ordinances, flood, hazmat, and land use regulations, and available technical information.

Louisville Metro agencies/organizations were also tasked to review common problems, development policies, mitigation strategies, and inconsistencies and conflicts in policies, plans, programs, and regulations. Examples of existing local studies/plans include information from development plans, climate change plans, comprehensive and capital improvement plans, watershed plans, emergency and continuity plans, transportation plans, and academic reports. Experts from federal, state, and local agencies and universities were also interviewed to ensure available pertinent information related to mitigation and associated strategies was received.

Table 6-6 shows the relationship between local codes, plans or regulations and the hazards identified in this plan.

Table 6-6: Code Crosswalk

Code, Plan or Regulation	Civil Unrest	Cyber	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Hailstorms	HazMat	Karst/Sinkhole	Landslide	Health Emergencies	Severe Storm	Severe Winter Storm	Tornado	Wildfire
Louisville 2040	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	N	Y	Y
Land Development Code	N	N	N	N	N	N	Y	N	Y	YP	YP	N	N	N	Y	YP
Floodplain Management Ordinance	N	N	N	N	N	N	YP	N	Y	N	N	N	N	N	N	N
Building Code	N	N	N	N	YP	Y	Y	YP	N	Y	Y	N	YP	YP	YP	N
Residential Code	N	N	N	N	YP	Y	Y	YP	N	Y	Y	N	YP	YP	YP	N
Hazardous Materials Ordinance	N	N	N	N	N	N	N	N	YP	N	N	N	N	N	N	N
Kentucky State Hazard Mitigation Plan	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y

Y The regulation addresses at least partially the identified hazard
YP The regulation is the primary one for that hazard
N The regulation does not currently address the hazard

6.7 Federal Grant Applications and Awards

Louisville Metro has taken advantage of numerous opportunities to garner federal money in a post-disaster setting. As a result, the community has secured funding for planning, warning systems, protective measures, public education, generators, flood-proofing, and acquisitions.

FEMA post-disaster grant application project types are grouped into three categories: planning, initiative, and projects (i.e., construction, drainage, and acquisition/demolition).

After a presidentially declared disaster, eligible communities submit Letters of Intent (LOIs) to KyEM for consideration. KyEM determines whether the project is located in an affected disaster area. If so, the project takes precedence over those that were not in the designated disaster area. Louisville Metro has been in the declared area for the last three Kentucky disasters. Table 6-7

presents a summary of Louisville Metro federal grant program awards dating back to 1998 as identified on the OpenFEMA Dataset: Hazard Mitigation Grants-v1.[95]

[95] https://www.fema.gov/openfema-data-page/hazard-mitigation-grants-v1

Table 6-7: Summary of Louisville Metro FEMA Mitigation Grant Awards

Program	Project Type	Status	Subgrantee	Project Amount	Federal Share	Date Approved	Date Closed
HMGP	Generators	Closed	Louisville and Jefferson County	$35,800.00	$26,848.00	2013-05-15	2013-05-22
HMGP	Generators	Closed	Louisville and Jefferson County	$71,119.00	$53,335.00	2013-04-26	2013-05-13
HMGP	Generators	Closed	Louisville and Jefferson County	$39,400.00	$29,548.00	2013-05-15	2013-05-22
HMGP	Generators	Closed	Louisville and Jefferson County	$54,870.00	$41,149.00	2013-05-17	2013-05-30
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Louisville	$958,050.00	$718,528.00	2003-01-14	2008-07-15
HMGP	Generators	Closed	Graymoor-Devondale	$7,975.00	$5,981.00	2012-04-16	2012-04-17
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville MSD	$2,304,172.00	$1,728,129.00	2007-08-10	2007-08-10
FMA	Acquisition of private real property (structures and land) - riverine	Obligated	Louisville MSD	$731,240.00	$1,256,073.53	2021-01-29	Ongoing
HMGP	Dry floodproofing private structures - riverine (commercial)	Closed	Jewish Hospital & St. Mary's Healthcare	$2,390,226.00	$1,792,526.00	2017-03-02	2017-03-02
HMGP	Warning systems (as a component of a planned, adopted, and	Closed	Louisville	$89,771.00	$67,323.00	2015-04-15	2015-05-27

Program	Project Type	Status	Subgrantee	Project Amount	Federal Share	Date Approved	Date Closed
	exercised risk reduction plan)						
HMGP	Local multihazard mitigation plan	Closed	Louisville	$17,513.00	$13,134.00	2015-10-13	2015-10-14
HMGP	Local multihazard mitigation plan	Closed	Jefferson County	$20,271.00	$15,202.00	2014-03-07	2014-03-10
HMGP	Infrastructure protective measures (roads and bridges)	Closed	Jewish hospital & St. Mary's Healthcare	$338,616.00	$253,942.00	2013-06-13	2013-06-24
HMGP	Generators	Closed	Louisville and Jefferson County	$48,900.00	$36,672.00	2013-05-16	2013-05-30
FMA	Acquisition of private real property (structures and land) - riverine	Obligated	Louisville MSD	$834,937.75	$362,155.50	2020-12-10	Ongoing
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville MSD	$3,280,176.15	$2,459,935.32	2022-08-10	2022-08-11
HMGP	Utility protective measures (electric, gas, etc.)	Closed	University of Louisville	$28,635.00	$21,476.00	2013-01-25	2013-02-06
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Louisville MSD	$808,181.00	$433,703.00	2018-05-07	Ongoing
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville MSD	$1,378,866.00	$1,034,067.00	2018-03-22	2018-03-08

Program	Project Type	Status	Subgrantee	Project Amount	Federal Share	Date Approved	Date Closed
HMGP	Generators	Closed	Jefferson County	$121,738.00	$91,304.00	2014-02-05	2016-02-11
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville	$647,098.00	$485,324.00	2003-01-14	2008-07-15
HMGP	Water and sanitary sewer system protective measures	Approved	Louisville MSD	$1,226,773.00	$900,306.00	1999-05-28	Ongoing
HMGP	Public awareness and education (brochures, workshops, videos, etc.)	Closed	Jefferson County	$40,830.00	$16,088.00	1998-09-16	2002-08-06
HMGP	Generators	Closed	Louisville and Jefferson County	$81,354.00	$61,011.00	2013-05-14	2013-05-22
HMGP	Utility protective measures (electric, gas, etc.)	Closed	University of Louisville	$1,155,000.00	$866,250.00	2012-11-20	2014-05-16
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville MSD	$987,086.00	$740,255.00	2017-10-31	2017-10-31
HMGP	Generators	Closed	Jefferson Community College	$135,261.00	$101,446.00	2011-06-16	2013-04-30
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville MSD	$1,716,732.37	$1,291,057.68	2022-08-12	2022-08-16
HMGP	Acquisition of private real property	Approved	Jefferson County MSD	$3,933,268.00	$2,949,951.00	2018-12-12	Ongoing

Program	Project Type	Status	Subgrantee	Project Amount	Federal Share	Date Approved	Date Closed
	(structures and land) - riverine						
FMA	Acquisition of private real property (structures and land) - riverine	Obligated	Louisville MSD	$2,178,839.75	$2,135,262.95	2020-12-09	Ongoing
HMGP	Generators	Closed	Louisville and Jefferson County	$63,414.00	$47,557.00	2013-05-17	2013-05-30
HMGP	Generators	Closed	Prospect	$69,359.00	$52,019.00	2012-10-04	2012-10-18
HMGP	Acquisition of private real property (structures and land) - riverine	Closed	Louisville MSD	$412,190.00	$309,143.00	2013-08-07	2019-10-02
HMGP	Generators	Closed	Seven counties svc inc.	$135,681.00	$101,753.00	2013-02-21	2013-03-06
HMGP	Local multihazard mitigation plan	Closed	Louisville	$70,539.00	$52,900.00	2017-10-05	2017-10-06
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Jefferson County	$274,873.00	$206,154.75	2020-11-24	Ongoing
HMGP	Planning related activities	Approved	Louisville and Jefferson County	$68,970.00	$51,728.00	2016-10-18	Ongoing
HMGP	Generators	Closed	Louisville and Jefferson County	$109,350.00	$82,006.00	2013-05-31	2013-06-04
HMGP	Acquisition of public real property (structures and land) - riverine	Closed	Louisville	$111,349.00	$83,505.00	2017-07-25	2017-07-25

Program	Project Type	Status	Subgrantee	Project Amount	Federal Share	Date Approved	Date Closed
HMGP	Water and sanitary sewer system protective measures	Closed	Louisville MSD	$1,237,241.00	$27,624.00	2000-03-09	2002-08-26
HMGP	Other equipment purchase and installation	Closed	Jefferson county	$160,200.00	$120,150.00	1999-08-16	2002-11-21
HMGP	Generators	Closed	Louisville and Jefferson County	$49,686.00	$37,261.00	2013-05-15	2013-05-30
HMGP	Generators	Closed	Louisville and Jefferson County	$63,295.00	$47,467.00	2013-04-26	2013-05-13
HMGP	Utility protective measures (electric, gas, etc.)	Closed	University of Louisville	$97,434.00	$73,076.00	2012-08-13	2013-06-24
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Louisville MSD	$607,841.00	$455,880.75	2018-12-11	Ongoing
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Louisville MSD	$1,979,816.00	$1,484,862.00	2015-09-28	Ongoing
FMA	Acquisition of private real property (structures and land) - riverine	Obligated	Louisville MSD	$305,690.00	$275,121.00	2021-03-03	Ongoing
PDM	Mitigation plan - local multihazard mitigation plan	Closed	University of Louisville	$131,609.00	$94,958.00	2004-07-01	2004-07-10
HMGP	Local multihazard mitigation plan	Closed	University of Louisville	$99,880.00	$74,910.00	2013-12-05	2014-04-30

Program	Project Type	Status	Subgrantee	Project Amount	Federal Share	Date Approved	Date Closed
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Louisville MSD	$6,673,152.00	$5,004,864.00	2018-12-17	Ongoing
HMGP	Local multihazard mitigation plan - update	Approved	Louisville	$183,980.00	$137,985.00	2021-04-29	Ongoing
HMGP	Shoreline stabilization (riprap, etc.)	Closed	Louisville and Jefferson County	$740,279.00	$519,757.00	2013-02-20	2013-03-19
HMGP	Acquisition of private real property (structures and land) - riverine	Approved	Louisville and Jefferson County	$809,600.00	$607,200.00	2021-11-18	Ongoing
HMGP	Acquisition of public real property (structures and land) - riverine	Closed	Louisville MSD	$726,827.00	$545,077.00	2007-11-20	2008-01-09
HMGP	Acquisition of private real property (structures and land) - landslide	Closed	Louisville	$138,355.00	$103,758.00	2007-10-17	2007-10-17
HMGP	Generators	Closed	Louisville and Jefferson County	$67,188.00	$50,387.00	2013-05-15	2013-05-30
FMA	Acquisition of private real property (structures and land) - riverine	Obligated	Louisville MSD	$702,159.00	$684,605.02	2020-03-19	Ongoing

7 Mitigation Actions

Most residents of Louisville Metro have a general knowledge about the potential hazards that their communities face. However, residents likely have little education concerning mitigation actions that increase or decrease their communities' vulnerability to certain hazards. Education concerning mitigation strategies and potential losses is a key factor for Louisville Metro's mitigation strategy.

Because of the Louisville area's history with both major natural disasters (flooding in 2018), civil unrest (2020–21), and the Covid-19 pandemic (2020–present), it is expected that there is generalized support for advancing hazard mitigation strategies. Louisville Metro has attended and participated in the mitigation planning process, largely because the community has been widely affected by these disasters.

7.1 2016 Mitigation Plan Strategy Summary

Louisville's 2016 Mitigation Plan recommended mitigation 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. Mitigation actions from the 2016 Plan were reviewed and noted as completed, outdated strategies were removed and noted as incomplete, and ongoing strategies were renewed. A status report for all of the mitigation actions and strategies from the 2016 Plan can be found in Table 7-1.

The statuses for 2016 strategies include:

- *Removed:* Strategy is not carried forward into the new plan
- *Complete:* Strategy is complete and not carried forward into the new plan
- *Ongoing:* Strategy is updated and carried forward into this mitigation plan.

Table 7-1: Status of the Mitigation Actions and Strategies from the 2016 Plan

ALL HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Notes/Comments**
1.1	**Develop risk assessment of publicly owned buildings, essential facilities, and transportation:** 1. Review Evacuation Plans for Central downtown government Public Buildings. 2. Disseminate Safe Room locations. 3. Develop/Revise Emergency Action Plans (EAP), as needed	Complete	Project was led by Facilities and OSHA. Evacuation plans have been updated. Emergency Actions Plans have been incorporated into building operations.
1.2	**Develop risk assessment with best available building data. Collect additional enhanced building data**: 1. Year built, especially structures older than 1980 2. Type of foundation, building construction type, number of stories	Removed	Building data related to age of construction is maintained by PVA. However, no risk assessment has been completed based on building age. Collecting enhanced dated is not planned.
1.3	**Historical Structures Survey coordinated by Metro PDS, PVA, and LOJIC:** 1. Inventory of public buildings review data for accuracy and completeness	Removed	LOJIC role is to store and share data and factoring it into models and maps for future actions. Currently there is no inventory of historic structure in place. Data from partners is constantly being generated and warehoused in the LOJIC platform. There may be other databases at Louisville Metro agencies that have not yet been incorporated into LOJIC; however, there are no known plans to review historical structure data for accuracy and completeness.
1.4	**Mitigate public transportation, public buildings and utility infrastructure:** 1. Develop a strategy and program to retrofit structures at-risk from hazard events (wind loads, seismic shock, flooding, etc. utilizing results of the risk assessment.	Removed	Major effort that did not receive funding. No longer a planned activity.
1.5	**Prepare for special needs at-risk groups during disaster.** Develop Special needs preparedness program: 1. Develop "Special needs registry" 2. Promote campaign to self-identify if special needs in household 3. Build a Special needs database to help plan for response activities and shelters and evacuation. Use www.disability.gov as resource	Ongoing	Initial efforts completed with other agency support, specifically, Office of Sustainability. Carry over into 2022 Plan.
1.6	**Data collection for hospital patient discharge data**	Removed	Not completed due to budget concerns.

ALL HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Notes/Comments**
	Emergency Department patient discharge data for preparedness epidemiologist for six syndromes: 1. Cardiac (chest pain), 2. G.I. (vomiting, diarrhea), 3. Neurological (seizures, paralysis), 4. Respiratory (difficulty breathing, symptoms of asthma), 5. Psych (mental status change, emotional instability) and 6. Other: Infectious Disease Will require purchase of telecom/software to facilitate sharing of hospital data to MPH		
1.7	**Health Impact Assessment "tool" to develop projects:** 1. For evaluation of proposed development projects in connection with the potential ramifications to the health and wellness of stakeholders.	Ongoing	Efforts being led by Center for Health Equity within Health and Wellness. Health impact assessment reports are produced regularly. Carry over into 2022 Plan.
1.8	**Community health education "clearinghouse:"** 1. Promotion potentially partnering with others to serve as a "clearinghouse" 2. Will help people find proper resources for such things as health screenings, existing education or outreach programs, etc. 3. Public Health currently working to develop a list of resources. Developing strategy to better promote a coordinated service.	Ongoing	Community Health Equity also leading this effort. Carry over into 2022 Plan.
1.9	**Increase training for WebEOC:** 1. Increase training for more people to use Web EOC. 2. Set a schedule 3. Develop list of potential candidates.	Ongoing	Louisville Metro uses the State WebEOC license and provides "just-in-time" training to stakeholders as they need access to the platform. Carry over into 2022 Plan.
1.10	**Develop inventory of barricades and signage that can be used during hazard events and develop system for deployment.**	Complete	A complete inventory has been conducted. Louisville Metro police also have emergency supply contracts for various barricades with local businesses.
1.11	**Install emergency generators in JCPS facilities:** 1. Acquire emergency generators to completely supply electrical power for all shelters both for the school system and the community.	Ongoing	Generators have been installed in Jefferson County schools; however, some City of Louisville schools still are waiting for their units. Generators are typically added as part of major HVAC projects. Approximately 75% of all Louisville Metro schools have generators. Generator testing and assessments are done as

ALL HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Notes/Comments**
	2. Begin project by prioritizing facilities to receive generators.		needed; however, there is no formal program. Carry over into 2022 Plan.
1.12	**Oxygen generators in ambulances for EMS:** 1. Generators for EMS to charge life-saving equipment, e.g., oxygen	Complete	Covered under a grant funded generator program.
1.13	**Emergency preparedness training for public schools:** 1. Provide funding for professional development for administrators for Mitigation, Preparedness, Response and Recovery through JCPS' Safety Procedures Manual training. 2. Additional FEMA Introduction to Incident Command for Schools course would also be administered. 3. Promote self-preparedness. 4. Partner w/ KyEM for instructors and materials	Complete	Schools administrators go through online safety and compliance training that helps them plan for and respond to disasters. Incident Command System (ICS) 100 training is provided to administrators as well. Training is updated annually to reflect changes in best practices. Cabinet level members also get COOP training. Schools operate under a National Incident management System (NIMS) protocol to include dedicated incident management teams. Finally, within the school system, a dedicated incident command channel has been reserved within the larger Louisville Metro radio system.
1.14	**Emergency communication for public school buses during disaster:** 1. To enhance communication systems through 2-way radio system compatible with MetroSafe including radios for buses.	Complete	Upgraded radio capabilities for buses. There are 15 bus compounds and there are 15 separate bus channels. Capability now exists to communicate directly to each bus. This was District funded. Drivers also have personal cell phones that can serve as backup communications.
1.15	**Emergency supply kits for public schools:** 1. Basic emergency supply kit for schools and medical/medicine storage – to have minimal storage for medicines and records for school.	Ongoing	It is each schools responsibility to store secure and maintain their own emergency kits. Recommendations are provided, but it is up to each principal to get what they believe is needed. Carry over into 2022 Plan
1.16	**During emergency hazard event response:** 1. Portable water purification systems	Complete	Responsibility for securing potable water after a disaster has transferred from Health and Wellness to ES. ES works directly with KyEM to secure potable water. If an emergency required water, it would ultimately come through ES and KyEM.
1.17	**Community Hazard Assessment and Mitigation Planning System (CHAMPS) implementation and training for Louisville Metro emergency management staff.**	Ongoing	Louisville Metro ES staff have been trained on CHAMPS use. Louisville Metro has not taken active engagement in platform. As program matures, it may be brought back to life. Carry over into 2022 Plan

ALL HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Notes/Comments**
1.18	**Increase business partnerships and the creation of COOP planning.**	Complete	Louisville Metro COOP plan was developed and delivered in 2018.
1.19	**Public education and standard public statements for all hazards:** 1. Promote use of early warning systems in multiple languages for standard outreach materials 2. Utilize recording by MetroCall 311 to disseminate brief information on hazards. 3. Use Greater Louisville TV (GLTV) for awareness messages. 4. Utilize News media for public education and event notification 5. Promote better personal planning/public education for disaster preparedness 6. Utilize LEPC "Fact Sheets" for educational and public outreach to ensure consistent message for ARC, Health Dept., EMA, LG&E, Dept. of Education, 7. Partner with known disability advocacy organizations to target preparedness messages and threat alerts to vulnerable populations (hearing impaired, visually impaired, homeless, linguistically isolated, etc..)	Ongoing	Public education and outreach are pillars of the Louisville Metro ES department. Louisville Metro ES will continue to work with partners such as the National Weather Service, where notification capabilities have increased with automatic alert technologies. ES also completed walkthroughs on request for public facilities. Public information and community engagement is handled through 311. New platforms include posting on 311 page related to preparedness. Moving forward, ES and various partners continue to believe that public education and outreach are important aspects of hazard mitigation activities. Fully integrated IPAWS is one example of continuous improvement. Carry over into 2022 Plan
1.20	**Increase registration for LENS/CodeRed**	Ongoing	LENS/Code Red has been replaced by Rave Mobile Safety for automatic signups. ES and other agencies go to public events to promote sign-up. Also use smart 911 and app to push out notifications. ES and the NWS will continue efforts to sign up and activate Louisville Metro residents.
1.21	**Utilize JCPS weather stations being installed on 15-20 schools as part of University of Louisville study on urban heat island to get real-time data, including temp, dew point, precipitation, winds, and barometric pressure.**	Ongoing	University of Louisville is in the process of completing a study on Urban Heat Aspects. Advanced Planning also published a recent study on heat management. NWS is the main source of data for these reports and works with MSD on rain gauge monitoring.
1.22	**Re-establish bi-annual hazard mitigation stakeholders and implementers, update funding and progress, coordinate with Silver Jackets.**	Ongoing	Multiple meetings focused on mitigation between ES and MSD. This is an ongoing process. Meeting cadence typically increases in both pre-and post-disaster environments. MSD regularly interfaces with the Silver Jackets.

ALL HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Notes/Comments**
1.23	**Botanica, Waterfront Botanical Garden -** 23 acre water retention project including utilizing runoff for irrigation. Educational component includes air, water, and waste sustainability projects. Projects sits on river, Beargrass Creek, and is an old city landfill. Site will be planted with trees - lots of trees.	Removed	Project has not been initiated. Replaced by larger mitigation effort discussed in Flood section.
1.24	**Vulnerability assessment web application and training.** Develop web application (ARCGIS Online) for vulnerability assessment maps and provide training for public agencies in how to use the maps for their programs and projects	Complete	ES produced an Interactive Vulnerability Map. Training was shelved due to Covid. Also completed RWAP Office of Infrastructure Protection (not public).

FLOOD HAZARD			
Action No	**Type of Activity or Project**	**Status**	**Comments**
2.1	**Update Floodplain Ordinance:** 1. Create Floodplain Ordinance Workgroup to review existing ordinance and propose changes to improve safety and resiliency, as well as improve ordinance administration.	Ongoing	Created Floodplain Ordinance Workgroup to review existing ordinance and propose changes to improve safety and resiliency, as well as improve ordinance administration. Revised Floodplain Ordinance was adopted 8/25/2017. Ordinance will be updated as needed in future. Carry over into 2022 Plan
2.2	**Flood studies for mitigation:** Update flood models in areas with known flooding issues and problematic modeling, including the 10-year flood interval, including: **1.** Guardian Creek (formerly Greasy Ditch) **2.** Buechel Branch **3.** Brooklawn Tributary	Ongoing	Guardian Creek Phase 1 completed in 2017, Phase 2 completed in 2018, Phase 3 (Snider Branch LOMR) submitted to FEMA and under review Buechel Branch completed with 50/50 funding with USACE in 2019. Carry over to 2022 Plan.
2.3	**Mitigation: project to protect existing buildings and infrastructure:** Target at-risk public and private buildings from flood for mitigation/retrofit 1. Inventory public buildings at-risk (also, see All Hazards # 4 & 5) 2. Develop a plan for mitigation for public property. 3. Develop a plan for mitigation for private property.	Complete	Completed a three step process: 1. Inventory public buildings at-risk 2. Developed a plan for mitigation for public property. 3. Develop a plan Inventory of government buildings has been completed."
2.4	**Future floodplain buyouts throughout the county:** 1. Identify repetitive loss, severe repetitive loss candidates, and other flood-prone properties 2. Prepare grant applications as funds become available	Ongoing	MSD continues to work on existing buyouts, including buyouts that were approved in 2021. Nine additional buyouts are under review by FEMA. MSD continues to identify repetitive loss, severe repetitive loss candidates, and other Floodprone properties for acquisition and prepare grant applications as funds become available.
2.5	**Acquisitions in Western Louisville Combined Sewer System Area(CSSA):** Continue acquisition projects approved by FEMA in Maple Street, Belquin, Algonquin, Wewoka West Park, and Linwood areas. Continue to look for additional potential areas, if needed and if funds become available.	Completed	The Maple Street buyout grant has been completed and closed out. The Belquin, Algonquin, and Wewoka West Park projects are completed and awaiting FEMA close out.
2.6	**Place flood elevation markers or other signage along flood-prone roads and parking areas.** Focus on roads that are frequently overtopped to demonstrate to drivers/pedestrians how deep the water is: 1. Complete an inventory of current sign locations	Ongoing	Metro Public Works has placed signs at 34 railroad viaduct locations which have historically flooded during rain events. MSD is working toward permits to allow the installation of level devices in viaduct stations to allow MSD to work with Public Works for notification of high water. MSD has completed an inventory of current sign locations and is developing a

FLOOD HAZARD			
Action No	**Type of Activity or Project**	**Status**	**Comments**
	2. Develop strategy for other at-risk areas 3. Post signs		strategy for other at-risk areas prior to postings. Carry of to 2022 Plan.
2.7	**Review and update flood related emergency preparedness and response plans** Review and update flood plans including evacuation of at-risk populations including seniors and disabled: 1. Complete an inventory 2. Review Plans 3. Update Plans	Ongoing	Working with health facilities and long term care facilities on preparedness and response plans. Many are complete but some are still outstanding. Carry over to 2022 Plan. .
2.8	**LaClede Basin – Proposed flood control basin located near end of W. Indian Trail and Greasy Ditch**	Removed	Ongoing process covered under Action 2.19.
2.9	**Tin Dor Way Basin - proposed flood control basin in Fairdale near Tin Dor Way If flood control basin is not feasible, then develop strategy for possible buyouts**	Removed	Ongoing process covered under Action 2.19.
2.10	**Flood Pump Stations** 1. Rehab, replace and update flood pump stations 2. Inventory and verify emergency generators and backup. Apply for grants where needed. 3. Apply for grants where needed	Ongoing	MSD continually looks to inspect, rehab, replace and update flood pump stations as needed. MSD reviews level of service of these pump stations to plan for future climate change resilience. MSD also conducts annual inventories and verifies emergency generators and backup power systems for operational readiness. Pump stations with major pump repairs, rehabilitation or capacity improvements are either repaired via long-term capital improvement funds, funding applications, or through emergency work orders. Carry over to 2022 Plan.
2.11	**Metro Parks reviewing its buildings for flood damage mitigation** 1. Reviewing backflow prevention devices, floor drains, sump pumps, gutters and downspouts, and sheet runoff diversion. Develop inventory. 2. Mitigation projects identified in this review will be placed on repair schedule 3. Accomplished as funds permit over the next five years.	Complete	Project completed with available funding. Additional actions will always be addressed as needed.

FLOOD HAZARD			
Action No	**Type of Activity or Project**	**Status**	**Comments**
2.12	**Establish and coordinate tree programs and partnerships to increase tree canopy, parkway areas.** Metro Parks and MSD are expanding the tree canopy in the metropolitan area as part of the plant 10,000 trees campaign. 1. Metro Parks will continue over the next five years to replace trees along parkways and in landscaped park areas as needed to retain tree canopy cover in the metropolitan area.	Ongoing	Metro Parks and MSD are expanding the tree canopy in the metropolitan area as part of the plant 10,000 trees campaign. Metro Parks will continue over the next five years to replace trees along parkways and in landscaped park areas as needed to retain tree canopy cover in the metropolitan area. Metro Parks and MSD both plan to continue planting trees, including 2,000 trees from Metro Parks Urban Forestry and 1,000 trees from MSD each year. Carry over to 2022 Plan.
2.13	**Public outreach about basement flooding:** 1. Education of the public from keeping critical items out of basements – computers, books, important files etc. 2. Target the audience on regulatory floodplain or MSD customer service requests rather than just the FEMA floodplains	Ongoing	Annual letters sent in December 2021. Other advertising continues on a regular basis. Education of the public from keeping critical items out of basements (computers, books, important files etc.), is a constant process. Carry over to 2022 Plan.
2.14	**Public outreach: evaluate ways to get message to a targeted audience.** Message is to better educate the public regarding flood-prone areas including flood insurance and plumbing modification programs	Ongoing	MSD produces an annual Program for Public Information plan that includes information about outreach efforts being made in Louisville Metro related to flood and water quality topics. These efforts continue year-after-year. Carry over to 2022 Plan.
2.15	**Increase coordination of flood warning using NWS chat rooms.** NWS Chat Rooms are set up to coordinate with staff in an official capacity. Several chat rooms exist, and NWS can set up additional ones if needed. Chat Rooms already include USGS, Corp, media, & EMS and can be made available to other agencies.	Ongoing	NWS Chat rooms are used primarily with media partners (mainly TV stations). NWS also uses twitter and auto generated retweets. As flood issues arise, comments are made in the chat rooms that are monitored by NWS. The amount of chat increases significantly as severe weather events arise. Carry over to 2022 Plan.
2.16	**Construct additional rain gauges, CCSA flow/level monitors, and stream gages on un-gaged streams to be used for warning, forecast flooding.**	Ongoing	Existing rain gauges, flow/level monitors and stream gauges are being maintained by MSD. Additional CSSA instrumentation and stream gauge installations should be added as needed to improve flood forecasting and public notification warnings.
2.17	**Elevation of flood-prone properties along the Ohio River:** 1. Phase 1 - Determine if elevation is feasible and cost effective for existing flood-prone homes. 2. Phase 2 - If feasible, elevate homes to at least one foot above the local regulatory floodplain elevation	Ongoing	Elevation is not a focus at this time; however, can remain a strategy as things may change in the future. Carry over to 2022 Plan.

FLOOD HAZARD			
Action No	**Type of Activity or Project**	**Status**	**Comments**
2.18	**Flood protection and drainage improvement projects to improve level of service and reduce structural flooding, such as upsizing culverts, constructing detention basins, and widening channels:** 1. Phase 1 - Analyze and develop watershed solutions. Use risk-based watershed tool to prioritize which sub-watersheds are assessed first. 2. Phase 2 - Construct cost effective projects determined to be feasible in studies	Ongoing	MSD has developed a risk-based watershed prioritization tool to advance stormwater master planning efforts with limited resources available. It allows MSD to move forward with planning solutions for areas that have the most flood exposure as well as the highest consequences of failure first. Using this equitable approach, MSD will pursue funding for design and construction of stormwater solutions.
2.19	**Beargrass Creek Stream Restoration and Beargrass Creek Greenway. Flood Risk Reduction through stream restoration and ecosystem services.**	Complete	Capital improvement project completed in 2020 to restore a tributary to Middle Fork Beargrass Creek and nearby wetlands near Peterson Ave and Grinstead Drive.

DAM AND LEVEE FAILURE			
Action No.	**Type of Activity or Project**	**Status**	**Comment**
3.1	**Risk Assessment: develop a dam & levee risk assessment with best available data.** **Phase 1: Verify GIS locations for existing dams**. Develop data inventory of all dams within Louisville Metro area. Steps: 1. Collect data from KDOW for locations and assessment of the State-Owned dams. 2. Perform research in the State Dam Safety Program records, which requires an "Open Records" request to the KDOW. 3. Research records and locations of dams within metro boundaries. 4. From research, collect other important data, e.g. current emergency operations plans (EOPs), dam materials, past inspections, violations, etc. 5. Collect inventory of dam locations and geo-code. 6. Verify which Class C dams have an EOP. * FEMA grant submitted in 2016 by Metro	Ongoing	USACE has completed their Semi-Qualitative Risk Assessment(SQRA) on MSD flood protection system/levees. Additional actions are planned.
3.2	**Risk Assessment: develop a dam & levee risk assessment with best available data.** **Phase 2: Perform Risk Assessments on Class B and C Dams, Class C High-Hazard Dams:** 1. Verify all Class C dams have and maintain an EOP (tied to above action item results). 2. Verify downstream warning system, public notice, etc. are included in EOP. **Class B, Moderate/Significant Risk Dams:** 1. Assess Class B dams for any downstream construction that might raise dam classification	Ongoing	A new template has been developed for dam EOPs. EOP's for all high-hazard dams are now in place and MSD is responsible for completion on those owned by the agency. Additional items have not been completed Projects for installing level sensors on MSD-owned high hazard dams and the Willowbrook flood protection area are in progress. These should provide real-time warning through MSD's SCADA system of any sudden change in water elevations.
3.3	**Mitigation: develop EOP for Class C dams:** 1. Develop EOPs for dams without plans 2. Update existing EOPs 3. Add NWS notification for alerts via weather radios	Complete	EOPs were developed for MSD-owned dams. Private dams are not addressed. . Remaining items are on hold.
3.4	**Mitigation: post a sign/landmark on dams with classification type (A, B, or C).** Signs to include: 1. Contact numbers 2. Name of dam 3. Maximum water impoundment ** Project dependent upon dam inventory (Phase 1)*	Ongoing	MSD is still working on putting signs on all dams. Once complete, dams will be identified by: 1. Contact numbers 2. Name of dam 3. Maximum water impoundment

DAM AND LEVEE FAILURE			
Action No.	**Type of Activity or Project**	**Status**	**Comment**
			Many dams are privately owned and therefore cannot be forced to place signs on their property
3.5	**Mitigation: removal or replace unsafe dams.** Once inspections are complete, the list of unsafe dams will determine next steps for repair and/or removal of dams. An unsafe dam would move to a Priority A project for immediate action. ** Project dependent upon dam inventory and assessment (Phases 1 & 2)*	Ongoing	As dams are determined to be unsafe during annual inspections, they are addressed through emergency or planned actions. An unsafe dam would move to an immediate action priority. Dam inspections will continue as scheduled. Carry over to 2022 Plan.
3.6	**Risk assessment and mitigation:** 1. Place a benchmark or similar point on dams to determine if movement is occurring. 2. Benchmark placement should coincide with inspection and data development.	Removed	For public-owned dams, this is not being done.
3.7	**Consider requiring EOPs for Class B dams:** 1. Class B dams have at-risk structures below the levee, therefore should require an emergency plan. 2. Partner with KY DOW Dam Safety Program for requirements and regulations	Removed	Requires regulatory action. This has not occurred.
3.8	**Mitigation: evaluate damage to levee and flood protection system:** Primarily Ohio River Flood Protection System and large pump stations (i.e. Beargrass Creek). Corps annual inspection is ongoing. Five-year inspection is more detailed	Ongoing	MSD and USACE are continuously monitoring flood protection systems for damage and structural integrity. Formal inspections take place annually and more intense inspections take place every five years. These are regulatory driven. Carry over to 2022 Plan
3.9	**Mitigation: develop better local dam construction and inspections criteria.** In order of the following: 1. Develop inspection and construction criteria to review existing dams 2. Begin periodic dam Inspection to develop reports. Metro Parks has a plan in place and performs regular inspections.	Ongoing	Dam construction is a highly regulated activity. Construction regulations are maintained at the state level and are reviewed on an as needed basis. Carry over to 2022 Plan.
3.10	**Metro Parks remedial work on their dams.** Remedial work needs to be competed on some dams: 1. Maintenance and inspection needed 2. Coordinate with MSD	Ongoing	Metro Parks has authority to inspect and repair dams under their control. This is done through contracted maintenance agreements.

DAM AND LEVEE FAILURE			
Action No.	**Type of Activity or Project**	**Status**	**Comment**
3.11	**Increase public awareness:** **S**ignage of the flood protection system history and assets, indicate allowed/prohibited activities	Ongoing	Public outreach activities are ongoing. Carry over to 2022 Plan
3.12	**Inspect and assess ash ponds to ensure they are safe**.	Complete	Ash Ponds have been removed
3.13	**Install 24-hour high hazard dam monitoring and warning system for those in inundation areas.**	Ongoing	MSD is moving forward with design and construction of level sensors/monitoring equipment on High Hazard dams under their control. Carry over to 2022 Plan
3.14	**Conduct catastrophic flood/levee failure planning study.**	Ongoing	This project was completed under the Regional Resiliency Assessment Program (R-RAP) by DHS and through the intermediate breech study by the USACE under the Flood Plain Management Assistance Program (Phase I). FEMA's evacuation consultant is currently developing a concept of operations plan (Phase II). Once this plan has been reviewed and approved the actual evacuation plan will be developed. FEMA requested a standard form 424 relating to the grant award under DR-4428. The award of the grant is expected soon. This will allow the contracting of a consultant to bring all the parts that have been developed together, write the actual plan, exercise it and finalize it.

METEOROLOGIC HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
4.1	**Find location and build tornado shelters/safe rooms for Minors Lane neighborhood** 1. Tornado shelter/safe room for Minors Lane Neighborhood property. Minors Lane school is being opened for the community during severe storm warnings for 2 manufactured home parks. A separate 24-hour available independent shelter is desperately needed. This would give immediate access to the community. 2. Research location at manufactured home parks, JCPS, and/or UPS property	Ongoing	Metro ES review facilities as requested; however, Covid made visiting locations difficult. Minors Lane is just part of larger program. The researching of safe rooms is a continual process that will continue into the future. Carry over to 2022 Plan
4.2	**Promote safe rooms/tornado shelter for new construction** 1. Encourage new construction to include a safe room. Tax incentive for property tax for constructing tornado safety room in house 2. Require all new manufactured home parks to build a safe room. Tornado Shelters for manufactured homes. 3. ARC work with the BIA to build safe rooms.	Ongoing	Nothing has moved on this. This is a big ask and requires regulatory changes to building codes. Carry over to 2022 Plan
4.3	**Increase awareness of outages during an event** 1. Outbound calls from LG&E re: outages 2. Mapping on websites	Complete	An LG&E outage map is updated in near real-time to reflect the most up-to-date information available on outages in your area, including estimated restoration time and the cause of an outage, if known.
4.4	**Promote & distribute weather radios**	Ongoing	NWS constantly establishing partnerships with media and retail establishments. Took break with covid but getting back out again. This is a major initiative for NWS and will be carried over to 2022 plan.
4.5	**Public outreach on retrofitting, mitigation, education and wind-driven building techniques** 1. Develop standardized message and program for how to make a home wind resistant 2. Partner with KY Weather Preparedness Committee (KWPC) that applied for a grant to buy FLASH (Federal Alliance for Safe Homes) cards	Ongoing	KWPC meetings still take place. Unknown on progress. Metro ES has major focus on outreach, therefore this project should be included in the 2022 Plan.

METEOROLOGIC HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
4.6	**Expand snow routes outreach** LOJIC maps showing snow routes (live routes) should be more accessible/better advertised e.g., radio and media links, Metro TV. 1. Outreach to public/ advertise, maybe use Mayor's Media office. 2. Show GPS, real-time Expand Operation Snow & Transportation planning 3. Staggered release plan to ease traffic before snow storms, esp. downtown	Ongoing	Ongoing process. This capability has come a long way since 2014. Outreach related to storms and events can now be found at https://www.lojic.org/snow-map Public works provides info and LOJIC maps are used for public info. Social media also is being used to promote maps. Although this activity is up and running, it is constantly being improved. Carry over to 2022 Plan.

GEOLOGIC HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
5.1	**Public outreach strategy to specific geologic hazard areas:** 1. Develop standard outreach for areas at-risk according to risk assessment 2. Disseminate to targeted areas and to partner website, media, Metro Council districts …	Ongoing	Various outreach activities are being implemented to educate the public about geologic hazards. Mainly these actions are being carried out by KGS. These actions will continue and even increase as Covid concerns abate. Carry over to 2022 Plan
5.2	**Develop an Earthquake Risk Assessment with best available building data.** Collect All Enhanced Building Data. A major research project: 1. Year built, especially structures older than 1980 2. Type of foundation, building construction type, number of stories * tied to All Hazards public building inventory project.	Ongoing	Not completed based on year built. PVA is the best source for this information. Data on "year built" is tough, as data is incomplete. This is a project that might be useful in future years and should be carried over to 2022 Plan.
5.3	**Earthquake risk assessment: research the existing collected data and incorporate inventory into LOGIC.** PDS completed collecting public historical data. Next steps: 1. Historical Structures Survey. 2. Inventory of public buildings: review data for accuracy and completeness. 3. Incorporate data into LOJIC Metro Planning Design Services (PDS) and Property Valuation Administration (PVA) will work with LOJIC to coordinate the inventory.	Removed	This has not been initiated.
5.4	**Earthquake mitigation: target critical and essential public buildings for mitigation or retrofit:*** 1. Develop a standard method for structural soundness and asset tie-downs (i.e. heavy bookcases, equipment). Utilize proven success strategy and methods from JCPS 2. Will require evaluation of each public building **Dependent on completion of inventory and assessment. See All Hazards #1, 2, & 5.*	Removed	This has not been initiated
5.5	**Earthquake education and outreach to schools:** 1. Education in schools: K- 12 / colleges / universities	Ongoing	The JCPS system participates in annual Great ShakeOut events. Take links and include in email to principals for communication to student families. Training is done on request.

GEOLOGIC HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
	2. Emphasize take the information home 3. Use National Earth Science Education Standard for kindergarten - 12 http://www.uky.edu/KGS/education/edustand.htm 4. Utilize JCPS & KY EQ drill as standard.		This activity will continue into the coming years. Carry over to 2022 Plan.
5.6	**Karst/sinkhole risk assessment.** Data collection to inventory sinkholes 1. Dye tracing by KDOW to detect sinkholes. Partner with KGS. 2. Will require coordination and meetings with KGS, KDOW, and MSD to determine next steps and to build a schedule	Ongoing	Actions 5.6, 5.7, and 5.8 are all related and have been initiated by KGS for locations throughout Kentucky. This is being done by "District" and the KIPDA District has not yet been mapped. However, KGS is operating a reporting website that is collecting data needed to effectively map occurrences. Carry over to 2022 Plan
5.7	**Karst/Sinkhole risk assessment.** Data collection to inventory sinkholes. Using high-resolution aerial imagery and geophysics to assess high-hazard areas for incipient cover collapse sinkholes. 1. Develop strategy to phase project or as one larger project to accommodate funds and time. Could be a Phased 1- to 4-year project. LOJIC to be recipient of the resulting digital data, and a central repository for the report	Ongoing	See Action 5.6
5.8	**Karst/Sinkhole Risk Assessment.** Project to collect standardized info to protect existing, new and future buildings and infrastructure: 1. Need a central local agency or avenue to report and receive info for karst/sinkhole locations indicated on development plans per new karst regulations. 2. Need a central local agency or avenue to report and receive info for karst/sinkhole damages and events 3. Develop SOP or Policy Development 4. Store loss inventory, esp. for roads, buildings and utilities	Ongoing	See Action 5.6
5.9	**Karst/sinkhole public outreach/education/warning:** 1. Develop strategy for outreach/warning 2. Post warnings and barriers be posted around sinkholes on public lands 3. Develop Signage	Ongoing	KGS is partnering with numerous agencies to initiate outreach and public education activities. This includes conducting various educational days. Carry over to 2022 Plan

GEOLOGIC HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
5.10	**Certification process for regulations in development code for karst/sinkhole:** 1. Training Program, as needed	Removed	Not being considered.
5.11	**Karst/sinkhole mitigation: repairs to public lands and facilities:** 1.Parks 2.Government owned	Removed	Repairs are done on an as needed basis. This cannot be scoped or planned.
5.12	**Landslide risk assessment.** Project to collect info to protect existing, new and future buildings/infrastructure from landslides: 1.KGS can be a central local agency or avenue to report and receive info for landslide, including damages and events. 2.Develop method to partner and receive info Research what has been looked at in the past. LiDAR will assist with this element.	Ongoing	This is a long-tern effort. Currently KGS has completed a landslide survey for five counties within the state. Jefferson County has not yet been included; however, as funding becomes available, additional counties will be assessed. Carry over to 2022 Plan.
5.13	**Landslide mitigation: Regulations** Project to enforce current regulations and protect infrastructure: 1.Enforce Binding Elements 2.Limit clearing of vegetation on high-risk slopes 3.Ensure BMPs for drainage	Ongoing	KGS was listed as the lead agency; however, they are not tasked with enforcement powers. That said, they do generate various mitigation strategies associated with landslides to protect infrastructure. These strategies are typically not "local" and can apply to various locations throughout the state.
5.14	**Landslide mitigation: reforestation** Project to repairs and reforestation to public lands and facilities: 1.10,000 tree initiative **Repairs to:** 1.Parks 2.Government owned	Removed	Addressed under Actions 2.12 and 6.11.

OTHER HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
6.1	**Promote public education for hazmat activities and sheltering in place:** 1.Promote sheltering-in-place 2.Promote education of hazmat activities 3.Utilize print, Metro-TV, and other media.	Ongoing	Prior to Covid, hazmat outreach activities were common. Various agency representatives attended public events and promoted hazmat best practices. As Covid restrictions are being relaxed, public engagement and speaking are being done on request. During hazmat incidents, the responding fire department has Incident Command on releases and their PIO is the first to brief the population. During larger events, other agency PIOs become involved as part of the Unified Command. Carry over to 2022 Plan
6.2	**Develop HazMat Public Education/ Awareness/Training for business community:** 1.Encourage companies with chemicals to consider the effects of natural hazards on their stock of hazardous materials and negative impact on employees and/or public.	Ongoing	The Louisville Metro hazmat ordinance has been passed and there are excellent capabilities between Police, Health, MSD, Fire, ES and Air Pollution Control District. All work together to promote hazmat transport, use, storage and releases and all have their own outreach and public education programs. Carry over to 2022 Plan
6.3	**HazMat outreach to individuals and Small Businesses.** Promote Spill Plans to individuals and small businesses that have hazmat, but aren't required by law to have a spill plan. Outreach to: 1.Encourage storing materials in a safe manner above flood potential or anchoring tanks etc. 2.Make available "industry best practices" for handling haz-mat. For small companies, KOSHAs education and training division could be a good resource.	Ongoing	Metro ES has partnered with KyEM on various initiatives. However, these are no longer active. Likely will return once additional funding becomes available. Carry over to 2022 Plan
6.4	**HazMat Risk Assessment.** Develop methodology and system for collecting and categorizing hazardous materials by location, type, quantity, and potential consequences. Data to be managed by Metro EMA and continually updated for inclusion in hazard mitigation plan risk assessment and emergency planning.	Ongoing	Metro EMA staff continue to work with Louisville Metro hazmat handlers to report spill and release activities and provide information on use, storage and transport. APCD partially funds Metro ES staff to review emergency plans. Carry over to 2022 Plan.
6.5	**Develop method for collecting drought data:** 1.Information on historic data 2.Estimates for losses 3.Dates of occurrences	Ongoing	NWS working with Drought Early Warning System (DEWS). NWS regularly puts out bulletins on potential droughts as they come up. Carry over to 2022 Plan

OTHER HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
6.6	**Drought mitigation: drought damage and outreach/education.** When drought occurs, outreach and education to keep the public informed should include: 1. Foundation cracking outreach: Promote public awareness, soil shrinkage can lead to cracking in foundations – solutions are to water the lawn and the foundation 2. Drought leads to fire hazards, including wildfire	Removed	Other drought programs took precedent over this activity.
6.7	**Extreme heat public outreach & education.** Coordinate with non-traditional agencies for community outreach.	Ongoing	NWS sends out email blasts to partners to warn of future extreme heat and cold events. There is a move to get wind chill values raised which is a mitigation strategy for 2022. NWS does not pull any triggers for opening shelters. Just provides email blasts on hourly basis so decisions can be made. Carry over to 2022 Plan.
6.8	**Extreme heat public outreach and education promoting National NWS campaign:** 1. Propose Louisville be a test bed to promote child heat safety in vehicles. 2. Advisory Committee promote via partnerships.	Ongoing	Various public outreach efforts are underway. This is a long-term strategy. Carry over to 2022 Plan
6.9	**Extreme heat public outreach and education:** 1. Animals and sheltering during a disaster. 2. Develop ideas for public service piece on MetroTV and other media outlets.	Ongoing	NWS just completed a Pediatric Vehicle Heatstroke study and is in the process of socializing with various Louisville Metro partners. Animal strategies are in development. Carry over to 2022 Plan.
6.10	**Extreme heat mitigation: Policies** Louisville Metro region adopt policies incentivizing or requiring minimum albedo levels at the time of routine roof, street, and parking lot resurfacing and for all new development.	Ongoing	Louisville Metro's Office of Sustainability conducted comprehensive heat management assessment as one component of a broader effort to enhance livability, health, and sustainability in the Louisville Metro region. This report assessed the extent to which Louisville Metro is warming due to urban development and deforestation, estimate the extent to which rising temperatures are impacting public health, and present a series of neighborhood- based recommendations for moderating this pace of warming. Carry over to 2022 Plan
6.11	**Extreme heat mitigation: Cooling** Louisville Metro region set tree planting and green roofing goals by district, enhance tree cover through a public tree planting program, and protect existing canopy through the	Ongoing	In 2021, Louisville Metro produced its first Tree Canopy Report using the USDA Tree Canopy Assessment protocols. This report is helping Louisville Metro better understand its green infrastructure through tree canopy

OTHER HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
	adoption of a comprehensive tree protection ordinance.		mapping and analytics. When integrated with other data, such as land use or demographic variables, this assessment can provide vital information to help Louisville Metro and its residents chart a cooler future. Carry over to 2022 Plan
6.12	**Extreme heat mitigation: Energy** Incentivize or require increased energy efficiency for both public and privately owned buildings.	Removed	This is being conducted at the federal level through the Bipartisan Infrastructure Law.
6.13	**Extreme heat mitigation: Greening** Cool materials and greening strategies be implemented in concert at the neighborhood level, and that energy efficiency programs be continued and expanded for the Louisville Metro region as a whole.	Ongoing	This is happening as part of an overall program to reduce ambient air temperatures. This includes tree canopy programs, ozone reduction regulations, and other cooling activities. This is an ongoing activities that will be carried over in 2022.
6.14	**Wildfire public outreach & education: public awareness and outreach** 1. Increase public awareness during drought about wildfire potential 2. Wildfire early warning (Red Flag) education and outreach 3. Increase public awareness and enforcement of no burn regulations 4. Develop standardized reporting system	Ongoing	Not a real depth of wildland firefighting equipment. Division of Forestry is likely going to be needed to address a large scale forest fire. Lots of access roads into forests so it's easier to combat when they occur. Timber stays moist. Not a lot of "long camps" There is a social media program to update residents of Red Flag days. Red flag days are no burn days. Forest fires are reported through National Fire Incident Report System.
6.15	**Wildfire mitigation: cleanup of damaged trees:** Partner with Metro Parks and Public Works	Removed	There has been no movement on this activity
6.16	**Wildfire Mitigation: acquisitions:** Acquire and deed restrict forested land (E.g. Jefferson Memorial Forest, greenways, and parks)	Removed	There have been no acquisitions related specifically to fire related mitigation.
6.17	**Wildfire mitigation: fire suppression** Project to develop strategies for fire suppression: 1. Target wildfire at-risk areas 2. Promote Best Management Practices (BMPs) 3. Delineation of non-wooded areas susceptible to wildfire	Ongoing	Louisville Metro has clearly defined high risk areas as it pertains to wildfires. The county has also implemented a requirement that firefighters attend a wildfire training class (150-hours) to obtain wildfire certification. This training incorporates best practices. County fire also has mutual aid agreements with other county departments to provide support as needed. Finally, the Louisville Metro area has local agreements with counties and cities. As new best practices or technologies become available, they will be incorporated into local

OTHER HAZARDS			
Action No.	**Type of Activity or Project**	**Status**	**Comments**
			planning. Because of this, this strategy will be carried over into the 2022 Plan.
6.18	**Wildfire outreach: coordination** Coordinate among emergency response groups about standard for reporting grass, wild fire, etc. Action to involve coordinated outreach among Fire Dept's, MetroSafe, and any other emergency response group as needed to increase awareness of the event tracking/reporting tools/processes currently used.	Complete	Location reporting is difficult for wildfires. Louisville and County Fire have access to a contractor for 24/7 drone support to pinpoint locations via GPS. Also have capabilities to Police Department air units thought mutual aid.). With this information, Louisville Metro can inform the public of fire status and locations to avoid.

7.2 2022 Mitigation Strategies

The activities and projects listed in this section are those in which Louisville Metro agencies and residents can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation. The action items are organized within the Mitigation Actions Matrices shown in Table 7-2, which like the 2016 plan, contain lists for:

- All Hazards
- Flood Hazards
- Dam and Levee Failures
- Metrological Hazards
- Geologic Hazards
- Other Hazards

Data collection and research resulted in the development of these action items. The matrices includes the following information for each action item:

Funding Source

Each strategy can be funded through a variety of sources, possibly including the normal operating budget; various FEMA grant programs including HMGP, BRIC, FMA, PDM, and other grants; private funding; and other funding opportunities.

Lead Agency

Each strategy has a primary agency (or in some cases, multiple agencies) responsible for implementation. The hierarchies of the assignments may vary from positions to departments to committees. The primary responsibility for implementing the action items falls to the entity shown as the "Lead Agency."

The Lead Agency has either the regulatory responsibility to address hazards, or must be willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Lead agencies may include Louisville Metro or regional/state agencies that are capable of or responsible for implementing activities and programs.

Alignment with Plan Goals

The Alignment with Plan Goals addressed by each strategy is included as a way to monitor and evaluate how well the strategies, and the mitigation plan in general, are achieving their goals once implementation begins. The plan goals are numbered as follows:

1. Minimize the loss of life and injuries that could be caused by multi-hazards.
2. Facilitate a sustainable economy by protecting agriculture, business, and other economic activities from multi-hazards.
3. Facilitate the strengthening of public emergency services, its infrastructure, facilities, equipment, and personnel to multi-hazards.

4. Develop a community-wide mitigation effort by building stronger partnerships between government, businesses, and the general public.
5. Increase public and private understanding of multi-hazard mitigation through the promotion of mitigation education and awareness of multi-hazards.
6. Enhance existing or design new policies and technical capabilities that will reduce the effects of multi-hazards.
7. Enhance existing technical and GIS data and capabilities that will reduce the effects of multi-hazards.
8. Promote the development of policies, programs, initiatives, and projects that prioritize diversity, equity, and environmental justice.

Benefit/Cost Ratings

The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the HMGP and BRIC grant programs. A less formal approach was used because some projects may not be implemented for up to 5 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

Cost ratings were defined as follows:

High	Existing jurisdictional funding will not cover the cost of the strategy so other sources of revenue would be required.
Medium	The strategy could be funded through existing jurisdictional funding but would require budget modifications.
Low	The strategy could be funded under existing jurisdictional funding.

Benefit ratings were defined as follows:

High	The strategy will provide short-term and long-term impacts on the reduction of risk exposure to life and property.
Medium	The strategy will have long-term impacts on the reduction of risk exposure to life and property.
Low	The strategy will have only short-term impacts on the reduction of risk exposure to life and property.

The cost and benefit ratings above were slightly different than those utilized in 2016. In the 2016 Hazard Mitigation Plan, the classifications of “Low”, “Medium”, “High” and “Very High”

were used. This plan simplifies the classification systems to just “Low,” “Medium,” and “High.” This was done to avoid confusion over the differences between “High” and “Very High.”

The Planning Team used the following Priority Rating method. As noted, designations of “High,” “Medium,” and “Low” priority were assigned to all of the action items using the following criteria:

Does the Strategy:

- Solve an existing or future problem?
- Reduce the exposure or vulnerability to a targeted hazard?
- Address multiple hazards?
- In general, have benefits that equal or exceed costs?
- Implement a goal, policy, or project identified in the previous Hazard Mitigation Plan, General Plan, or Capital Improvement Plan?

Can the Strategy be:

- Implemented with existing funds?
- Implemented by existing state or federal grant programs?
- Completed within the 5-year life cycle of the Hazard Mitigation Plan?
- Implemented with currently available technologies?

Will the Strategy:

- Be accepted by the Louisville Metro community?
- Be supported by community leaders?
- Provide benefit to vulnerable populations?
- Provide benefit to underserved communities as defined by CDC’s SVI?
- Comply with local ordinances or zoning laws?
- Create an overall positive or neutral impact on the environment?
- Comply with existing local, state, and federal environmental laws and regulations?

Is there:

- Sufficient expertise in the Louisville Metro Area to undertake the project?
- Do Agencies have the existing authority to undertake the project?

As mitigation action items were updated or written the Planning Team completed worksheets for each strategy. Each “Yes” answer was worth “1 point” while a “no” answer was worth zero. Answers to the criteria above determined the priority according to the following scale.

- 1-6 = Low priority
- 7-12 = Medium priority
- 13-18 = High priority

Scoring sheets associated with each strategy are presented in Appendix F.

Table 7-2: All Hazards

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.1	**Prepare for special needs at-risk groups during disaster.** Continue to develop special needs preparedness program: 1. Continue to develop "Special needs registry" 2. Promote campaign to self-identify if special needs are in a household 3. Build a Special needs database to help plan for response activities and shelters and evacuation.	☐Yes ☒No	Ongoing	Metro EMA Sustainability	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
1.2	**Develop Health Impact Assessment "Tool" to assist in developing mitigation projects:** 4. Continue to develop a Health Impact Assessment Tool though Center for Health Equity that will evaluate proposed development projects in connection with the potential ramifications to the health and wellness of stakeholders.	☒Yes ☐No	Ongoing	Public Health and Wellness	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☒ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.3	**Community Health Education clearinghouse:** Center for Health Equity to continue public education efforts: 5. Promotion and potentially partnering with others to serve as a "clearinghouse" for local health information 6. Assist people find proper resources for such things as health screenings, existing education or outreach programs, etc. 7. Public Health currently working to develop a list of resources. Developing strategy to better promote a coordinated service.	☐Yes ☒No	Ongoing	Public Health and Wellness	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
1.4	**Increase training for WebEOC.** **Continue to promote and utilize state WebEOC platform for managing local incidents:** 8. Increase training for more people to use Web EOC. 9. Set schedules 10. Develop list of potential candidates.	☐Yes ☒No	Ongoing	Metro EMA	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.5	**Continue to install emergency generators in public schools:** 11. Acquire emergency generators to supply electrical power for shelters both for the school system and the community. 12. Continue to prioritizing facilities to receive generators based on HVAC renovations.	☒Yes ☐No	Ongoing	JCPS	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
1.6	**Continue to procure emergency supply kits for public schools:** 13. Continue to procure basic emergency supply kits for schools based on real-time threats, using new and improved technologies where possible.	☐Yes ☒No	Ongoing	JCPS	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
1.7	**Community Hazard Assessment and Mitigation Planning System (CHAMPS) implementation and training for Louisville Metro emergency management staff:** 14. Although staff have been trained on CHAMPS use, Metro ES staff have not taken active engagement in platform. As program matures, make efforts to increase participation	☐Yes ☒No	Ongoing	Metro EMS KyEM	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.8	**Continue public education & standard public statements for all hazards:** 15. Continue to promote use of early warning systems in multiple languages for standard outreach materials 16. Continue to use records by MetroCall 311 to disseminate brief information on hazards. 17. Continue to use Greater Louisville TV (GLTV) for awareness messages. 18. Utilize News media for public education and event notification 19. Continue to promote better personal planning/public education for disaster preparedness 20. Develop and utilize "Fact Sheets" for educational and public outreach to ensure consistent message for ARC, Health Dept., EMA, LG&E, Dept. of Education, 21. Continue to partner with known disability advocacy organizations to target preparedness messages and threat alerts to vulnerable populations (hearing impaired, visually impaired, homeless, linguistically isolated, etc..)	☐Yes ☐No	Ongoing	Metro EMA NWS ARC Public Health and Wellness JCPS LG&E	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.9	**Increase registration for Mobile Alert technology:** 22. Continue efforts to increase resident and business participation in receiving mobile alerts related to potential hazards.	☐Yes ☒No	Ongoing	Metro EMA NWS MSD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
1.10	**Utilize JCPS weather stations:** 23. Stations were installed on 15-20 schools as part of UofL study on urban heat island to get real-time data, including temp, dew point, precipitation, winds, and barometric pressure. Continue this program to obtain additional data.	☐Yes ☒No	Ongoing	NWS JCPS	☐ Goal 1 ☒ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
1.11	**Re-establish bi-annual hazard mitigation meetings:** 24. Bring together stakeholders and implementers to update mitigation strategies (funding and progress)	☐Yes ☒No	Ongoing	Metro EMA MSD KyEM	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☒ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.12	**Update and develop new research publications related to climate change and its impact on hazards:** 25. Over the past five years, Advanced Planning produced numerous research reports associated with climate change. Through the next five years, continue these efforts to further address how a changing climate changes Louisville Metro threat and risk profile.	☐Yes ☒No	1-5 Years	Advanced Planning	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
1.13	**Review JCPS MetroSafe access:** 26. Refine strategies linking JCPS radio systems to MetroSafe network so that during emergency events a secure communications channel can be established.	☐Yes ☒No	1-3 Years	JCPS	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H
1.14	**Continue exercise program and expand to include discussions on mitigation strategies:** 27. The Pandemic put exercises on hold. Major exercise should focus on active shooter or natural disaster such as Tornado and discuss all elements of emergency management to include mitigation efforts.	☐Yes ☒No	1-3 Years	JCPS	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

ALL HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
1.15	**Conduct early-warning siren tests at schools:** 28. Conduct test at each JCPS to determine if early-warning siren systems are audible Incorporate EARS (Emergency Alert Radio System) radio functionality into tests.	☐Yes ☒No	1-3 Years	JCPS	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
1.16	**Explore partnerships to increase weather monitoring:** 29. Explore partnerships with Louisville Metro facilities to install weather monitoring date on existing government buildings. This should include JCPS facilities. Use data collected as part of school educational curriculum.	☐Yes ☒No	1-3 Years	JCPS	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H	☒ - L ☐ - M ☐ - H
1.17	**Institute a formal emergency generator management/maintenance program:** 30. Institute a central generator management program to include a dashboard that can provide immediate visibility to JCPS leadership on issues related to operational capabilities.	☒Yes ☐No	1-3 Years	JCPS	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

Table 7-3: Flood Hazards

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.1	**Review/Update Floodplain Ordinance:** 1. Review existing Floodplain Ordinance and propose changes to improve safety and resiliency, as well as improve ordinance administration as needed/required.	☐Yes ☒No	Ongoing	MSD	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☒ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.2	**Flood studies for mitigation:** 2. Continue to update flood models in areas with known flooding issues and problematic modeling, including the 10-year flood intervals.	☐Yes ☒No	Ongoing	MSD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.3	**Continue floodplain buyouts throughout the county:** 3. Identify repetitive loss, severe repetitive loss candidates, and other floodprone properties. 4. Prepare grant applications as funds become available.	☐Yes ☒No	Ongoing	MSD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.4	**Review feasibility and construct regional stormwater/flood control basins:** 5. Review feasibility and construct new regional stormwater/flood control basins 6. Prepare grant applications as funds become available	☒Yes ☐No	Ongoing	MSD	☒ Goal 1 ☒ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.5	**Place flood elevation markers, other signage and safety measures along floodprone roads and parking areas:** 7. Continue program to focus on roads that are frequently overtopped to demonstrate to drivers/pedestrians how deep the water can be. 8. Complete an inventory of current sign locations, develop a strategy for posting warning signs and post as funding allows. 9. Install level sensors, automated gate-arm barricades, flashing lights, and other public notifications at selected areas throughout the city. 10. Incorporate flood notification information into emergency response route changes.	☐Yes ☒No	Ongoing	MSD Metro Public Works Parks	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.6	**Review and update flood related emergency preparedness and response plans:** 11. Continue to review and update plans including evacuation of at-risk populations to include seniors and disabled.	☐Yes ☒No	Ongoing	EMA MSD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.7	**Repair and replace flood pump stations as required:** 12. Continue to rehab, replace and update flood pump stations as needed. 13. Inventory and verify emergency generators and backup. Apply for grants where needed.	☒Yes ☐No	Ongoing	MSD	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☒ Others	☐ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.8	**Establish and coordinate tree programs and partnerships to increase tree canopy, parkway areas:** 14. Continue program with Metro Parks to expand the tree canopy in the metropolitan area. 15. Metro Parks will continue over the next five years to replace trees along parkways and in landscaped park areas as needed to retain tree canopy cover in the metropolitan area. MSD will contribute 1,000 trees per year.	☐Yes ☒No	Ongoing	Metro Parks MSD Louisville Metro Community Forestry	☐ Goal 1 ☒ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.9	**Continue public outreach regarding basement flooding:** 16. Continue to send annual letters to everyone in floodplain and repetitive loss properties. 17. Educate the public on keeping critical items out of basements – computers, books, important files etc.	☐Yes ☒No	Ongoing	MSD Media	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.10	**Continue Public Outreach related to NFIP and Plumbing Modification Programs:** 18. Continue to deliver annual letters to everyone in floodplain and repetitive loss properties discussing the merits of both programs.	☐Yes ☒No	Ongoing	MSD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.11	**Increase Coordination of Flood Warning using NWS Chat Rooms:** 19. NWS Chat Rooms are set up to coordinate with staff in an official capacity. Several chat rooms exist, and NWS can set up additional ones if needed. Chat Rooms already include USGS, Corp, media, & EMS and can be made available to other agencies.	☐Yes ☒No	Ongoing	NWS	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.12	**Elevation of floodprone properties:** 20. Determine if elevation is feasible and cost effective for existing floodprone homes. 21. If feasible, elevate homes to at least one foot above the local regulatory floodplain elevation.	☐Yes ☒No	Ongoing	MSD	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☒ - L ☐ - M ☐ - H
2.13	**Continue drainage improvement projects:** 22. Conduct new studies on subbasin basis to determine future drainage improvement projects based on the newly developed risk-based prioritization tool. 23. Construct drainage improvement projects, such as increasing culvert capacity, widening channels, and increasing flood storage.	☒Yes ☐No	Ongoing	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

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Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.14	**Increase the use of information technology:** 24. Continue to explore new technologies to replace aging infrastructure. Research and secure improvements related to level sensors on streams, flood prone areas and viaducts to provide flood information. 25. Continue to explore new technologies to ensure systems are secure from cybersecurity attacks.	☒Yes ☐No	Ongoing	MSD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.15	**Increase notification capabilities:** 26. Incorporate best-practice information technology related to flooding and dams/levee failures.	☐Yes ☒No	Ongoing	MSD Metro EMA	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.16	**Protect existing buildings and infrastructure:** 27. Target at-risk public and private buildings from flood for mitigation/retrofit	☐Yes ☒No	Ongoing	MSD LOJIC Jeffersontown	☐ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.17	**Install a rain garden and creek access at the MSD Floyds Fork Water Quality Treatment Center:** 28. Follow concept design to include educational outreach signage.	☐Yes ☒No	1-3 Years	MSD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.18	**Conduct a Big Run Flood Mitigation Study:** 29. A grant application has been submitted to FEMA for review for conducting a flood mitigation study to determine potential projects needed to reduce flooding impacts from Big Run.	☐Yes ☒No	1-5 Years	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.19	**Continue Drive In Branch Flood Basin Project:** 30. Drive In Branch, a tributary of Big Run, is currently being studied to investigate potential benefits of improvements to existing storage basins and channels in mitigating localized flooding. Alternatives being evaluated in the study are expansion of storage basin volumes, incorporation of green management practices and channel restoration.	☐Yes ☒No	Ongoing	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.20	**Paddy's Run Flood Pumping Station Project:** 31. The Paddy's Run Flood Pumping Station will be replaced with a new facility to increase the pumping capacity of this location. Built in 1953, it is beyond its useful life and in need of full replacement to prevent catastrophic risks to disadvantaged communities within the inundation area.	☒Yes ☐No	3-5 Years	MSD	☒ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.21	**River Road Reconstruction Project:** 32. This project will elevate River Road above the 10 year floodplain to increase access to properties along River Road during smaller, more frequent floods.	☒Yes ☐No	1-3 Years	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.22	**Western Flood Pump Station Project:** 33. The Western Flood Pump Station project proposes to increase capacity of the pump station and increase the volume of the surge basin to reduce roadway and structure flooding in this area.	☒Yes ☐No	1-3 Years	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.23	**Northern Ditch Watershed Mitigation Project:** 34. Preliminary approval has been given for a grant to evaluate the Northern Ditch watershed for mitigation opportunities. A location near West Indian Trail has been identified for a potential regional detention basin and would be included in this study. This basin would create additional storage volume for the Pond Creek Watershed during major flooding events.	☒Yes ☐No	1-3 Years	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.24	**Evaluate new platforms to better facilitate communications related to flooding concerns:** 35. National Weather Service personnel are currently assessing various notification platforms to increase capabilities to inform people of potential flooding events.	☐Yes ☒No	1-2 Years	NWS	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.25	**Construct additional rain gages and stream gages:** 36. Construct additional gages on un-gaged streams to be used for flood forecast and warning. 37. Construct additional flow/level sensor throughout the CSSA.	☐Yes ☒No	1-3 Years	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others ☐	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.26	**Development of real-time flood mapping application, predictive flood modeling, flood alert and notification system, and flood safety barricade infrastructure to improve flood safety**	☒Yes ☐No	1-5 Years	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
2.27	**Increase Flood Risk Mitigation for Wastewater Facilities** 38. Treatment facilities within the flood plain are at risk of failing during flood events, resulting in discharge of untreated wastewater. Sanitary sewer overflows are possible when flood water infiltrates pump stations and manholes during flood events. Assets at risk of flooding may require relocation, upgrades, and or/ protections to improve resiliency during flood events, especially as frequency of extreme storms increases with climate change.	☐Yes ☒No	1-3 Years	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.28	**Wastewater facility flood protection and customer backup prevention through Plumbing Modification and Rehabilitation Programs:** Increased occurrences of extreme storms put strain on the existing collection system due to higher volume of rainfall occurring during short periods of time. These storms can increase the risk of backups in basements of customers. 39. Secure additional resources for the sewer rehabilitation program and the Plumbing Management Program (PMP) to allow for a proactive response to this risk. The PMP mitigates backups through plumbing improvements including the installation of backflow preventers, sump pump disconnections, and lateral service line renewal. The sewer rehabilitation program mitigates the stress of intense storms, improves system resilience by extending the life of existing infrastructure, reduces backups into homes and wastewater overflows to waterways, and protects residents from sewer collapse and pump station emergencies.	☐Yes ☒No	1-3 Years	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others ☐ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

FLOOD HAZARD									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
2.29	Maintain backup power generators and the connections at applicable facilities: 40. Continue to implement measures for preventing sanitary sewer overflows during storm events or other power outages Increased frequency and intensity of storm events presents additional risk to maintaining power at wastewater facilities.	☐Yes ☒No	1-3 Years	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

Table 7-4: Dam and Levee Failure Hazards

DAM AND LEVEE FAILURE HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Potential Funding Sources**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
3.1	**Risk assessment: develop a Dam and Levee Risk Assessment with best available data.** **Phase 1: Verify locations for existing dams**. Develop data inventory of all dams within Louisville Metro area. Steps include: 1. Collect data from KDOW for locations and assessment of the State-Owned dams. 2. Perform research in the State Dam Safety Program records, which requires an "Open Records" request to the KDOW. 3. Research records and locations of dams within metro boundaries. 4. From research, collect other important data, e.g. current EOPs, dam materials, past inspections, violations, etc… 5. Collect inventory of dam locations and geo-code. 6. Verify which Class C dams have an EOP.	☒Yes ☐No	Ongoing	MSD LOJIC KDOW	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

DAM AND LEVEE FAILURE HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Potential Funding Sources**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
3.2	**Risk assessment: develop a Dam and Levee Risk Assessment with best available data.** **Phase 2: Perform Risk Assessments on Class B and C Dams, High-Hazard Dams** 7. Verify all Class C dams have and maintain an EOP (using a newly developed template and tied to above action item results). 8. Verify downstream warning system, public notice, etc. are included in EOP. **Class B, Moderate/Significant Risk Dams** 9. Assess Class B dams for any downstream construction that might raise dam classification	☐Yes ☒No	Ongoing	MSD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
3.3	**Inspect dams for failure and removal or replace unsafe dams:** 10. After inspections, unsafe dams will be addressed to determine next steps for repair and/or removal of dams. An unsafe dam would move to a Priority A project for immediate action. * Project dependent upon dam inventory and assessment (Phases 1 & 2)	☒Yes ☐No	Ongoing	KDOW	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☐ Grants ☒ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

DAM AND LEVEE FAILURE HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Potential Funding Sources**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
3.4	**Continue evaluation to levee and flood protection systems:** 11. Continue to evaluate Ohio River Flood Protection Systems and large pump stations (i.e. Beargrass Creek). Partner with USACE on both regulatory driven annual and five-year inspections	☐Yes ☒No	Ongoing	MSD USACE	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
3.5	**Continue Metro Parks remedial work on agency operated dams:** 12. Continue remedial work as needed based on inspections	☐Yes ☒No	Ongoing	Metro Parks	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
3.6	**Continue public awareness efforts:** 13. Installation of signage related to flood protection system history and assets to indicate allowed/prohibited activities on the levee system is complete.	☐Yes ☒No	Ongoing	MSD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

DAM AND LEVEE FAILURE HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Potential Funding Sources**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
3.7	**Initiate 24-hour high hazard dam monitoring and warning system for those in inundation areas:** 14. Moving forward with design and construction of level sensors/monitoring equipment on High Hazard dams maintained by MSD.	☐Yes ☒No	Ongoing	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☐ Grants ☒ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
3.8	**Catastrophic Flood/Levee Failure Planning Study** 15. Support FEMA evacuation consultant in the development of a concept of operations plan (Phase II). Once this plan has been reviewed and approved the actual evacuation plan will be developed. Funded through grants and Silver Jackets.	☐Yes ☒No	Ongoing	MSD	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☒ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
3.9	**Monitor and comment on state dam construction and inspection criteria.** 16. Continue to review proposed high hazard dams and follow MSD Design Manual.	☒Yes ☐No	Ongoing	MSD Metro Parks	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☒ - L ☐ - M ☐ - H

DAM AND LEVEE FAILURE HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Potential Funding Sources**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
3.11	**Develop EOPs for Class C Dams** 17. Continue with existing strategy to include: 1) Develop EOPs for dams without plans; 2) Update existing EOPs, and 3) add NWS notification for alerts via weather radios. EOPs have been completed for all Class C dams. Remaining items are on hold.	☐Yes ☒No	Ongoing	MSD Metro Parks KDOW	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
3.12	**Post Signs/Landmark on dams with classification type (A, B, or C):** 18. Procure and place signage on non-privately owned dams to assist the public in identifying dam types.	☐Yes ☒No	Ongoing	MSD Metro Parks KDOW	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
3.13	**Reduce Whipps Mill flooding potential:** 19. Place flood level sensors and remote monitoring equipment on the high hazard dam located at Whipps Mill.	☐Yes ☒No	1-3 Years	MSD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☐ - H	☐ - L ☐ - M ☐ - H	☐ - L ☐ - M ☐ - H

DAM AND LEVEE FAILURE HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Potential Funding Sources**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
3.14	**Roberson Run Flood Monitoring** 20. In an effort to reduce risks associated with flooding, flood level sensors and remote monitoring equipment will be placed on the high hazard dam located at Roberson Run.	☐Yes ☒No	1-2 Years	MSD	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

Table 7-5: Meteorologic Hazards

METEOROLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
4.1	**Find location and build tornado shelters/safe rooms for Minors Lane neighborhood:** 1. Evaluate the possibility for a tornado shelter/safe room for Minors Lane Neighborhood property. Minors Lane school is being opened for the community during severe storm warnings for two manufactured home parks. 2. Research alternative locations at manufactured home parks, JCPS, and/or UPS property	☒Yes ☐No	Ongoing	Metro EMA JCPS	☒ Goal 1 ☒ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
4.2	**Promote safe rooms/tornado shelter for new construction:** 3. Encourage new construction to include a safe room. Tax incentive for property tax for constructing tornado safety room in house 4. Require all new manufactured home parks to build a safe room. Tornado Shelters for manufactured homes. 5. ARC work with the BIA to build safe rooms.	☒Yes ☐No	Ongoing	NWS	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
4.3	**Promote and distribute NOAA weather radios:** 6. Continue to distribute NOAA Weather Radios at events and as needed to Louisville Metro	☐Yes ☒No	Ongoing	NWS	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4	☒ Normal Operating Budget ☐ Grants	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

METEOROLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
	partners. NOAA Weather Radio (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest National Weather Service office. NWR broadcasts official Weather Service warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week.				☒ Goal 5 ☐ Goal 6 ☒ Goal 7 ☐ Goal 8	☐ Others			
4.4	**Continue public outreach on related to retrofitting, mitigation, education and wind-driven building techniques:** 7. Work to develop standardized message and program for how to increase a structure's wind resistance. 8. Partner with outside agencies such as the KY Weather Preparedness Committee (KWPC), to determine of grant funding is available to purchase FLASH (Federal Alliance for Safe Homes) cards.	☐Yes ☒No	Ongoing	NWS Metro ES KWPS	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
4.5	**Expand existing snow route mapping outreach:** 9. LOJIC maps showing snow routes (live routes) should be more accessible/better advertised e.g., radio and media links, Metro TV.	☐Yes ☒No	Ongoing	Public Works LOJIC	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

METEOROLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
	10. Outreach to public/ advertise, maybe use Mayor's Media office. 11. Show GPS, real-time and expand operation snow and transportation planning. 12. Stagger release plan to ease traffic before snow storms, esp. downtown.				☐ Goal 7 ☐ Goal 8				
4.6	**Continue Extreme Heat mitigation public outreach and education:** 13. Coordinate with non-traditional agencies for community outreach. Socialize new plans and studies related to extreme heat impacts to the community.	☐Yes ☒No	Ongoing	Metro ES NWS Media LMPD LMFD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
4.7	**Continue Extreme Heat public outreach and education to promote NWS' Pediatric Vehicular Heatstroke campaign:** 14. Propose Louisville be a test bed to promote child heat safety in vehicles. 15. Task various advisory committees to promote via partnerships.	☐Yes ☐No	Ongoing	NWS	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
4.8	**Continue Extreme Heat public outreach and education related to Animals:** 16. Work with Louisville Zoo to formulate an outreach plan for	☐Yes ☒No	Ongoing	Louisville Zoo Metro EMA NWS	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5	☒ Normal Operating Budget ☐ Grants	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H

METEOROLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
	animals in extreme heat events to include sheltering and water consumption. 17. Develop ideas for public service piece on MetroTV and other media outlets.				☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☐ Others			
4.9	**Implement an Extreme Heat Mitigation Program focused on albedo levels:** 18. Work towards the Louisville Metro region adopting policies incentivizing or requiring minimum albedo levels at the time of routine roof, street, and parking lot resurfacing and for all new development.	☒Yes ☐No	1-3 Years	Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
4.10	**Extreme Heat Mitigation though Tree Canopy Programs:** 19. Continue to promote Louisville Metro's tree planting and green roofing goals through various media outlets. Focus on enhancing livability though public tree planting programs, and protect existing canopy through the adoption of a comprehensive tree protection ordinance.	☐Yes ☒No	Ongoing	MSD Metro Parks Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

METEOROLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
4.11	**Develop Extreme Heat and Extreme Cold Plans:** 20. Various Louisville Metro agencies should continue to work with Resilience to publish Extreme Heat and Cold plans. These documents are grant funded throughout the state. Updated older plans. In place for the end of the calendar year. Both plans are mitigation based. "What you can do to protect yourself"" should be the key driver.	☐Yes ☒No	Ongoing	Resilience NWS EMA	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
4.12	**Continue to manage vegetation thoughout the to reduce power outages:** 21. Various Louisville Metro agencies should continue to work with Resilience to publish Extreme Heat and Cold plans. These documents are grant funded throughout the state. Updated older plans. In place for the end	☐Yes ☒No	Ongoing	LG&E	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

Table 7-6: Geologic Hazards

GEOLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
5.1	**Continue to develop public outreach strategy related to specific geologic hazard areas:** 1. Continue to develop standard outreach for areas at-risk according to risk assessments. 2. Disseminate information to targeted areas and to partner websites, medias, Metro Council districts, etc.	☐Yes ☒No	Ongoing	Metro EMA KGS Develop Louisville KDOW	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H
5.2	**Develop an Earthquake Risk Assessment with best available building data:** 3. Collect enhanced building data for this major research project, including year built, especially structures older than 1980, Type of foundation, building construction type, number of stories. 4. Work with PVA to acquire building specific data	☐Yes ☒No	1-5 Years	LOJIC KGS PVA	☐ Goal 1 ☒ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

GEOLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
5.3	**Continue delivering earthquake education and outreach to schools:** 5. Develop updated education related to earthquake risk for JCPS K- 12 / colleges / universities 6. Develop and emphasize "take home information" for protection in the event of an earthquake 7. Incorporate National Earth Science Education Standard for kindergarten - 12 http://www.uky.edu/KGS/education/edustand.htm 8. Utilize JCPS & KY EQ drills as standard and promote Great ShakeOut participation.	☐Yes ☒No	Ongoing	JCPS KGS Metro EMA	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
5.4	**Expand Karst/sinkhole Risk Assessments to include Louisville Metro areas:** 9. Request KGS initiate a project to definitively collect data on sinkholes and karst so that a formal inventory can be established. 10. For major developments, request dye tracing by KDOW be completed to detect sinkholes. Partner with KGS.	☒Yes ☐No	Ongoing	Develop Louisville KDOW KGS MSD Metro ES	☒ Goal 1 ☒ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

GEOLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
5.5	**Collection of sinkhole data:** 11. Initiate a project to collect sinkhole data using high-resolution aerial imagery and geophysics to assess high-hazard areas for incipient cover collapse sinkholes: 12. Continue to develop strategies to phase this project so that it can be completed over time. 13. Task LOJIC to be the recipient of the resulting digital data, and a central repository for the report. 14. Work with Develop Louisville to map findings against new development plans	☒Yes ☐No	Ongoing	Develop Louisville KGS LOJIC	☒ Goal 1 ☒ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
5.6	**Continue Karst/Sinkhole public outreach, education and warning:** 15. Develop strategy for outreach/warning related to sinkholes and Karst within the Louisville Metro area. 16. Establish a SOP related to sinkhole management including what to do once one is identified. This could include posting warning and barriers around sinkholes found on public lands	☐Yes ☒No	Ongoing	Develop Louisville KGS Metro ES Metro Parks	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

GEOLOGIC HAZARDS									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
5.7	**Initiate a Landslide Risk Assessment: project to collect information on potential landslide events:** 17. Continue to review regulations aimed at protecting existing, new and future buildings/infrastructure from landslides events. 18. Work with KGS to act as a central local agency or avenue to report and receive info for landslide, including damages and events. 19. Research what has been looked at in the past. LiDAR will assist with this element	☒Yes ☐No	Ongoing	Develop Louisville KGS	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
5.8	**Incorporate landslide mitigation into building codes:** 20. Initiate a project to enforce current regulations to protect infrastructure to include limiting clearing of vegetation on high-risk/steep slopes and ensure best management practices are incorporated for in site drainage plans.	☒Yes ☐No	Ongoing	Develop Louisville KGS	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

Table 7-7: Other Hazards:

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.1	**Promote public education for HazMat response activities to include sheltering in place:** 1. Promote benefits sheltering-in-place 2. Promote education of HazMat response activities 3. Utilize print, Metro-TV, and other media to educate communities on robust Louisville Metro capabilities related to HazMat response.	☐Yes ☒No	Ongoing	LMFD Metro EMA LMPD MSD APCD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.2	**Develop HazMat public education/ awareness/training for business community:** **4.** Encourage companies with chemicals to consider the effects of natural hazards on their stock of hazardous materials and negative impact on employees and/or public.	☐Yes ☒No	Ongoing	Metro EMA LMPD LMFD MSD APCD	☐ Goal 1 ☒ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.3	**Conduct HazMat outreach to individuals and small businesses:** 5. Promote spill plans to individuals and small businesses that use, have HazMat, but aren't required by law to have a spill plan. 6. Encourage storing materials in a safe manner above flood potential or anchoring tanks etc. 7. Make available "industry best practices" for handling haz-mat. For small companies, KOSHAs education and training division could be a good resource	☐Yes ☒No	Ongoing	Metro EMA LMPD LMFD MSD APCD	☐ Goal 1 ☒ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
6.4	**Update HazMat Risk Assessments:** 8. Continue to refine methodologies and systems for collecting and categorizing hazardous materials by location, type, quantity, and potential consequences. **9.** Data to be managed by Metro EMA and continually updated for inclusion in hazard mitigation plan risk assessment and emergency planning.	☐Yes ☒No	Ongoing	Metro EMA LMFD LDPD MSD APCD	☐ Goal 1 ☒ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.5	**Develop innovative methods for collecting drought data:** 10. Investigate new methods for collecting drought data to include estimates for losses and dates of occurrence.	☐Yes ☐No	Ongoing	NWS	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
6.6	**Wildfire public outreach and education:** 11. Increase public awareness during drought about wildfire potential. 12. Develop materials related to wildfire early warning (red flag) education and outreach. 13. Increase public awareness and enforcement of no burn regulations. 14. Develop standardized reporting system to capture wildfire data outside the National Fire Incident Reporting System that can be shared with the public on online platforms.	☐Yes ☒No	Ongoing	Metro Fire APCD	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.7	**Continue to develop strategies for wildfire suppression:** 15. Target wildfire at-risk areas. 16. Promote best management practices. 17. Delineation of non-wooded areas susceptible to wildfire. 18. Identify updated and specialized equipment that can be used specifically to combat wildfires.	☐Yes ☒No	Ongoing	Metro Fire	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
6.8	**Continue to coordinate wildfire outreach activities:** 19. Coordinate among emergency response groups about standard for reporting grass, wild fire, etc. 20. Initiate actions to involve coordinated outreach among fire dept's, MetroSafe, and any other emergency response group as needed to increase awareness of the event tracking/reporting tools/processes currently used.	☐Yes ☒No	Ongoing	Metro Fire	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
6.9	**Update Multi-model transportation plan:** 21. A Louisville Metro multi-model transportation plan was delivered in 2016. In subsequent updates, incorporate hazard mitigation planning to include HazMat response capabilities.	☐Yes ☒No	5 years	Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☒ - L ☐ - M ☐ - H	☒ - L ☐ - M ☐ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.10	**Incorporate hazard mitigation into Neighborhood Development Plans:** 22. Various neighborhoods in the Louisville Metro area have specific development plans. These plans incorporate flooding but other hazards are not always represented.	☒Yes ☐No	1-5 years	Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☒ - M ☐ - H
6.11	**Promote public outreach related to natural hazards in neighborhoods:** 23. Establish presentation materials related to natural hazards facing developments in the Louisville Metro area. Structure these so they can be delivered in online settings and in-person.	☐Yes ☒No	1-3 Years	Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
6.12	**Establish an Emergency Housing Plan:** 24. Think about hazards from housing perspective. Residents and impacts to land use if major disaster occurs such as a HazMat releases, or levee breach. The Louisville Metro area is challenged by a shortage of housing. A disaster effecting housing could create immediate hardships for residents.	☒Yes ☐No	1-3 Years	Develop Louisville	☒ Goal 1 ☒ Goal 2 ☒ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.13	**Promote hazard mitigation within Economic Development outreach:** 25. Effective hazard mitigation can be packaged as selling point for companies looking to relocate to the Louisville Metro area.	☐Yes ☒No	1-2 Years	Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☒ - M ☐ - H
6.14	**Promote sustainability initiatives at educational institutions:** 26. Partner with JCPS, the University of Louisville and the Jefferson County Technical College to promote strategies in the 20222 Hazard Mitigation Plan.	☐Yes ☒No	1-2 Years	Develop Louisville	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☒ - L ☐ - M ☐ - H
6.15	**Refine and update Louisville Metro's homeless sheltering strategy:** 27. Establish a plan for homeless management in the event of natural disasters. 28. Continue to incorporate homeless and vulnerability populations into Public Health and Wellness hazard mitigation strategies.	☐Yes ☒No	1-3 Years	Resilience Public Health and Wellness	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.16	**Continue to support the development of the Disease Outbreak Support Plan (DOSP):** 29. This plan contains information on potential bio agents that could trigger infection outbreaks. Revise report to identify responsible parties, potential outcomes, and other info that can change annually.	☐Yes ☒No	1-2 Years	Public Health and Wellness	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.17	**Refine Mass vaccination plan:** 30. Louisville Metro's Mass Vaccination Plan was put in place after Covid. Participate in revisions to mirror POD dispensing plan. 31. Medical Counter-measures plan also being revised FY23.	☐Yes ☒No	1-2 Years	Public Health and Wellness	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.18	**Continue to fund Housing Authority security measures:** 32. Fund upgrades to building security systems as needed. Specifically, the secure 550 site, H Temple Spears, and Wiggins Community Center. 33. Offer interconnectivity with MetroSafe to provide access to Housing Authority's camera system.	☐Yes ☒No	1-2 Years	Housing Authority	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.19	**Improve Housing Authority Fire Control Systems:** 34. Move forward in changing out fire alarm systems at various Housing Authority properties. This can be funded though capital improvement funds.	☐Yes ☒No	1-2 Years	Housing Authority	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.20	**Extend external security agreements:** 35. Continue to secure support though outside security contractors.	☐Yes ☒No	Ongoing	Housing Authority	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.21	**Extend security agreements with Louisville Metro Police Department:** 36. Renegotiate a new LMPD Halo Contract with new administration.	☐Yes ☒No	1-2 years	Housing Authority	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.22	**Secure IT data center from natural hazards:** 37. Incorporate findings of hazard mitigation plan into hardening strategies for Louisville Metro's data center.	☐Yes ☒No	1-2 Years	Housing Authority	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☒ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.23	**Secure IT data center from cyber-attacks:** 38. Continue to incorporate best practices in the cyber protection world to safeguard Louisville Metro's data center and data.	☐Yes ☒No	Ongoing	Housing Authority	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.24	**Transition to cloud-based servers:** 39. Transition to cloud-based servers. Data is currently backed up in physical hard drive and stored offsite. Goal is to be totally cloud-based by 2024.	☐Yes ☒No	1-2 Years	PVA	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.25	**Establish Emergency Reassessment protocols:** 40. Establish simple protocols to quickly reassess properties after a disaster. 41. Develop outreach and public information related to Emergency Reassessment activities after natural disaster. 42. Establish formal field teams with capabilities to quickly reassess damaged properties.	☐Yes ☒No	1-3 Years	PVA FEMA	☐ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
6.26	**Continue air quality alert day program and announcements:** 43. Conduct continued outreach to inform vulnerable residents when precautions should be taken to avoid exposures.	☐Yes ☒No	1-2 years	APCD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☒ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.27	**APCD continue to support HazMat activities:** 44. ACPD staff are not trained first responders but pay ½ salary for an EMA response person to support program initiatives. 45. Continue to focus on Chemical/HazMat accident avoidance. 46. Continue to fund this program. Review plans and reports and enforcement of violations.	☐Yes ☐No	Ongoing	APCD Metro ES	☐ Goal 1 ☐ Goal 2 ☒ Goal 3 ☒ Goal 4 ☐ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☒ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
6.28	**Continue to manage and fund the Strategic Toxic Air Reduction Program:** 47. Continue program to reduce air toxics in the air to include VOCs and metals. Continue to manage this program through fees.	☐Yes ☐No	Ongoing	APCD	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☒ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H
6.29	**Secure additional HazMat response equipment:** 48. Secure additional equipment to address HazMat releases (chemical, biological, medical, etc.) to include modern air monitoring equipment, radiation detection equipment, and trucks that would allow for extended breathing air at incident sites.	☐Yes ☒No	Ongoing	Metro Fire County FD	☒ Goal 1 ☒ Goal 2 ☐ Goal 3 ☐ Goal 4 ☐ Goal 5 ☒ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H	☐ - L ☐ - M ☒ - H

OTHER HAZARDS:									
Action No.	**Type of Activity or Project**	**New Building and Infrastructure**	**Proposed Schedule**	**Lead Agency**	**Alignment with Plan Goals**	**Funding**	**Cost (L-M-H)**	**Benefit (L-M-H)**	**Priority (L-M-H)**
6.30	**Maintain zoning regulations associated with HazMat separation requirements:** 49. Continue to review and adjust existing zoning regulations related to HazMat facility separation requirements with specific attention paid to new residential development and places of assembly.	☐Yes ☒No	Ongoing	Develop Louisville	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H
6.31	**Develop new regulations related to Tree Canopy removal:** 50. Assess current zoning and planning regulations to determine if more stringent development regulations are needed to maintain Louisville Metro's tree canopy.	☒Yes ☐No	1-3 Years	Develop Louisville	☒ Goal 1 ☐ Goal 2 ☐ Goal 3 ☐ Goal 4 ☒ Goal 5 ☐ Goal 6 ☐ Goal 7 ☐ Goal 8	☒ Normal Operating Budget ☐ Grants ☐ Others	☒ - L ☐ - M ☐ - H	☐ - L ☒ - M ☐ - H	☐ - L ☐ - M ☒ - H

8 Plan Maintenance

Once a Plan update is approved, Louisville Metro must maintain and amend the Plan as needed. A routine method and schedule for maintaining the Plan is necessary to ensure continued risk reduction and loss avoidance.

Completing the Plan maintenance process will keep Louisville on track and serve as the basis for the 2027 Plan update. The process of monitoring the Plan will provide Louisville Metro the opportunity to document progress in achieving mitigation goals.

8.1 Monitoring Evaluating, and Updates

The Hazard Mitigation Plan Steering Committee will meet twice per year. Meetings will be open to the public, and stakeholders who participated in the 2022 planning process will be encouraged to continue their participation. Additionally, the Steering Committee will coordinate with the Louisville Silver Jackets Chapter in plan implementation.

Louisville Metro will also use Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) to track mitigation strategies and apply for HMGP funding.

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 a change in federal regulations, programs, and policies, such as a change in the allocation of BRIC, FMA, HMGP, or PDM grant dollars. These evaluations will be addressed in the annual Progress Report for the Plan, and may affect the Action Plan.

Progress on the Mitigation Strategies will be evaluated annually by the Steering Committee, and a progress report will be posted on the Louisville Metro Emergency Services website. The progress report is required under the CRS program, and will be submitted to FEMA Region IV, the Kentucky State Hazard Mitigation Officer, and Kentucky Division of Water.

Louisville Metro will be responsible for the next five-year update in 2027, as required by DMA 2000.

8.2 Incorporation into Future Planning Mechanisms

Louisville Metro will begin the planning process for a new comprehensive plan soon after this planning process is complete. Coordination with Develop Louisville has been ongoing and the Hazard Mitigation Plan will be an important component of the new comprehensive plan. Other planning mechanisms have and will continue to use pieces of the Mitigation Plan.

8.3 Continued Public Involvement

The Project Team determined that Louisville Metro will continue public involvement. As public and private stakeholders, the Steering Committee contributes to open public involvement, thereby overseeing the process and ensuring actions are incorporated in their respective agencies/organizations for hazard mitigation. In addition, the public is invited to Steering Committee meetings. To maintain continued public involvement, the Mitigation Plan, as well as annual progress reports, will be maintained on EMA's website and referenced on MSD's website, and comments will be officially registered.

9 Plan Adoption

Adoption by Louisville Metro demonstrates a commitment to fulfilling the hazard mitigation goals and actions outlined in the Plan. Also, updated plans are adopted to demonstrate recognition of the current planning process, and commit to the prioritization of the actions from the mitigation strategy. Louisville Metro understands that the Plan must satisfy the prerequisites before the Plan can be approved by FEMA.

The Plan submittal process begins when Louisville Metro submits the Plan to KYEM for review and comment, then Metro will incorporate any requested revisions. KYEM submits the Plan to FEMA region IV for approval, pending local adoption status. Once the Plan is certified approvable by FEMA, Louisville Metro submits the Plan to Metro Council for formal adoption, and then resubmits to the State and FEMA for final review and approval.

APPENDIX A

PRESENTATIONS

APPENDIX A

PRESENTATIONS

Kick-off

Louisville Metro
Hazard Mitigation Plan Update
Steering Committee Kickoff Meeting

January 2022

This meeting is being recorded

A Message from Director Meiman

MAYFIELD, Ky. — Louisville Emergency Management Director E.J. Meiman and FEMA Administrator Deanne Criswell discuss response operations near the Mayfield Consumer Products factory that was destroyed by a tornado late on December 10, 2021.

Agenda

- Welcome and Introductions
- Hazard Mitigation 101
- Purpose & Goals
- Project Approach
- Public and Stakeholder Outreach
- Timeline
- On-Plan Approval
- Contacts
- Wrap-Up / Questions

This meeting is being recorded

Welcome & Introductions

Louisville Metro Emergency Services Team:

Jim Bottom

Jim McKinney

Amy Rose

AECOM Project Team:

Meghan Brown, CFM, GISP

Ed Koubek, CEM

Lael Holton, AICP, MPA

Kelly Stoll, APR

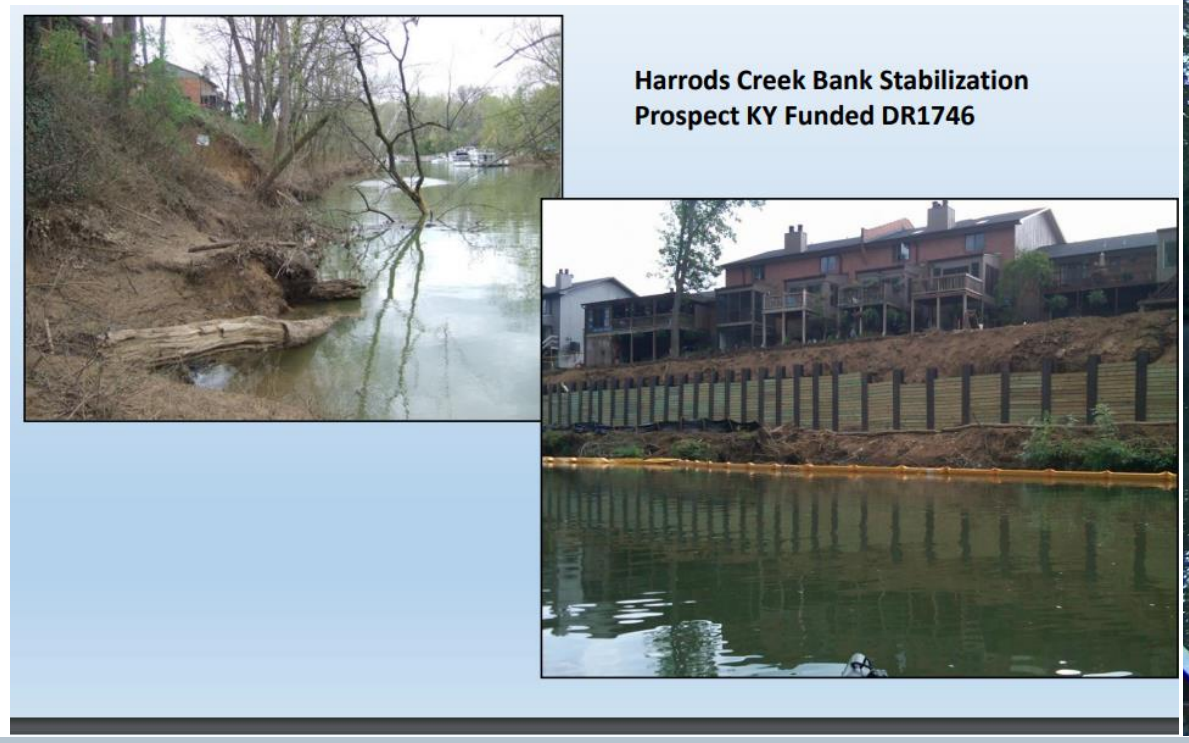
National Weather Service

River Flooding of February 2018

This meeting is being recorded

Hazard Mitigation Success Story

- Jim Bottom, Louisville Metro Emergency Services, Supervisor



Hazard Mitigation 101

- Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters
- It begins by identifying natural disaster risks and vulnerabilities that are common in the area
- After identifying these risks, communities develop long-term strategies for protecting people and property from similar events
- Mitigation plans are key to breaking the cycle of disaster damage and reconstruction

Hazard Mitigation 101

Under the Code of Federal Regulation's Title 44, Emergency Management and Assistance, the key responsibilities of local governments are to:

(1) Prepare and adopt a jurisdiction-wide natural hazard mitigation plan as a condition of receiving project grant funds under the HMGP, in accordance with § 201.6

(2) At a minimum, review and update the local mitigation plan every 5 years in order to continue program eligibility

Hazard Mitigation 101

History

2004: Initial Plan Developed

2011: Initial 5-year Plan Update

2016: Latest 5-yeat Plan Update

2022 Update

- The current plan expires in January 2022
- The delay associated with plan updating was due to circumstances beyond Louisville Metro's control
- When funding was available, support was secured

Hazard Mitigation 101

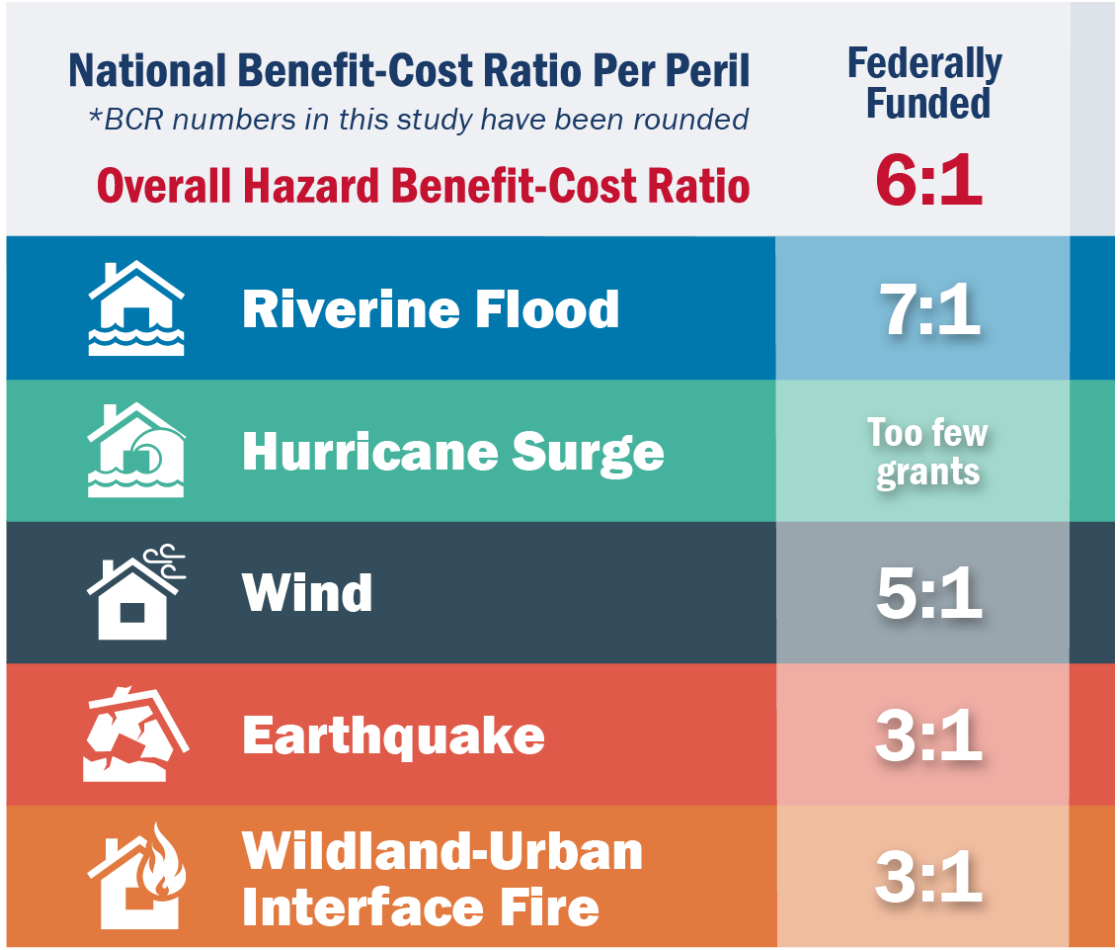
What's at stake…

- Building Resilient Infrastructure and Communities
- Available funding: $1Billion
- State/Territory Allocation: $56.6 million
- All 50 states will receive funding under the State/Territory Allocation
- National Competition for Mitigation Projects: $919.4M

Hazard Mitigation 101

Hazard Mitigation Works!

According to the January 2019 National Institute of Building Sciences, *Natural Hazard Mitigation Saves: 2018 Interim Report,* **federal mitigation grants save $6 for every $1 spent**

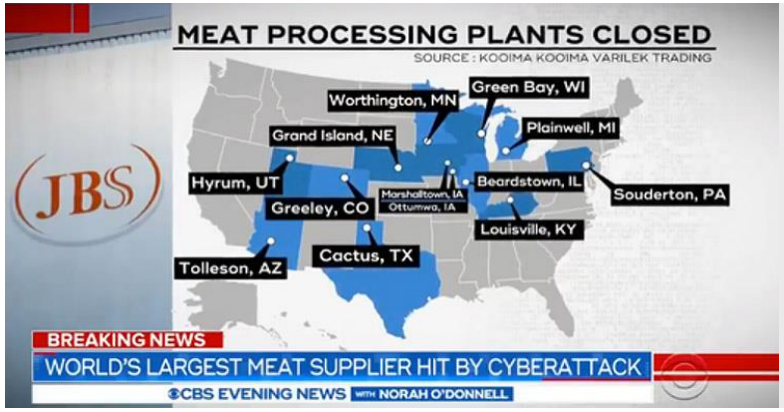


Purpose & Goals

Purpose:
Strategy for building a more resilient community by mitigating damages/losses caused by hazard events.

Key Goals:

- Update 10 documented hazards
- Document / develop strategies for additional risks:
  - Human-caused hazards (terrorism, cyber security threats, etc.),
  - Public health emergencies (pandemics, opioids, etc.),
  - Civil unrest
- Develop mitigation strategies



Project Approach

Using FEMA's Local Hazard Mitigation Handbook as the overarching guide, the Project will consist of four tasks:

Task 1: **Planning Process**
Documentation of 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

Task 2: **Hazard Identification and Risk Assessment**
Provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Provides sufficient information to enable Louisville Metro to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards

Project Approach

Task 3: **Development of Mitigation Strategy**

A mitigation strategy that provides Louisville Metro'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

Task 4: **Development of Draft and Final Plans**

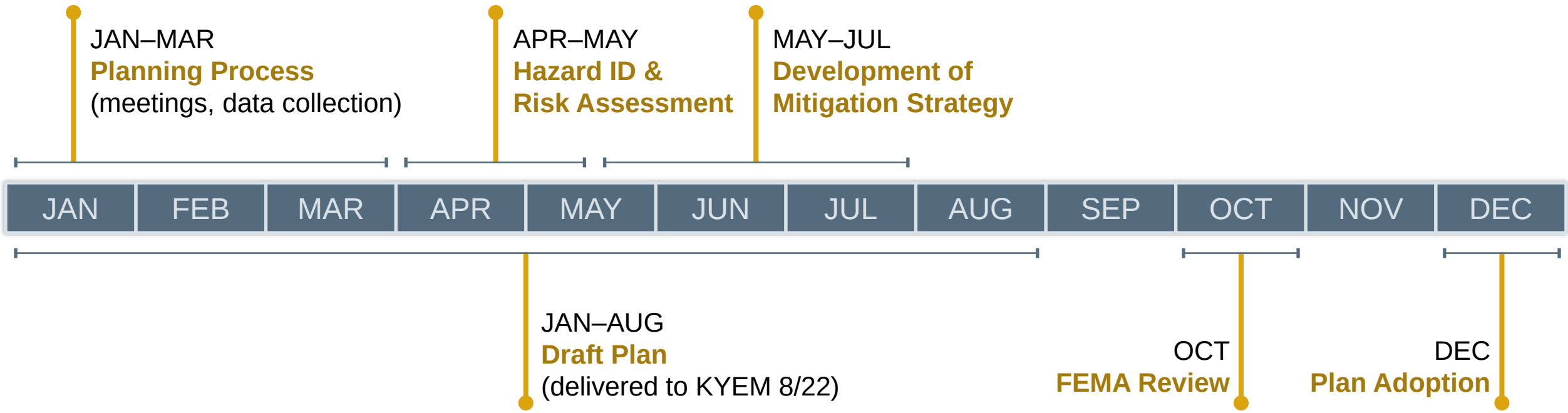
A draft plans will be submitted to the State Hazard Mitigation Officer (SHMO) for initial review. The State will then send the plan to the appropriate FEMA Regional Office for formal review and approval. This process can take up to 90 days

Public and Stakeholder Outreach

Digital Visualization Studio customized for a Louisville Metro audience:

- Information hub
- Capture stakeholder input via surveys
- Links to existing resources

Timeline


JAN–MAR
Planning Process
(meetings, data collection)
APR–MAY
Hazard ID &
Risk Assessment
MAY–JUL
Development of
Mitigation Strategy
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN–AUG
Draft Plan
(delivered to KYEM 8/22)
OCT
FEMA Review
DEC
Plan Adoption

As a Steering Committee member…

As a member of the 2022 Hazard Mitigation Plan Steering Committee member, you will be expected to…

- ✓ Guide Louisville Metro through the process of drafting a multijurisdictional Hazard Mitigation Plan
- ✓ Deliver a plan that can be embraced both politically and by the constituency within the planning area
- ✓ Provide guidance and leadership, oversee the planning process, and act as the point of contact for all partners and the various interest groups in the planning area
- ✓ Participate, as the makeup of this committee was selected to provide the best possible cross section of views to enhance the planning effort and to help build support for hazard mitigation

On Plan Approval…

Once the 2022 Hazard Mitigation Plan Update is approved, Louisville Metro will have a plan that will . . .

- ✓ Improve Louisville Metro and local jurisdictions' preparedness for identifying and mitigating hazards and threats
- ✓ Present mitigation strategies based on updated Hazard Identification and Risk Assessments
- ✓ Ensure integration of updated Louisville Metro plans, policies, programs, and initiatives
- ✓ Demonstrate effective implementation of past mitigation strategies and projects in the Louisville Metro region
- ✓ Present findings based on input from the public, government stakeholders, and other members of the Louisville Metro Emergency Management community

Contact Us

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Questions?

HIRA

Louisville Metro
Hazard Mitigation Plan Update

Hazard Identification and Risk Assessment (HIRA) Meeting

February 28, 2022

This meeting is being recorded

Agenda

- Welcome and Introductions
- Planning Steps
- Hazard Identification and Risk Assessment Planning (HIRA) – Terminology
- Concept
- Hazard Profiling
- Hazard Identification
- Next Steps
- Wrap-Up / Questions
- Contacts

Welcome & Introductions

Louisville Metro Emergency Services Team:

Jim McKinney

Jim Bottom

Amy Rose

Director Edward Meiman

AECOM Project Team:

Ed Koubek, CEM

Lael Holton, CFM

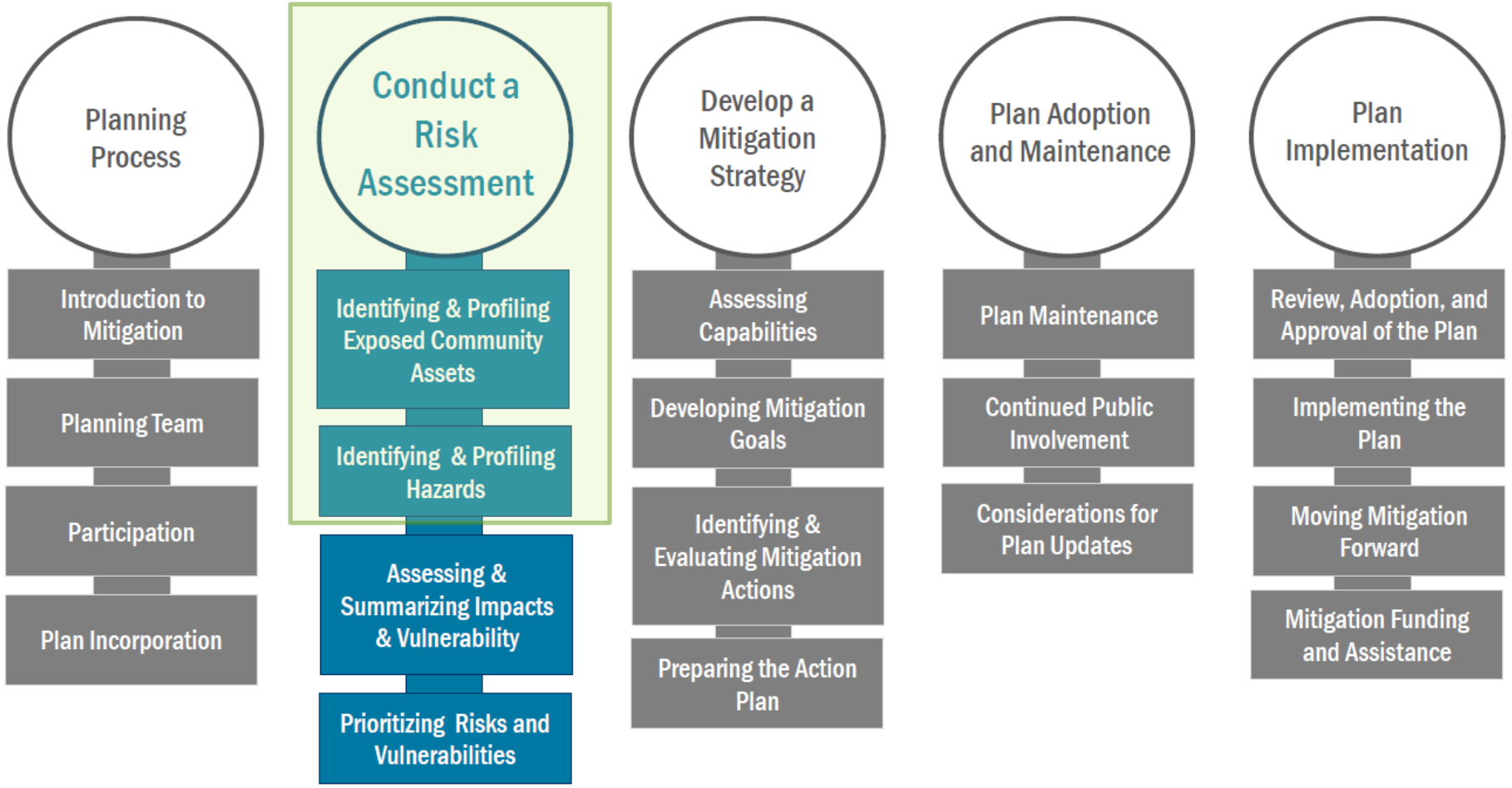
Kelly Stoll, APR

Katelyn Henry GISP, CFM

National Weather Service

River Flooding of February 2018

Hazard Mitigation Planning Steps



Hazard Identification and Risk Assessment Planning (HIRA) – Terminology

Hazards

Source of harm or difficulty created by a meteorological, environmental, geological, or man-made event

Community Assets

People, structures, facilities, and systems that have value to the Louisville Metro community

Vulnerability

Characteristics of community assets that make them susceptible to damage from a given hazard

Hazard Identification and Risk Assessment Planning (HIRA) – Terminology

Impact
Consequences or effects of a hazard on the community and its assets

Risk
Potential for damage, loss, or other impacts created by the interaction of hazards with Louisville Metro assets

Hazard Identification and Risk Assessment Planning (HIRA) – Terminology

Risk Assessment

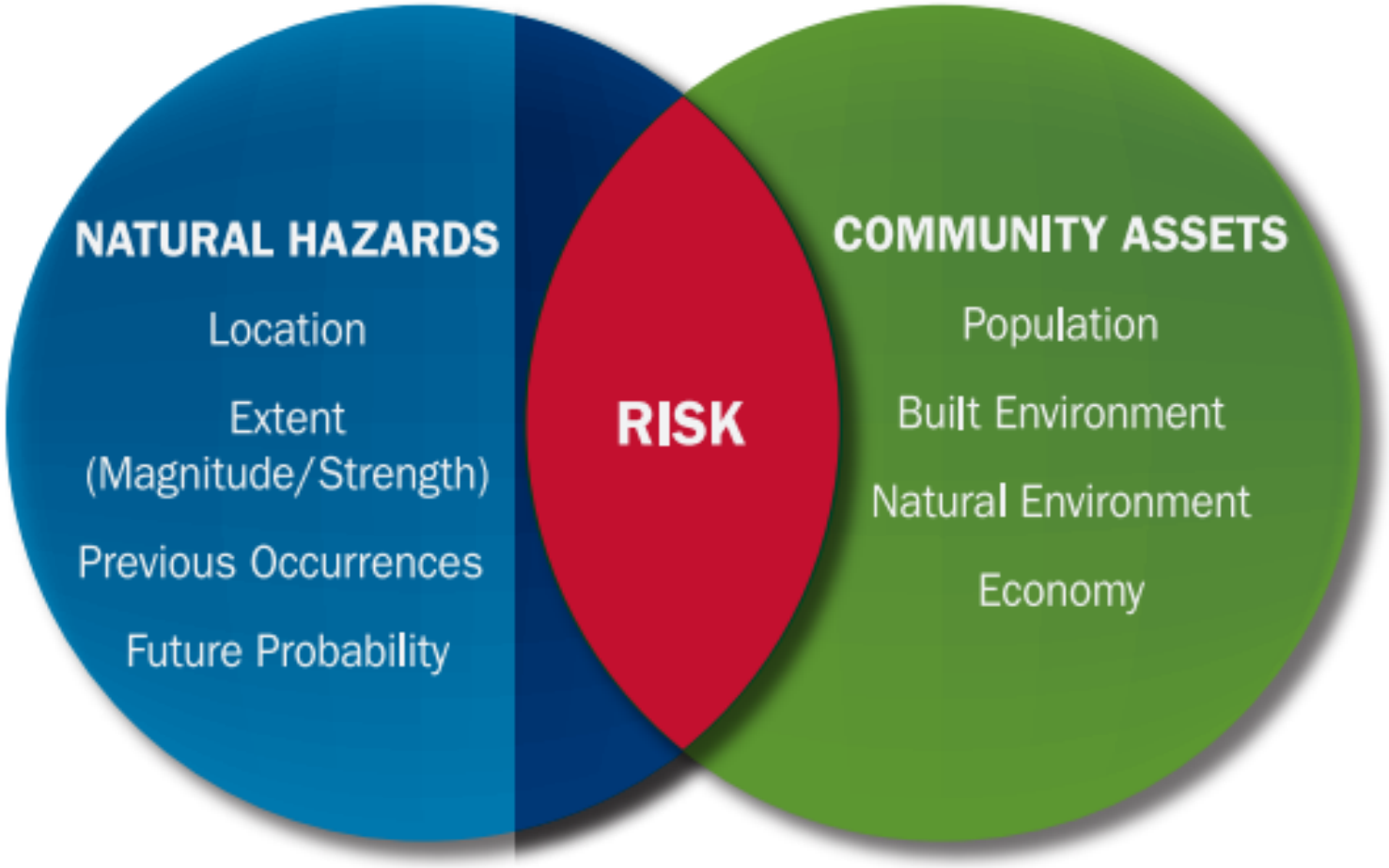
A process that helps Louisville Metro:

- Understand the impacts of hazard events
- Communicate vulnerabilities
- Informs decision making

Our Risk Assessment provides the BASIS for Louisville Metro's mitigation strategy needed to reduce future community loss

Risk Assessment Concept

- This illustration from FEMA shows the concept of risk as the relationship, or overlap, between hazards and community assets.
- The smaller the overlap, the lower the risk.
- This forms the basis of the risk assessment



Louisville Metro Hazard Profiling

Location

Extent

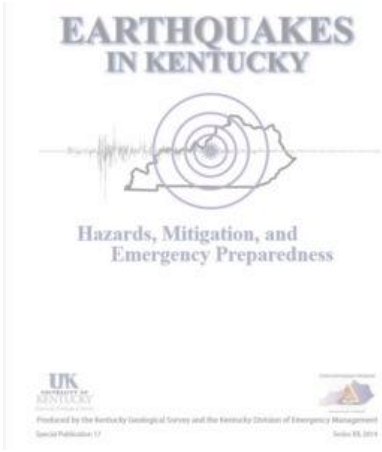
Previous Occurrences

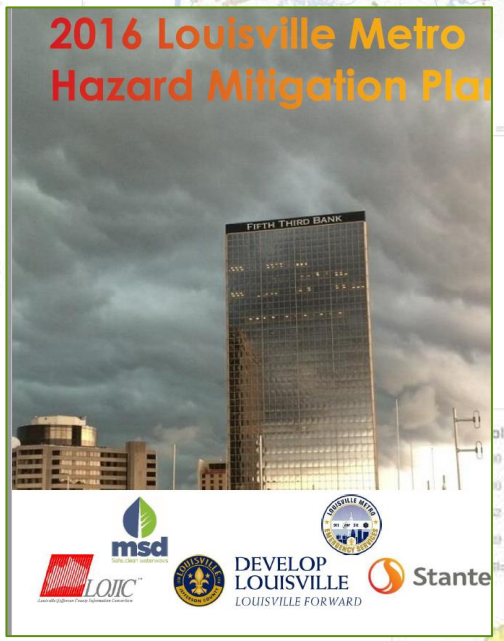
Probability of Future Events

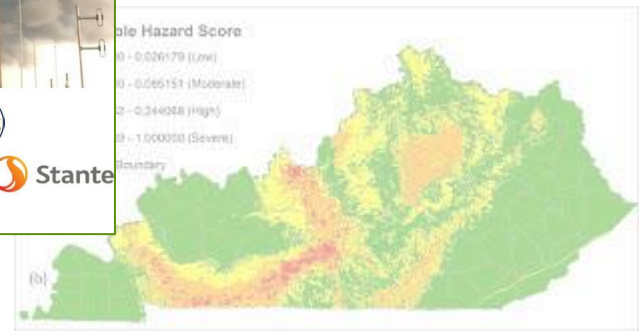
- Has anything changed since the current HMP was adopted?
- What new data are available?

Louisville Metro Hazard Identification

- Identify hazards that may impact a community*
- Provide the best available information to show hazard impacts
- Reflect any changes in hazards since the 2016 Louisville Metro Hazard Mitigation Plan





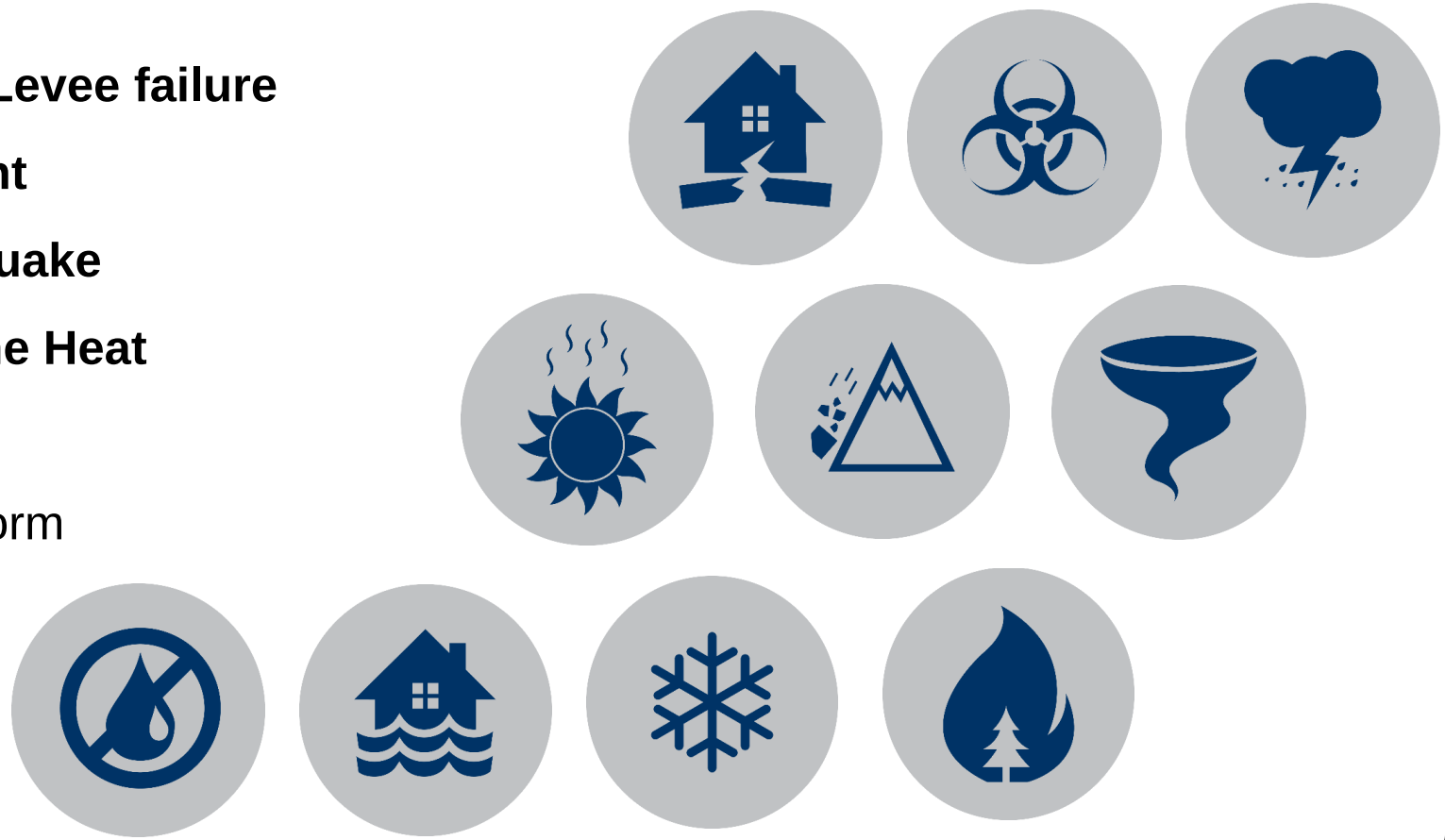


* The word **"all"** will not be used

The inherent nature of hazards is they are ever changing. We will not capture everything

Hazard Identification
2016 HMP

- **Dam / Levee failure**
- **Drought**
- **Earthquake**
- **Extreme Heat**
- **Flood**
- Hail Storm



Hazardous Materials

Karst / Sinkhole

Landslide

Sever Winter Weather

Severe Storm

Tornado

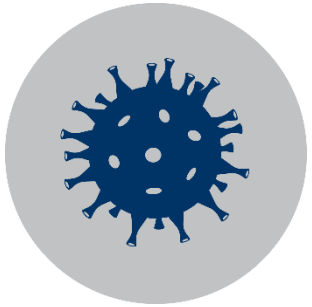
Wildfires

Bold *– also included in 2018 KY HMP*

Hazard Identification
New for 2022

All 13 hazards from 2016 plus…

Cyber



Pandemic

Urban Events/Civil Unrest

Louisville Metro Hazard Identification
Dam / Levee Failure

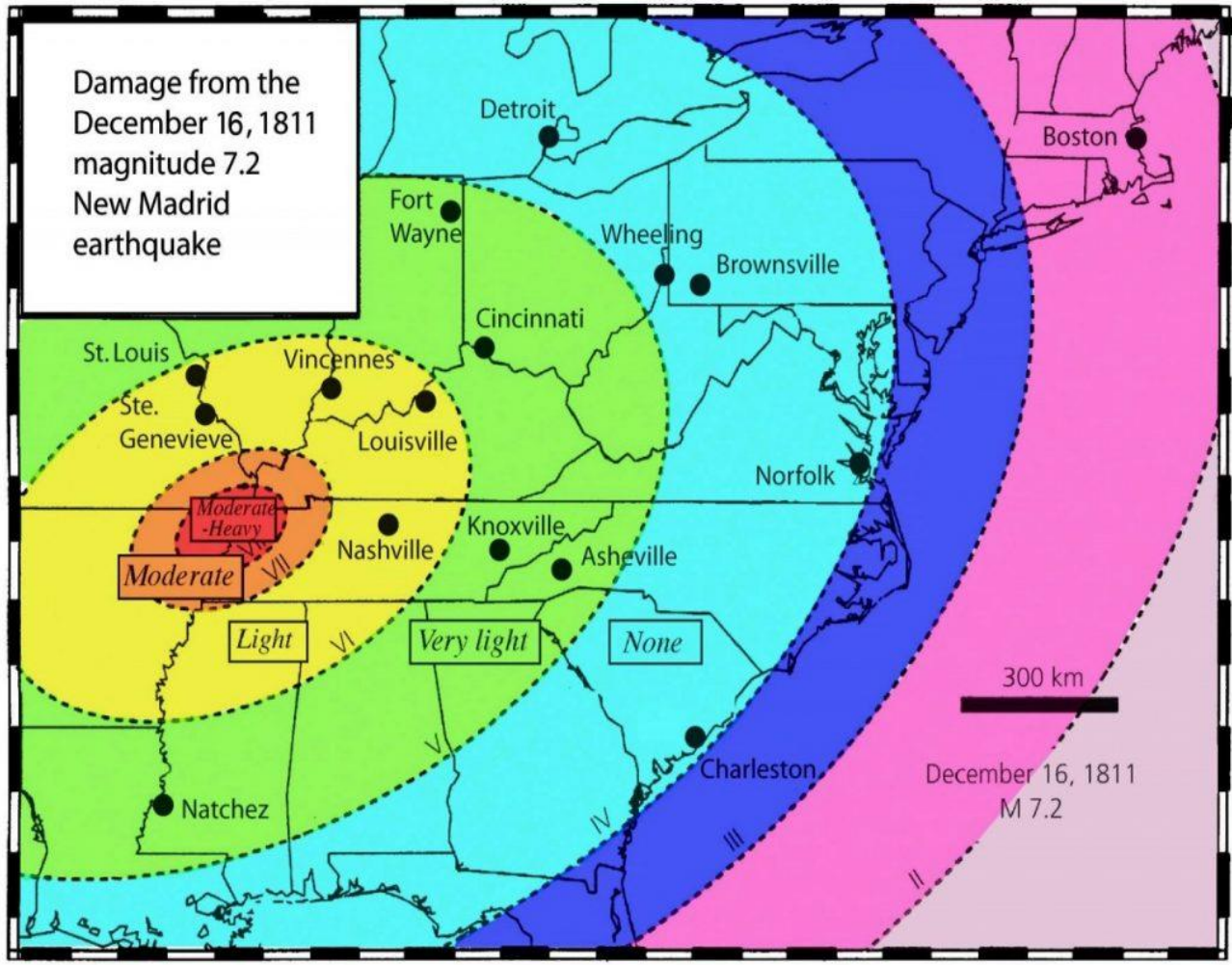
- Kentucky Division of Water (KDOW) indicates Louisville Metro has 40 dams with data from 1973-2015
- Frequency within 42 years: 1
- Total Losses: $0
- Probability: 0.2/year

Louisville Metro Hazard Identification
Drought

- National Centers for Environmental Information (NCEI) Storm Events Database for 71 years
- Frequency last 71 years: 32
- Total Losses: NA
- Probability: 0.45/year

Louisville Metro Hazard Identification Earthquake

- Kentucky Geological Society Division of Water (KDOW) indicates Louisville Metro data for 50+ years
- Frequency within last 50 years: 0
- Total Losses: NA
- Probability: NA

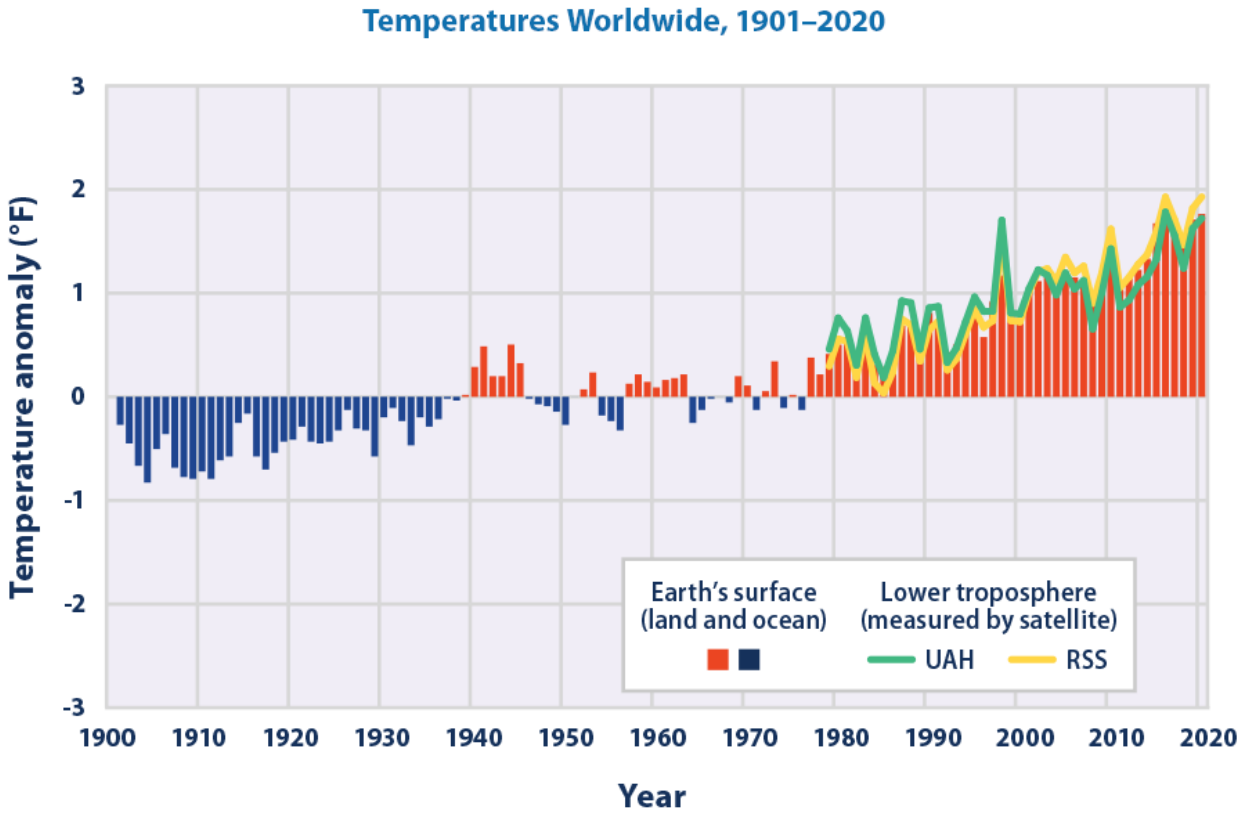


Several publications have declared a significant magnitude earthquake along the New Madrid Fault Line would be the costliest disaster in U.S. history

This meeting is being recorded

Louisville Metro Hazard Identification
Extreme Heat

- National Weather Service data from 2011-2012
- Frequency within 2 years: 3
- Total Losses: NA
- Probability: 1.5/year

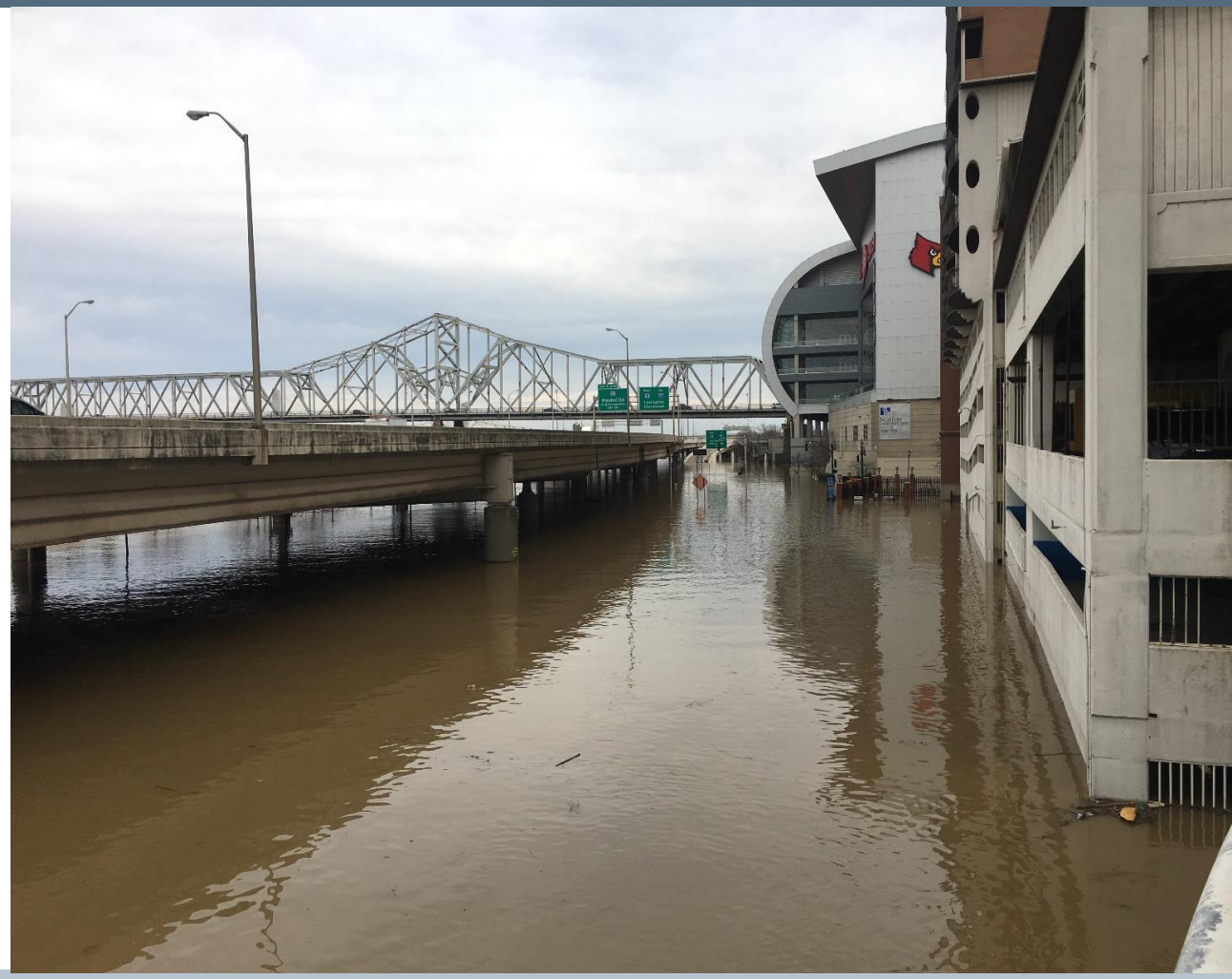


Data source: NOAA (National Oceanic and Atmospheric Administration). 2021. Climate at a glance. Accessed February 2021. www.ncdc.noaa.gov/cag.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

Louisville Metro Hazard Identification Flooding

- FEMA Food Database for events between 1996 and 2015
- Frequency within 20 years: 127
- Total Losses: $251,915,000
- Probability: 6.35/year



Louisville Metro Hazard Identification
Hail Storm

- NCEI Storm Events Database between 1961-2015
- Frequency within 55 years: 152
- Total Losses: $20,017,000
- Probability: 2.8/year

Hail dtorms in 1996 and 2012 each had insured losses at over 200 million

Louisville Metro Hazard Identification
Hazardous Material Release/Spill

- Department of Transportation
  Database of HazMat releases between 2010 and 2015
- Frequency within 6 years: 1,179
- Total Losses: NA
- Probability: 196.5/year

Louisville Metro Hazard Identification
Karst / Sinkhole

Louisville Zoo, Mega Cavern closed after sinkhole discovered Mar 6, 2019

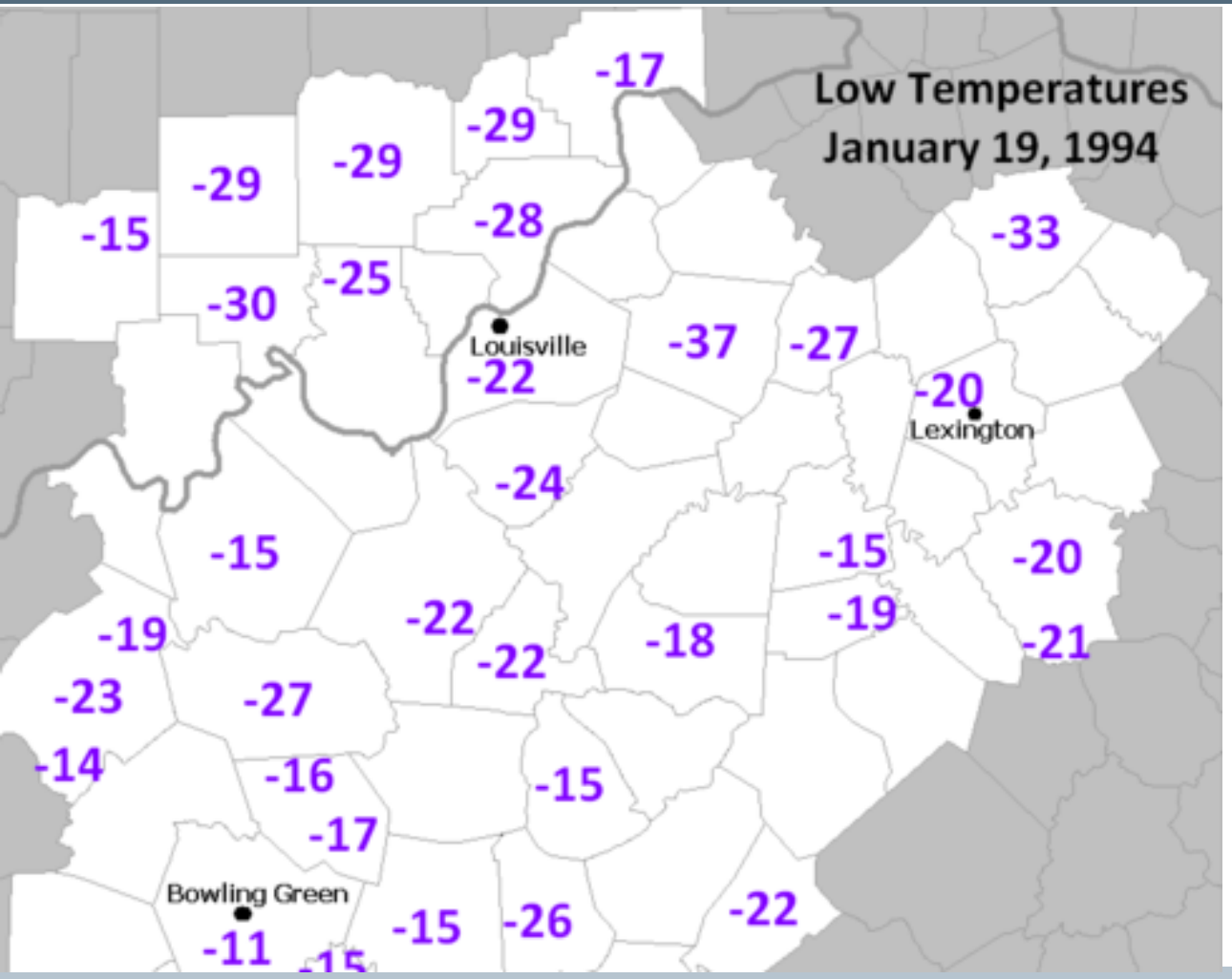
- Kentucky Geological Survey Data of mapped events (no timeline provided)
- Frequency: unknown (443 mapped)
- Total Losses: NA
- Probability: unknown

The estimated damage caused by karst hazards every year in Kentucky is between $0.5 million and $1 million.

Louisville Metro Hazard Identification Landslide

- Kentucky Geological Society Database of landslides between 1993 and 2015
- Frequency within 23 years: 5
- Total Losses: NA
- Probability: 0.22/year

Louisville Metro Hazard Identification
Severe Winter Weather



- National Weather Service Database of Severe winter weather between 1996 and 2015
- Frequency within 20 years: 27
- Total Losses: $105,000
- Probability: 1.35/year

Louisville Metro Hazard Identification
Severe Storm

- National Weather Service data from 1957 through 2015
- Frequency within 59 years: 452
- Total Losses: $3,552,000
- Probability: 7.66/year

Louisville Metro Hazard Identification
Tornado

- NCEI Storm Events Database between 1964-2015
- Frequency within 50 years: 23
- Total Losses: $5,705,000
- Probability: 0.46/year

Louisville Metro Hazard Identification
Wildfire

- Department of the Interior data for events between 2000 and 2016
- Frequency within 17 years: 6
- Total Losses: NA
- Probability: 0.35/year

Louisville Metro Hazard Identification
Public Health Emergencies

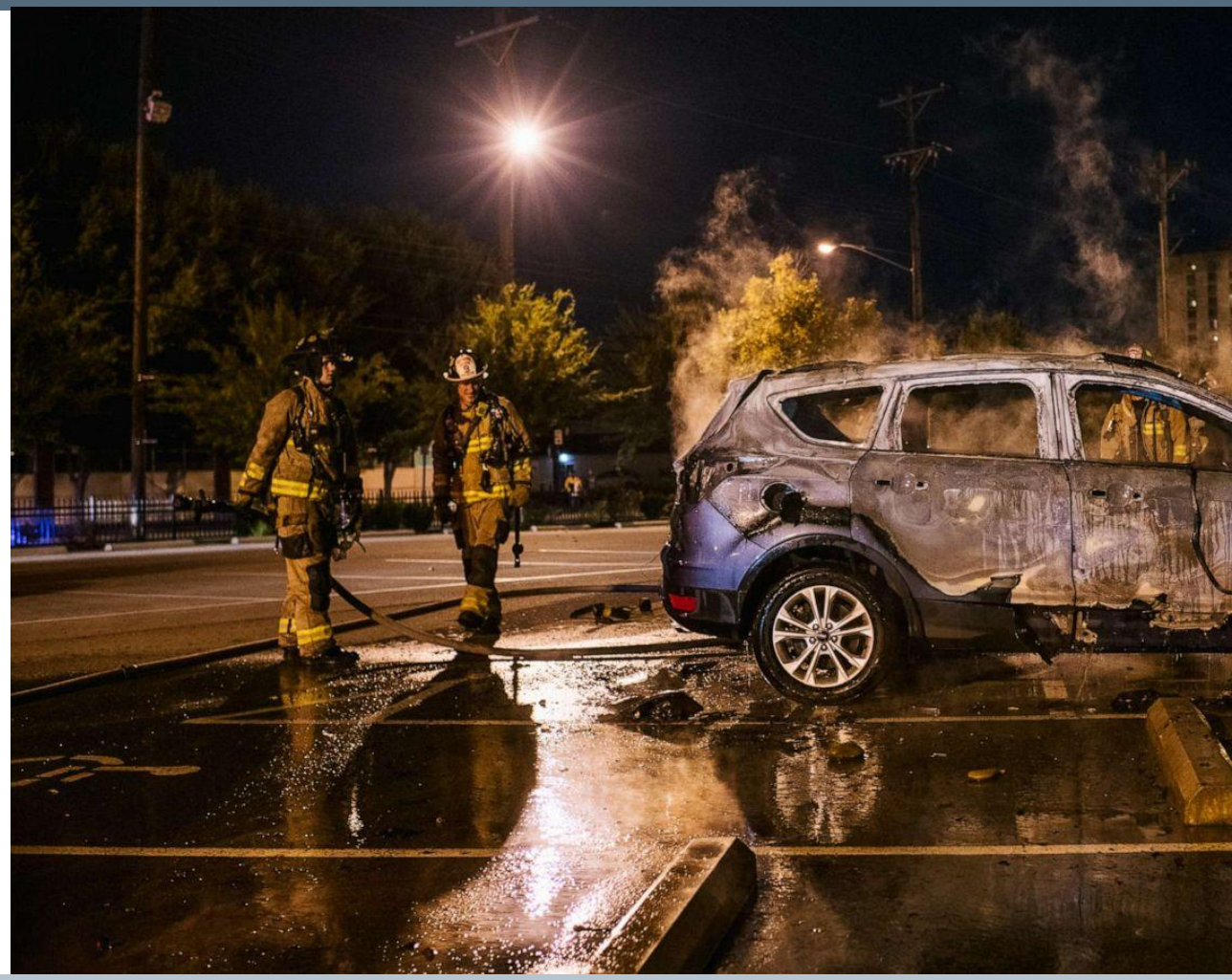
- In March 2020, President Trump declared a nationwide emergency pursuant to Sec. 501(b) of Stafford Act.
- All 50 states, the District of Columbia, and 5 territories have been approved for major disaster declarations
- CDC data covers from 1918-2021
- Frequency: 5 within 102 years
- Total Losses: $2,000,000,000+
- Probability: 0.05/year

Louisville Metro Hazard Identification
Cyber

- By some counts, there are more than 2,200 cyberattacks per day. That equates to about one cyberattack every 39 seconds
- Frequency within last 10 years: unk
- Total Losses: $unk
- Probability: 10,000+/year

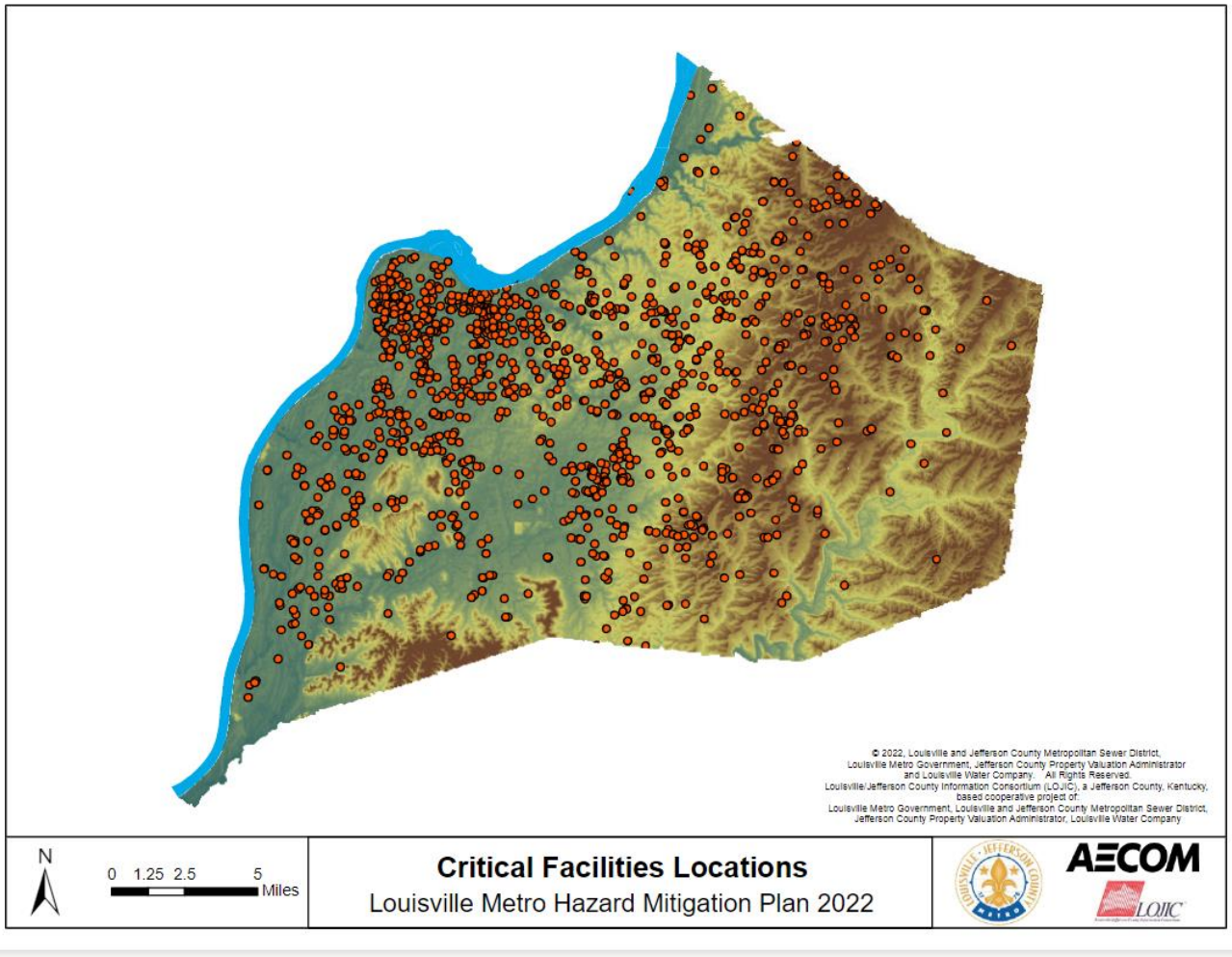
Louisville Metro Hazard Identification
Civil Unrest

- Louisville sustained protests for over 100 days to rally for justice in the shootings by authorities of Breonna Taylor on March 13 and David McAtee on June 1.
- Louisville Mayor Greg Fischer declared a state of emergency in September
- Frequency: 2 within 55 years
- Total Losses: $25,000,000+
- Probability: 0.25/year



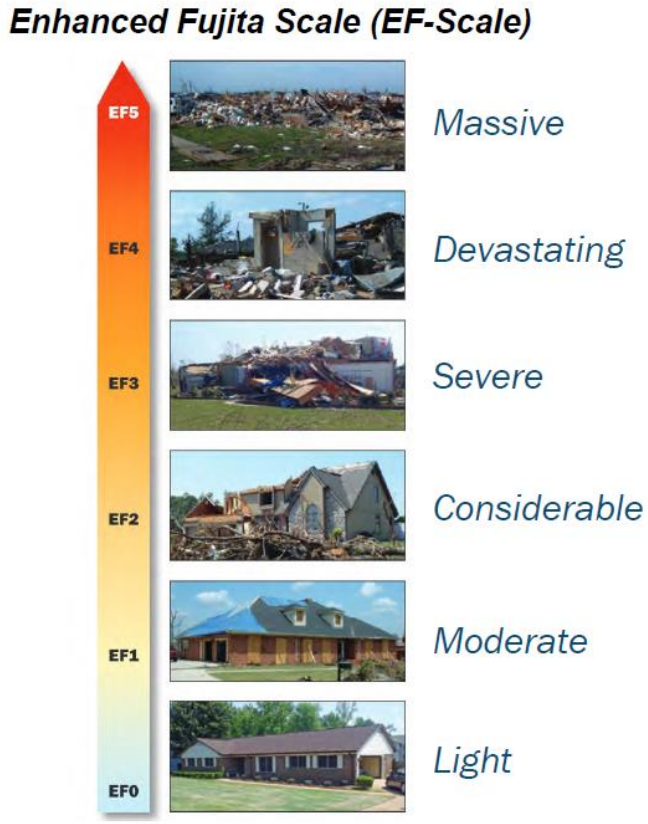
Hazard Profiling Locations

- Identify areas vulnerable to damage by each hazard
- Showing locations using new maps
- For certain hazards – public health emergencies, heat and cold temperatures, the entire region will be vulnerable



Hazard Profiling
Extent

- Careful not confuse extent with geographic boundaries
- Measure of a hazard event's strength
  - Value on an established scientific scale or measurement system
  - Other measures of magnitude, such as water depth or wind speed
- Speed of onset of a hazard event
- Event duration



Hazard Profiling
Previous Occurrences

- Describes how hazards historically affected Louisville/Jefferson County Metro, including:
  - Event date(s)
  - Damage descriptions
  - Event durations
- Include Presidential Emergency and Disaster Declarations
- Local knowledge from news outlets and personnel knowledge
- Includes events since previous HMP

Hazard Profiling
Probability of Future Occurrences

- Considering how often hazards occur
- Looking at probability, we will take the Historical Analysis Approach
  - $\frac{Occurrence}{timeframe} = probability\ of\ future\ events$

$$\frac{\text{15 flooding event occurrences}}{\text{50 years with data recorded}} = \text{30\% chance of a future flood occurrence}$$

Hazard Mitigation Plan
Next Steps

- Core Planning team will begin outreach to stakeholders to ask:
  - Do we have the right hazards identified?
  - Do we have the information we need to make informed decisions on location, extent, and previous and future occurrences?
  - Have there been updates to local ordinances or plans that need to be reviewed?
  - What role, if any, is climate change having on your operations today and in the future?

Contact Us

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AECOM Project Manager

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ED KOUBEK

AECOM Subject Matter Expert

Ed.Koubek@aecom.com

Questions?

Mitigation Strategy Introduction

Louisville Metro
Hazard Mitigation Plan Update
Hazard Mitigation Strategy Meeting

September 13, 2022

This meeting is being recorded

Agenda

- Welcome and Introductions
- Logistics
- Overview of Hazard Mitigation Planning Process
- 2021 Mitigation Strategies
  - Goals
  - Outreach
- Wrap-Up / Questions

This meeting is being recorded

Welcome & Introductions

Louisville Metro Emergency Services Team:

Jim Bottom

Amy Rose

AECOM Project Team:

Josh Hunn

Ed Koubek

Lael Holton

National Weather Service

River Flooding of February 2018

Planning Process

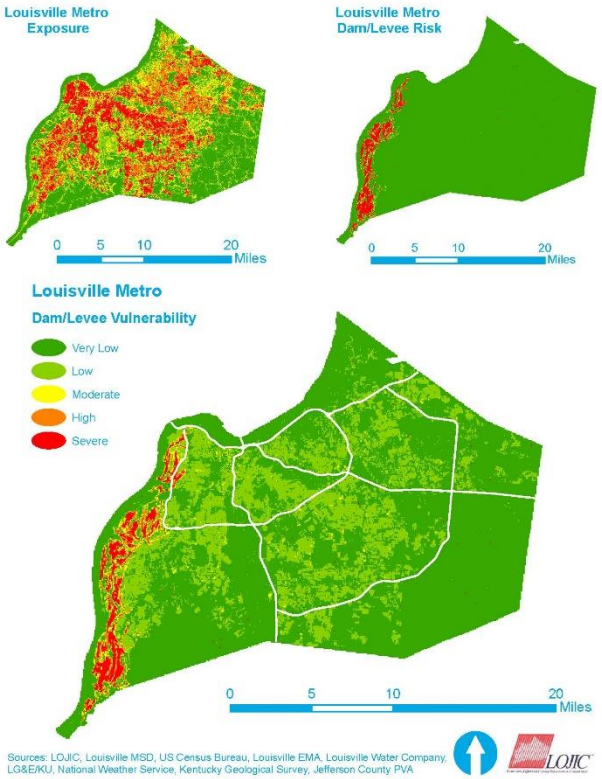
- ✓ Planning focus area
- ✓ Planning team
- ✓ Stakeholders
- ✓ Outreach strategy
- ✓ Opportunities for integration

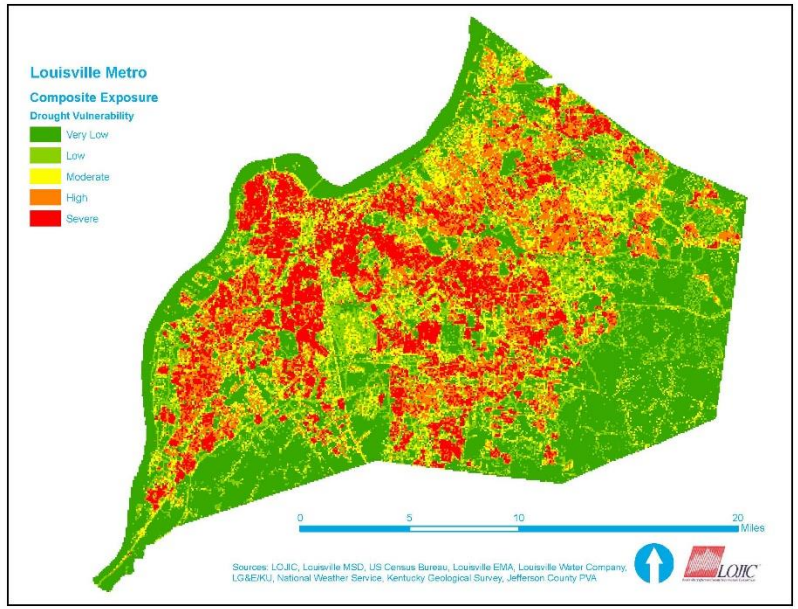
- ✓ Policies, programs
- ✓ Historical occurrences
- ✓ Magnitude
- ✓ Geographical extent
- ✓ Future Conditions

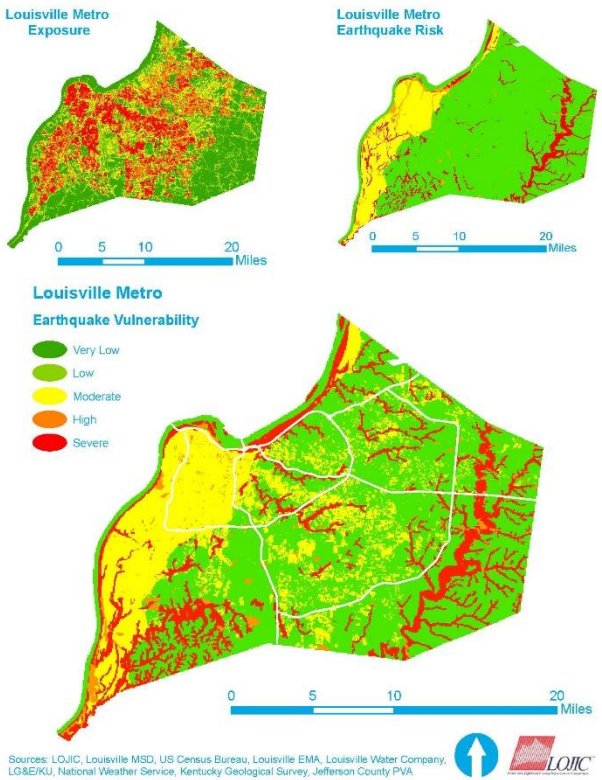
- Set goals
- Identity actions
- Identify lead agencies for implementation
- Prioritize actions

- Identify and obtain funding
- Conduct Annual Reviews
- Continue to build awareness and buy-in

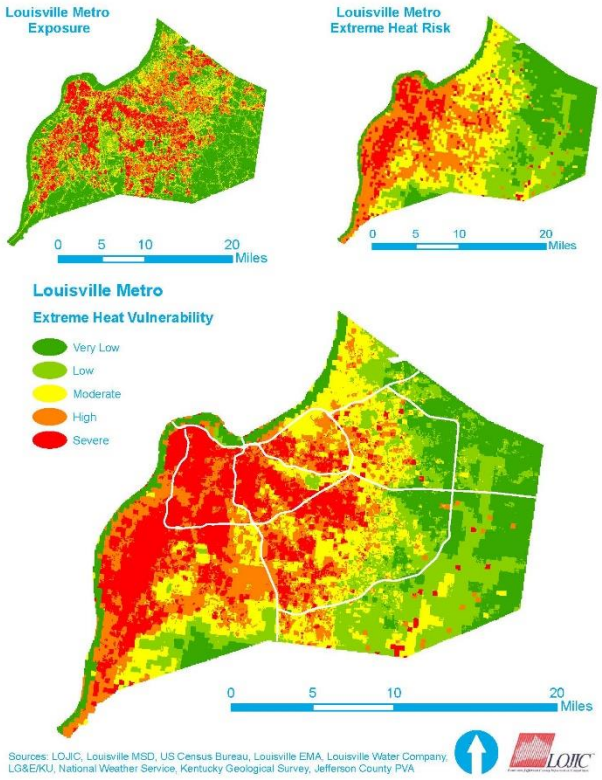
Hazard Identification and Risk Assessment Recap

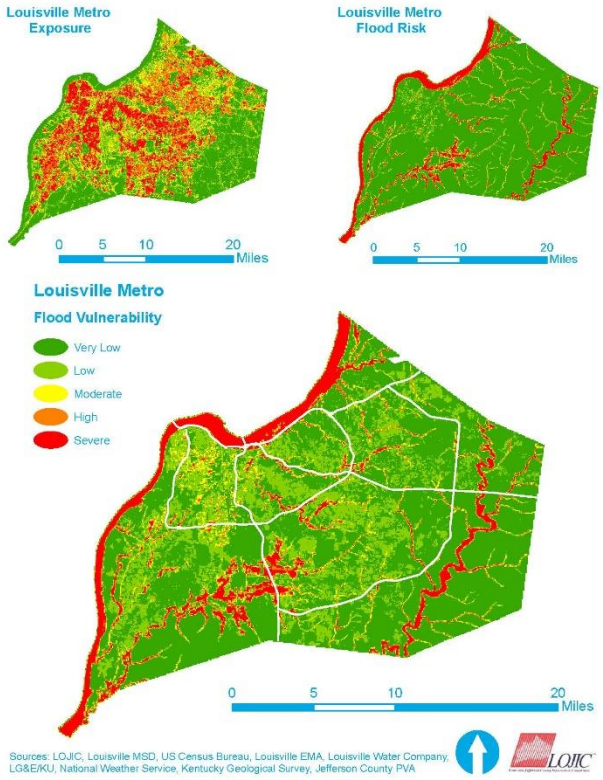


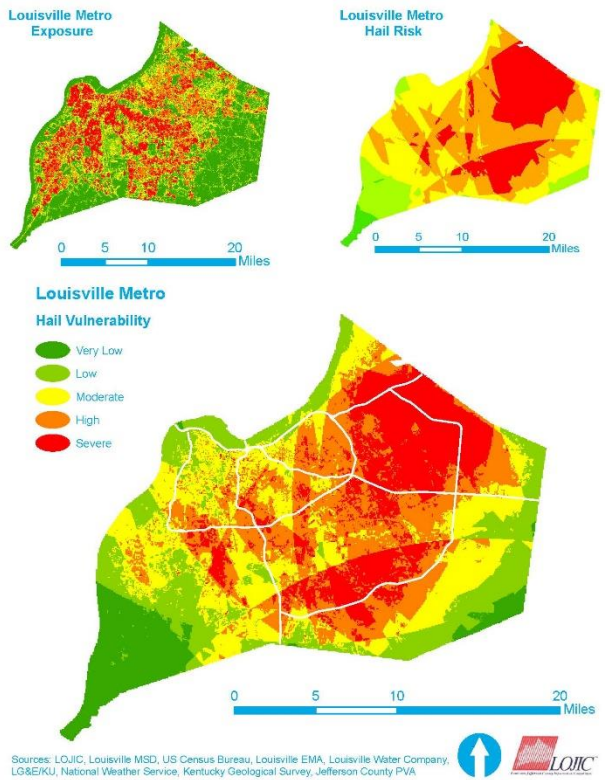




Hazard Identification and Risk Assessment Recap







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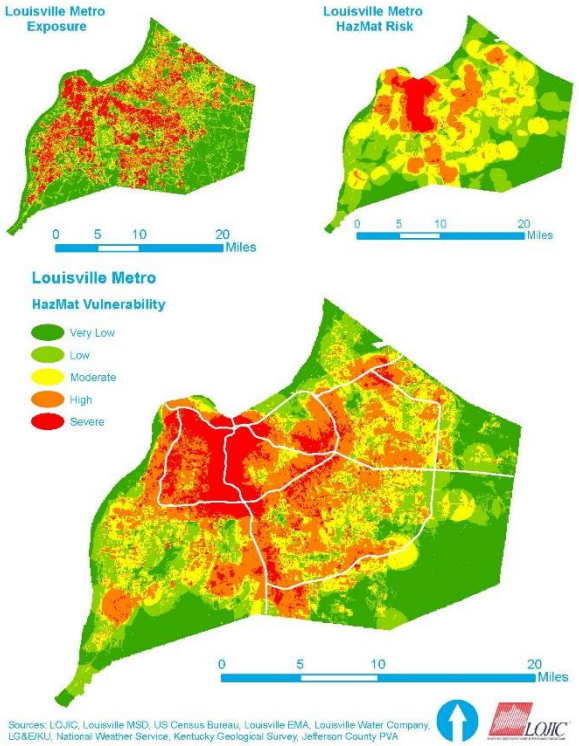
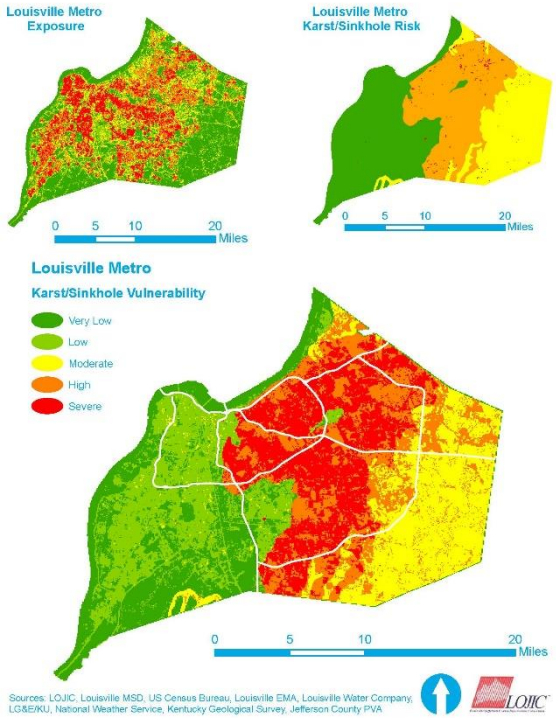
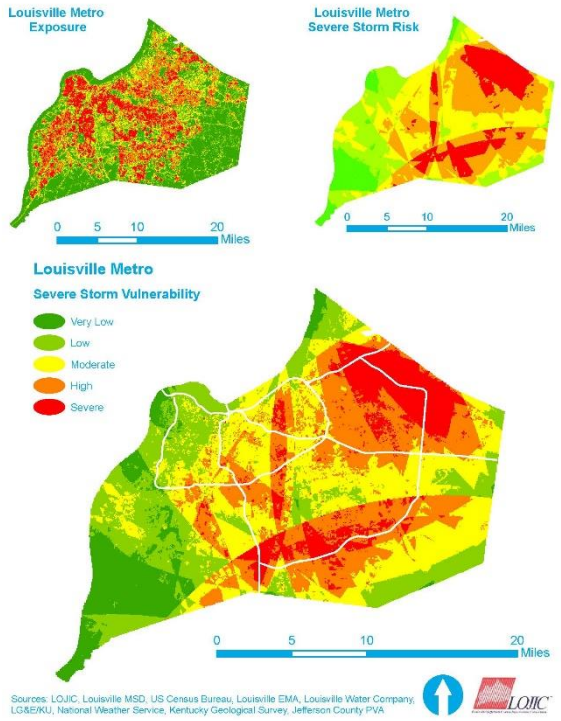
Hazard Identification and Risk Assessment Recap







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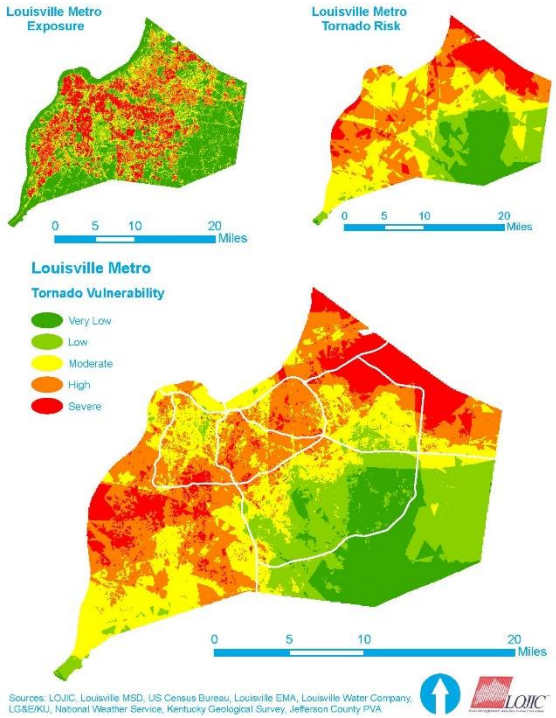
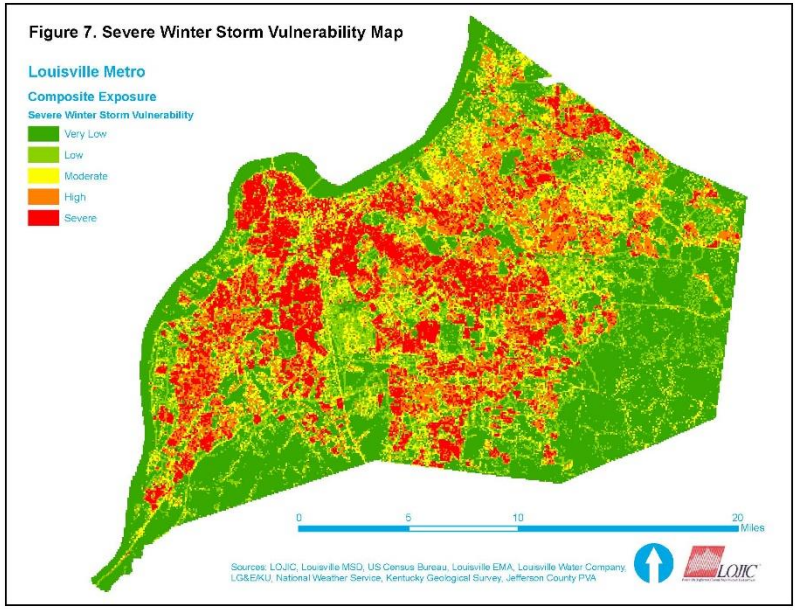
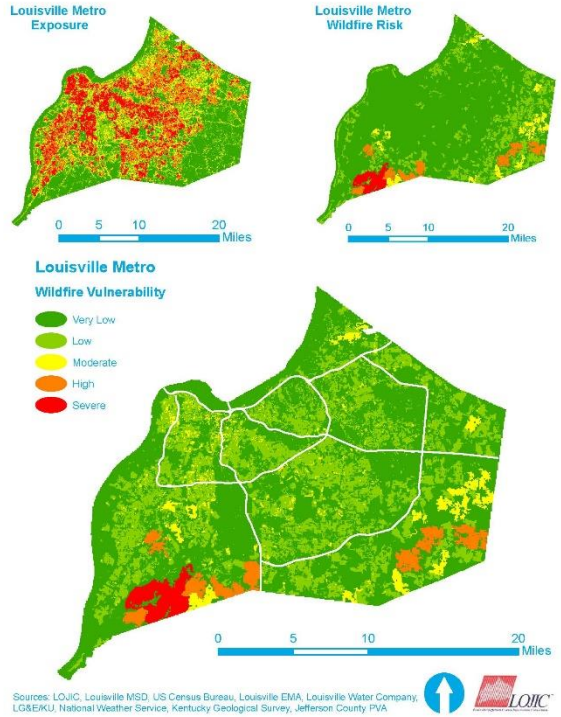






2022 Hazard Mitigation Plan Goals

1. Minimize the loss of life and injuries that could be caused by multi-hazards
2. Facilitate a sustainable economy by protecting agriculture, business, and other economic activities from multi-hazards.
3. Facilitate the strengthening of public emergency services, its infrastructure, facilities, equipment, and personnel to multi-hazards

2022 Hazard Mitigation Plan Goals

4. Develop a community-wide mitigation effort by building stronger partnerships between government, businesses, and the general public.
5. Increase public and private understanding of multi-hazard mitigation through the promotion of mitigation education and awareness of multi-hazards.
6. Enhance existing or design new policies and technical capabilities that will reduce the effects of multi-hazards.

2022 Hazard Mitigation Plan Goals

7. Enhance existing technical and GIS data and capabilities that will reduce the effects of multi-hazards.
8. **Promote the development of policies, programs, initiatives, and projects that prioritize diversity, equity, and environmental justices**

Mitigation Strategy

Goals: What long term outcomes do we want to achieve?

Actions: What specific actions will stakeholders take to reduce risk to hazards?

Action Plan: How will the actions be prioritized and implemented?

2015 Mitigation Strategies
All Hazards – High Priority

1. For publicly owned buildings and essential facilities - Develop risk assessment of publicly owned buildings, essential facilities, and transportation (ES)
2. Develop risk assessment with best available building data
3. Health Impact Assessment “Tool” to Develop Projects (PH)
4. Community health education “clearinghouse” (PH)
5. Increase training for WebEOC (ES)
6. Develop inventory of barricades and signage that can be used during hazard events and develop system for deployment (PW)
7. Emergency preparedness training for public schools (JCPS)
8. Emergency communication for public school buses during disaster (JCPS)
9. Emergency supply kits for public schools (JCPS)

2015 Mitigation Strategies
All Hazards – High Priority

10. CHAMPS implementation and training for Louisville Metro (KYEM)
11. Increase business partnerships and the creation of COOP planning (ES)
12. Public education and standard public statements for all hazards (ES)
13. Re-establish bi-annual hazard mitigation stakeholders and implementers, update funding and progress, coordinate with Silver Jackets (PH)

2015 Mitigation Strategies
Flood & Dam/Levee Failure – High Priority

1. Review and update flood related emergency preparedness and response plans including evacuation of at-risk populations including seniors and disabled
2. Establish and coordinate tree programs and partnerships to increase tree canopy, parkway areas (MSD/Parks)
3. Public outreach: evaluate ways to get message to a targeted audience (MSD)
4. Increase coordination of flood warning using NWS Chat Rooms (NWS)

1. Consider requiring EOP for Class B Dams (KDOW)

2015 Mitigation Strategies Meteorologic – High Priority

1. Promote Safe Rooms/Tornado Shelter for new construction (NWS)
2. Public outreach on retrofitting, mitigation, education and wind-driven building techniques (NWS/ES)
3. Expand snow routes outreach (LOJIC)

2015 Mitigation Strategies Geologic – High Priority

1. Public outreach strategy to specific geologic hazard areas
2. Earthquake Risk Assessment: Research the existing collected data and incorporate inventory into LOJIC
3. Earthquake education and outreach to schools (JCPS)
4. Karst/Sinkhole Risk Assessment data collection to inventory sinkholes (KDOW/KGS)
5. Karst/Sinkhole Risk Assessment: Data collection to inventory sinkholes (KGS)
6. Karst/Sinkhole Risk Assessment: Project to collect standardized info to protect existing, new and future buildings/infrastructure
7. Karst/Sinkhole public outreach/education/warning

2015 Mitigation Strategies
Geologic and Other Hazards – High Priority

1. Landslide Risk Assessment: Project to Collect Info to Protect Existing, New And Future Buildings/Infrastructure from landslides
2. Landslide Mitigation: Project to Enforce Current Regulations And Protect Infrastructure

1. Promote Public Education for HazMat Activities and Sheltering in Place (ES)
2. Develop HazMat Public Education/ Awareness/Training For Business Community (ES)
3. HazMat Outreach to Individuals And Small Businesses Promote Spill Plans (ES)
4. Develop Method for Collecting Drought Data (NWS)
5. Extreme Heat Public Outreach & Education (NWS)

2015 Mitigation Strategies
Other Hazards – High Priority

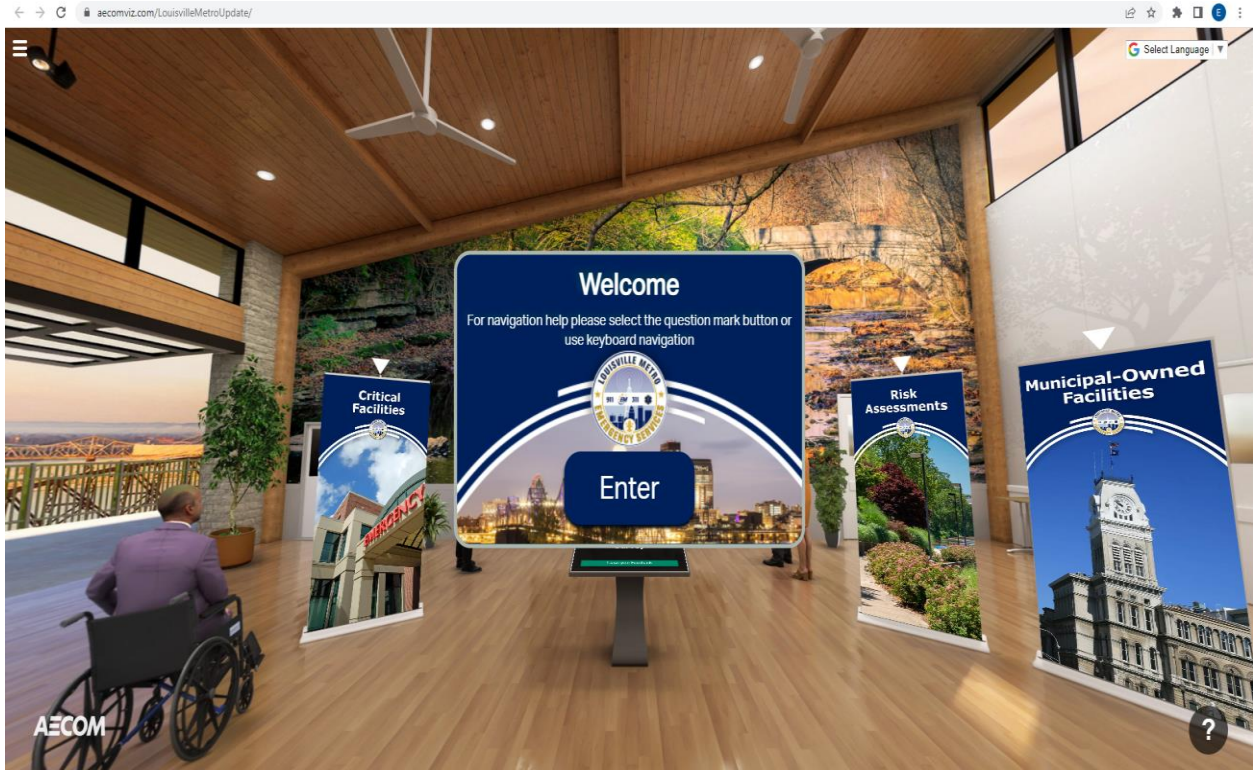
1. Extreme heat public outreach and education promote national NWS campaign (NWS)
2. Extreme heat mitigation (NWS)
3. Wildfire outreach coordinated among emergency response groups about standard for reporting grass, wildfire, etc (Metro Fire)

Next Steps…

1. AECOM will reach out to each Agency POC to discuss mitigation strategies over the next two weeks
2. Be prepared to discuss actions your agency is taking or plans to take in the next five years to reduce the effects of hazards
3. Completed Plan submitted to state for review on September 23

2022 Hazard Mitigation Plan Virtual Room

- Virtual engagement tool that provides an immersive, interactive experience for stakeholders to access Plan materials and provide feedback.
  - Risk and vulnerability Information
  - Public documents used in plan development
  - Meeting presentations
  - A survey instrument, designed to allow users to identify problem areas in their community and report them to Plan custodians



https://aecomviz.com/LouisvilleMetroUpdate/

On Plan Approval…

Once the 2022 Hazard Mitigation Plan Update is approved, Louisville Metro will have a plan that will . . .

- ✓ Improve Louisville Metro and local jurisdictions' preparedness for identifying and mitigating hazards and threats
- ✓ Present mitigation strategies based on updated Hazard Identification and Risk Assessments
- ✓ Ensure integration of updated Louisville Metro plans, policies, programs, and initiatives
- ✓ Demonstrate effective implementation of past mitigation strategies and projects in the Louisville Metro region
- ✓ Present findings based on input from the public, government stakeholders, and other members of the Louisville Metro Emergency Management community

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Questions?

Mitigation Strategy Overview

Louisville Metro
Hazard Mitigation Plan Update
Hazard Mitigation Strategy Meeting II

September 29, 2022

This meeting is being recorded

Agenda

- Welcome and Introductions
- Logistics
- Overview of Hazard Mitigation Planning Process
- 2016 Mitigation Strategies
- 2022 Mitigation Strategies
- Wrap-Up / Questions

Welcome & Introductions

Louisville Metro Emergency Services Team:

Jim Bottom

Amy Rose

AECOM Project Team:

Josh Hunn

Ed Koubek

Lael Holton

Katelyn Henry

Jen Sparenberg

Taylor Esco

National Weather Service

River Flooding of February 2018

This meeting is being recorded

Why we are here…

Yesterday, Florida experienced a direct hit from Ian, a Category 4 hurricane, on its western coast.

Initial reports had Ian making landfall somewhere in Florida's panhandle area. Then, Tampa became the likely landfall location. Then, just hours before the hurricane actually made landfall, predictions again changed. Cayo Costa was ground zero.

Weather and other hazards are always surprising. Predictions are just that…

Planning Process

Organize the Planning Process and Resources

- ✓ Empanel planning team
- ✓ Assign planning focus areas
- ✓ Convene stakeholders
- ✓ Develop outreach strategy
- ✓ Identify opportunities for integration

Assess Risks and Capabilities

- ✓ Review new policies and programs
- ✓ Review Historical occurrences
- ✓ Assess Magnitude and Geographical extent
- ✓ Identify Future Conditions

Develop a Mitigation Strategy

- ✓ Set goals
- ✓ Identitfied actions
- ✓ Identified lead agencies for implementation
- ✓ Prioritized actions

Adopt and Implement the Plan

- Identify and obtain funding
- Conduct Annual Reviews
- Continue to build awareness and buy-in

2022 Hazard Mitigation Plan Goals

1. Minimize the loss of life and injuries
2. Facilitate a sustainable economy
3. Facilitate the strengthening of public emergency services
4. Build strong partnerships
5. Increase understanding of Hazard mitigation
6. Enhance/design new policies and technical capabilities
7. Enhance existing technical capabilities
8. Promote diversity, equity, and environmental justice

Recent Actions

1. Reviewed 2016 Plan Mitigation Actions 96 total
2. Reached out to Louisville Metro Agency POCs to discuss mitigation strategies:
   - What has been done
   - What is planned
   - What is wished
3. Developed Tables summarizing 2016 Planned actions and current status:
   - Completed
   - Removed
   - Ongoing
4. Ongoing strategies are carried over into the 2022 Plan
5. Developed NEW STRATEGIES based on conversations and published documents and other feedback

2016 Mitigation Strategies - Status

96 Total Strategies

ALL HAZARDS (24)

- 8 Completed
- 5 Removed
- 11 Ongoing

FLOOD HAZARDS (19)

- 4 Completed
- 3 Removed
- 12 Ongoing

2016 Mitigation Strategies - Status

DAM AND LEVEE FAILURES (15)

- 4 Completed
- 3 Removed
- 8 Ongoing

METEOROLOGIC HAZARDS (6)

- 1 Completed
- 0 Removed
- 5 Ongoing

2016 Mitigation Strategies - Status

GEOLOGIC HAZARDS (14)

- 0 Completed
- 5 Removed
- 9 Ongoing

OTHER HAZARDS (18)

- 1 Completed
- 4 Removed
- 13 Ongoing

2016 Mitigation Strategies – Summary

18 - Completed

20 - Removed

58 - Ongoing

Completed projects shows progress is being made

Ongoing projects are carried over into the 2022 Plan

2022 Mitigation Plan Strategies – Summary

58 - Ongoing

50 - New Strategies

New strategies received from: Advanced Planning, PVA, Housing Authority, LFD, LMPD, Office of Resilience, Sustainability, MSD, NWS, JCPS, KGS, APCD, Metro ES, Public Health and Wellness, Develop Louisville

2022 Hazard Mitigation Plan Strategies
All Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Update and develop new research publications related to climate change and its impact on both natural and manmade hazards	Advanced Planning
Establish **JCPS MetroSafe access** to JCPS radio system so schools and Public Safety have visibility during emergencies	JCPS
Continue **school exercise program** and expand to include discussions on mitigation strategies	JCPS

2022 Hazard Mitigation Plan Strategies
All Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Conduct test at each JCPS school to determine if **early-warning siren systems** are audible Incorporate EARS (Emergency Alert Radio System) radio functionality into tests	JCPS
Explore partnerships to increase **weather monitoring data.** Use data collected as part of school educational curriculum	JCPS
Institute a formal **emergency generator** management/maintenance program	JCPS

2022 Hazard Mitigation Plan Strategies
Flood Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Review feasibility of regional stormwater/flood control basins for **repair and replacement**	MSD
Continue to explore **new technologies** to replace aging infrastructure to include level sensors and remote gages	MSD
Incorporate **best-practice information technology** related to increased notification capabilities associated with flooding and dams/levee failures	MSD

2022 Hazard Mitigation Plan Strategies
Flood Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Install a **rain garden** to reduce flooding at the MSD Floyds Fork Water Quality Treatment Center	MSD
Secure grant funding to conduct a Big Run **Flood Mitigation Study**. Identify projects that can mitigate flooding around Big Run	MSD
Continue efforts related to Oak Valley Floodplain Study. Identify projects to **alleviate localized flooding**	MSD

2022 Hazard Mitigation Plan Strategies
Flood Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Continue Drive In Branch **Flood Basin Project** to identify potential improvements to mitigating localized flooding	MSD
Replace Paddy's Run **Flood Pumping Station** to increase the pumping capacity and prevent catastrophic risks to **disadvantaged communities** within the inundation area	MSD
River Road Reconstruction and **Elevation Project** will raise the road above the 10 year floodplain to increase access to properties during smaller, more frequent floods	MSD

2022 Hazard Mitigation Plan Strategies
Flood Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Increase Western Flood Pump Station **surge basin capacity** to reduce roadway and structure flooding in this area	MSD
Use **grant funds** to evaluate the Northern Ditch watershed for mitigation opportunities to include adding additional storage volume major flooding events	MSD
Evaluate Roberson Run Flood Control Basin to determine of **retrofit opportunities** exist to reductions downstream flooding	MSD

2022 Hazard Mitigation Plan Strategies
Flood Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Assess and upgrade **notification platform** used to proactively inform people of potential flooding events	NWS
Construct additional rain gages and stream gages un-gaged streams to be used for **flood forecast and warning**	MSD
Target at-risk public and private buildings from flooding by recommending mitigation/retrofit actions	MSD LOJIC

2022 Hazard Mitigation Plan Strategies
Dam and Levee Failures - NEW

Type of Activity or Project	Lead Agency/Agencies
Reduce Whipps Mill flooding potential by placing flood level sensors and remote monitoring equipment on the high hazard dam located at Whipps Mill	MSD
In an effort to reduce risks associated with flooding, **flood level sensors and remote monitoring equipment** will be placed on the high hazard dam located at Roberson Run	MSD

2022 Hazard Mitigation Plan Strategies
Dam and Levee Failures - NEW

Type of Activity or Project	Lead Agency/Agencies
Initiate 24-hour high hazard dam **monitoring and warning system** for those in inundation areas	MSD
Develop EOPs for Class C Dams without plans and update existing EOPs for Class C Dams with plans	MSD
Post Signs/Landmarks on dams indicating classification type to **assist the public** in identifying dam types	MSD

2022 Hazard Mitigation Plan Strategies Meteorologic Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Continue public outreach and education and **socialize new plans** related to Extreme Heat mitigation	Metro ES, NWS
Promote NWS' **Pediatric Vehicular Heatstroke** campaign	Metro EMA, NWS, Media, LMFD
Continue Extreme Heat public outreach and education related to **animals** in partnership with Louisville Zoo	Louisville Zoo, Metro EMA, NWS

2022 Hazard Mitigation Plan Strategies Meteorologic Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Implement an Extreme Heat Mitigation Program focused on **albedo levels** to include possible regulatory policy adoption	Metro ES, NWS
Continue to promote Louisville Metro's **tree planting and green roofing** goals through various media outlets and protect existing canopy through the adoption of a tree protection ordinance	MSD, Metro Parks, Develop Louisville
Use Hazard Mitigation Plan findings to develop Extreme Heat and Extreme Cold Plans that address triggers for **homeless protective actions**	Resilience, Metro EMA, NWS, Public Health and Wellness

2022 Hazard Mitigation Plan Strategies Geologic Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
No new hazards strategies identified	
Likely due to long term projects that continually identify karst and sinkholes in the Louisville Metro area.	
Strategies related to vegetation management and tree cover to prevent landslides covered elsewhere	

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
When updating recently developed **Transportation Plan**, incorporate hazard mitigation planning to include HazMat response capabilities.	Develop Louisville
Incorporate hazard mitigation into **Neighborhood Development Plans**	Develop Louisville
Promote and develop public outreach materials related to natural hazards **targeted towards specific neighborhoods** so they can be delivered in online settings and in-person.	Develop Louisville

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Establish an **Emergency Housing Plan** to address how a major disaster would challenge the Louisville Metro housing market	Develop Louisville
Promote hazard mitigation through **Economic Development** outreach, as effective hazard mitigation can be packaged as selling point for companies looking to relocate	Develop Louisville
Promote **sustainability and mitigation initiatives** at educational institutions such as JCPS, UofL and JCTC	Develop Louisville

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Refine and update Louisville Metro's **homeless sheltering strategy** to address natural disasters	Resilience, Public Health and Wellness
Continue to support the development of the **Disease Outbreak Support Plan** (DOSP) to identify responsible parties, potential outcomes, and other info that can change annually Resilience	Public Health and Wellness
Refine **Mass Vaccination and Medical Countermeasures Plans** to sync with POD Dispensing plan	Public Health and Wellness

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Continue to fund Housing Authority security measures to include **security systems** as needed. Also pursue interconnectivity with MetroSafe to sync HA and MetroSafe camera systems	Housing Authority
Improve Housing Authority **Fire Control Systems** by changing out fire alarm systems at various Housing Authority properties	Housing Authority
Extend external **security agreements** to support daily operations	Housing Authority

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Extend security agreements with Louisville Metro Police Department by renegotiating a new **LMPD Halo Contract**	Housing Authority
Secure IT data center from natural hazards by incorporate findings of Hazard Mitigation Plan into future hardening strategies	Housing Authority
Secure IT data center from **cyber-attacks** via implementing best practices and updated software	Housing Authority

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Transition to **cloud-based servers** to be totally cloud-based by 2024	PVA
Establish **Emergency Reassessment protocols** to quickly reassess properties post disaster. These protocols should include outreach and public information guidance and establish formal field teams with capabilities to quickly reassess damaged properties	PVA
Continue **air quality alert day** program and announcements	APCD

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Continue to support HazMat activities via funding ½ salary for an EMA response person to support APCD program initiatives. Focus will be on Chemical/HazMat **accident avoidance**	APCD, Metro EMA
Continue to manage and fund the **Strategic Toxic Air Reduction Program**	APCD
Secure additional HazMat response equipment to include modern air monitoring equipment, radiation detection equipment, and trucks that would allow for extended breathing air at incident sites	Metro/County Fire

2022 Hazard Mitigation Plan Strategies
Other Hazards - NEW

Type of Activity or Project	Lead Agency/Agencies
Continue to **review and adjust existing zoning regulations** related to HazMat facility **separation requirements**, with specific attention paid to new residential development and places of assembly.	Develop Louisville
Assess current zoning and planning regulations to determine if more stringent development regulations are needed to maintain **Louisville Metro's tree canopy**	Develop Louisville

2022 Mitigation Plan Strategies – Summary2

Louisville Metro's 108 Strategies will drive mitigation efforts for next 5 years

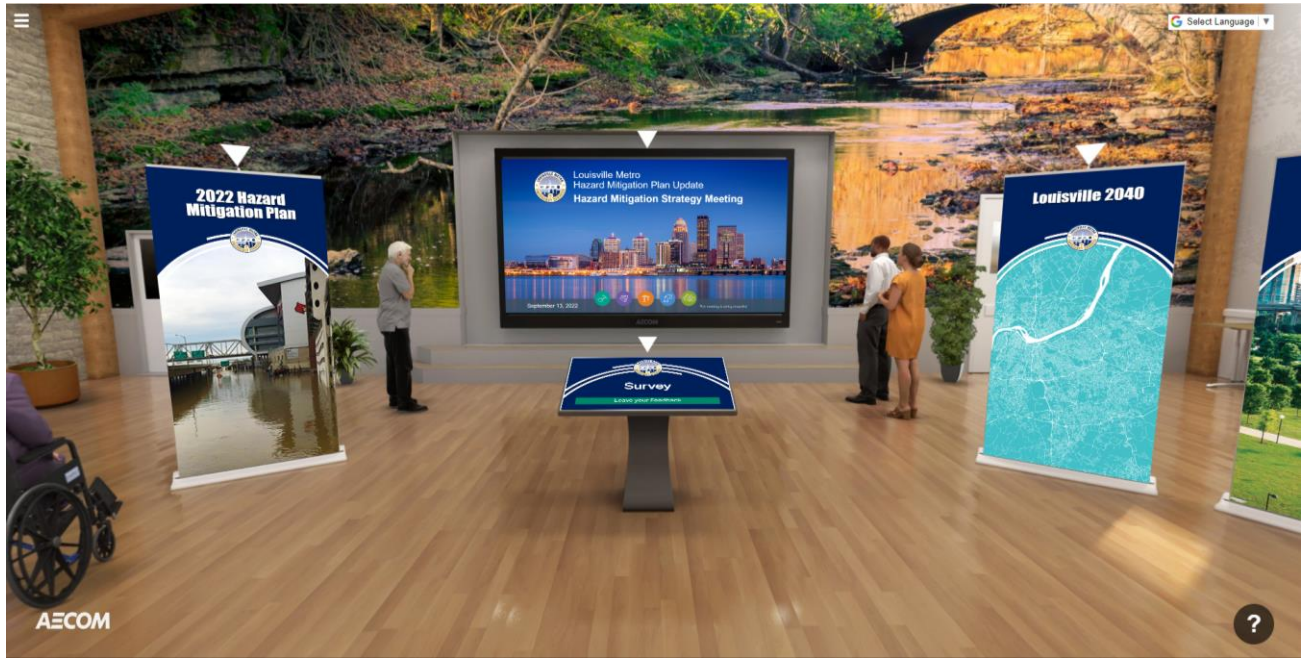
National Institute of BUILDING SCIENCES™
Innovative Solutions for the Built Environment

Mitigation Saves up to $13 per $1 Invested

2021 report

2022 Hazard Mitigation Plan Virtual Room

- Up and Running
- Virtual engagement tool that provides an immersive, interactive experience for stakeholders to access Plan materials and provide feedback.
  - 2022 Hazard Mitigation Plan
  - Public documents used in plan development
  - Meeting presentations
  - Totally customizable and maintained on AECOM server



https://aecomviz.com/LouisvilleMetroUpdate/

Upcoming Actions

1. Reviewed draft plan as found in Virtual Room
2. Plan will be revised often based on additional information and technical edits. It's a living document.
3. Draft Report submitted to Nick Grinstead, on Monday
4. State Reviews/Address Comments
5. FEMA Review/Address Comments
6. Louisville Metro Adoption

On Plan Approval…

Once the 2022 Hazard Mitigation Plan Update is approved, Louisville Metro will have a plan that will . . .

- ✓ Improve Louisville Metro and local jurisdictions' preparedness for identifying and mitigating hazards and threats
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Questions?


A Better Way to do Biz
NOW LEASING
561-3400
Renaissance Business Center
Main

APPENDIX B

MEETING SUMMARIES

Title of Event: Kickoff Meeting
Date of Event: Jan 25, 2022

Name	Department/Agency	Join Time	Leave Time	Attendance Duration	Minutes	Hours
Jim Bottom	Emergency Services	1/25/22 9:48 AM	1/25/22 11:00 AM	73	73	1.22
Meghan Brown	AECOM	1/25/22 9:48 AM	1/25/22 11:01 AM	73	73	0.00
Amy Rose	Emergency Services	1/25/22 9:52 AM	1/25/22 9:54 AM	3	3	0.05
Amy Rose	Emergency Services	1/25/22 9:54 AM	1/25/22 10:59 AM	65	65	1.08
James McKinney	Emergency Services	1/25/22 9:54 AM	1/25/22 10:59 AM	65	65	1.08
Lael Holton	AECOM	1/25/22 9:54 AM	1/25/22 10:59 AM	65	65	0.00
Mindy Christian	University of Louisville EM	1/25/22 9:55 AM	1/25/22 10:41 AM	46	46	0.77
Ed Koubek	AECOM	1/25/22 9:55 AM	1/25/22 10:59 AM	64	64	0.00
Steve Hosch	KY Department for Public Health	1/25/22 9:55 AM	1/25/22 10:59 AM	64	64	1.07
Jody Meiman	Emergency Services	1/25/22 9:55 AM	1/25/22 11:00 AM	65	65	1.08
Rick Tonini	St. Matthews	1/25/22 9:56 AM	1/25/22 10:58 AM	63	63	1.05
Perry Gayle	AECOM	1/25/22 9:56 AM	1/25/22 10:58 AM	63	63	0.00
Chris Seidt	Metro IT	1/25/22 9:56 AM	1/25/22 10:58 AM	63	63	1.05
15023828205		1/25/22 9:56 AM	1/25/22 10:59 AM	63	63	1.05
Amanda Hunter (HERA Coalition/KDPH) (Amanda Hunter (HPP R3))		1/25/22 9:56 AM	1/25/22 10:59 AM	63	63	1.05
jonjones	Louisville Metro Fire	1/25/22 9:56 AM	1/25/22 10:59 AM	63	63	1.05
Curt Bynum	LOJIC	1/25/22 9:57 AM	1/25/22 10:57 AM	61	61	1.02
Jason T. Canuel	Metro Parks	1/25/22 9:57 AM	1/25/22 10:58 AM	62	62	1.03
Chip Jones	Louisville Gas & Electric	1/25/22 9:57 AM	1/25/22 10:14 AM	17	17	0.28
Jason Meiman (PRP HQ)	Suburban Fire	1/25/22 9:57 AM	1/25/22 10:06 AM	9	9	0.15
Paul Kern	Public Health and Wellness	1/25/22 9:57 AM	1/25/22 10:58 AM	61	61	1.02
Derek Guthrie	Gonzalez	1/25/22 9:57 AM	1/25/22 10:59 AM	62	62	1.03
Stanford Mullen	Jefferson County Public Schools	1/25/22 9:58 AM	1/25/22 10:59 AM	61	61	1.02
Michelle King	Air Pollution Control District	1/25/22 9:58 AM	1/25/22 10:58 AM	61	61	1.02
Heidi Gilmore	AECOM	1/25/22 9:58 AM	1/25/22 10:58 AM	61	61	0.00
Brian Eaton	KYTC	1/25/22 9:59 AM	1/25/22 10:58 AM	60	60	1.00
Joshua Hunn	AECOM	1/25/22 9:59 AM	1/25/22 10:59 AM	60	60	0.00
JP Carsone	Louisville MSD - EPOR	1/25/22 9:59 AM	1/25/22 10:59 AM	61	61	1.02
Beth Allen	GIS	1/25/22 9:59 AM	1/25/22 10:59 AM	60	60	1.00
Allison Smith	Advanced Planning	1/25/22 9:59 AM	1/25/22 10:58 AM	60	60	1.00
Matt Swain	Louisville Metro Housing Authority	1/25/22 9:59 AM	1/25/22 11:00 AM	62	62	1.03
Joseph Haberman	Planning & Design	1/25/22 9:59 AM	1/25/22 10:58 AM	59	59	0.98
Greg		1/25/22 9:59 AM	1/25/22 10:59 AM	60	60	1.00
Tracy Lovell	KYTC	1/25/22 10:00 AM	1/25/22 10:58 AM	59	59	0.98
Jennifer Caummisar-Kern	Louisville MSD - MS4/Floodplain	1/25/22 10:00 AM	1/25/22 10:58 AM	59	59	0.98
Jess Hamner	LOJIC	1/25/22 10:00 AM	1/25/22 10:58 AM	59	59	0.98
Andrew McKinney	GIS	1/25/22 10:00 AM	1/25/22 10:58 AM	59	59	0.98
Lori Rafferty	Louisville MSD - MS4/Floodplain	1/25/22 10:00 AM	1/25/22 10:58 AM	59	59	0.98
Dirk Gowin	Public Works	1/25/22 10:00 AM	1/25/22 10:59 AM	59	59	0.98
Erin Wagoner (Erin Wagoner)	Louisville MSD - Community Benefits	1/25/22 10:01 AM	1/25/22 10:59 AM	58	58	0.97
Blake's iPad		1/25/22 10:01 AM	1/25/22 10:02 AM	2	2	0.03
Blake's iPad		1/25/22 10:01 AM	1/25/22 10:58 AM	58	58	0.97
Peter Cinotto	USGS	1/25/22 10:02 AM	1/25/22 10:59 AM	58	58	0.00
Vanessa Burns	Public Works	1/25/22 10:03 AM	1/25/22 11:01 AM	59	59	0.98

Title of Event: Kickoff Meeting
Date of Event: Jan 25, 2022

ktalley	Chief of Community Building	1/25/22 10:03 AM	1/25/22 10:59 AM	56 56	0.93
Gary Lewis	University of Louisville PD	1/25/22 10:03 AM	1/25/22 11:01 AM	58 58	0.97
Chip Jones	Louisville Gas & Electric	1/25/22 10:14 AM	1/25/22 10:17 AM	4 4	0.07
Chip Jones	Louisville Gas & Electric	1/25/22 10:17 AM	1/25/22 10:58 AM	42 42	0.70
Rachael Hamilton	Air Pollution Control District	1/25/22 10:46 AM	1/25/22 11:01 AM	15 15	0.25
Ron Steve	NWS	1/25/22 9:56 AM	1/25/22 10:59 AM	63 63	1.05
Genevieve First	Metro Council	1/25/22 10:01 AM	1/25/22 11:00 AM	60 60	1.00
Brandon Brummett	USACE	1/25/22 10:03 AM	1/25/22 10:48 AM	45 45	0.00
Rachael Hamilton	Air Pollution Control District	1/25/22 10:04 AM	1/25/22 10:48 AM	44 44	0.73
Brad Hart	Louisville Water Company	1/25/22 10:05 AM	1/25/22 10:59 AM	55 55	0.92
Tony's iPad		1/25/22 10:05 AM	1/25/22 10:59 AM	54 54	0.90
Jason Meiman	Suburban Fire	1/25/22 10:06 AM	1/25/22 10:59 AM	53 53	0.88
Nick Grinstead	UK Mitigation Office	1/25/22 10:08 AM	1/25/22 10:59 AM	52 52	0.87
Larry Chaney	KYTC	1/25/22 10:11 AM	1/25/22 10:58 AM	48 48	0.80
Melodie Humphrey	Jefferson County PVA	1/25/22 10:15 AM	1/25/22 10:59 AM	44 44	0.73
Aida Copic	TARC	1/25/22 10:19 AM	1/25/22 10:50 AM	31 31	0.00
					TOTAL

Title of Event: HIRA Meeting
Date of Event: Feb 28, 2022

Name	Department/Agency	Join Time	Leave Time	Attendance Duration	Minutes	Hours
meghan.brown	AECOM	2/28/2022 13:57	2/28/2022 14:00	3	3	0.05
jbottom	Emergency Services	2/28/2022 13:57	2/28/2022 14:01	4	4	0.07
Lael Holton	AECOM	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Sarah Teeters	Office for Aging & Disabled Citizens	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
jonjones	Louisville Metro Fire	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
James McKinney	Emergency Services	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Rick Tonini	St. Matthews	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Ed Koubek	AECOM	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
M Swain	Louisville Metro Housing Authority	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Paul Kern - LMPHW	Public Health and Wellness	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Blake's iPad		2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Amanda Hunter (HERA Coaliti	KY Department for Public Health	2/28/2022 13:58	2/28/2022 14:01	3	3	0.05
Greg		2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
Allison Smith	Advanced Planning	2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
Carrie Butler TARC	TARC	2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
Steve Hosch	KY Department for Public Health	2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
derek guthrie	Gonzalez	2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
Nick Grinstead	UK Mitigation Office	2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
Joshua Hunn	AECOM	2/28/2022 13:59	2/28/2022 14:01	3	3	0.05
jackie.phillips		2/28/2022 13:59	2/28/2022 14:01	2	2	0.03
jhaberman	Planning & Design	2/28/2022 13:59	2/28/2022 14:01	2	2	0.03
Curt Bynum	LOJIC	2/28/2022 14:00	2/28/2022 14:01	2	2	0.03
Kelly Stoll	AECOM	2/28/2022 14:00	2/28/2022 14:01	2	2	0.03
Chris Seidt	Metro IT	2/28/2022 14:00	2/28/2022 14:01	2	2	0.03
Keith Talley	Chief of Community Building	2/28/2022 14:00	2/28/2022 14:01	2	2	0.03
Katelyn Henry	AECOM	2/28/2022 14:00	2/28/2022 14:01	1	1	0.02
Andrew McKinney	GIS	2/28/2022 14:00	2/28/2022 14:01	1	1	0.02
Jess Hamner	LOJIC	2/28/2022 14:01	2/28/2022 14:01	1	1	0.02
Ginny		2/28/2022 14:01	2/28/2022 14:01	1	1	0.02
Amy Rose	Emergency Services	2/28/2022 14:01	2/28/2022 14:01	1	1	0.02
Jody Meiman	Emergency Services	2/28/2022 13:57	2/28/2022 14:01	4	4	0.07
Brandon Brummett	USACE	2/28/2022 13:58	2/28/2022 14:01	4	4	0.07
Greg		2/28/2022 14:01	2/28/2022 14:57	56	56	0.93
jonjones	Louisville Metro Fire	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
15027440585		2/28/2022 14:03	2/28/2022 14:07	4	4	0.07
Chris Seidt - City of Louisville#	METRO IT	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Amanda Hunter (HERA Coaliti	KY Department for Public Health	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Joshua Hunn	AECOM	2/28/2022 14:02	2/28/2022 14:20	19	19	0.32
Lael Holton	AECOM	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Steve Hosch	KY Department for Public Health	2/28/2022 14:02	2/28/2022 14:58	56	56	0.93
Jess Hamner	LOJIC	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Keith Talley	Chief of Community Building	2/28/2022 14:02	2/28/2022 14:58	56	56	0.93
jhaberman	Planning & Design	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
jbottom	Emergency Services	2/28/2022 14:02	2/28/2022 14:58	56	56	0.93

Title of Event: HIRA Meeting
Date of Event: Feb 28, 2022

jackie.phillips		2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Andrew McKinney	GIS	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Meghan Brown	AECOM	2/28/2022 14:02	2/28/2022 14:58	56	56	0.93
Blake's iPad		2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Erin Wagoner	MSD	2/28/2022 14:02	2/28/2022 14:57	56	56	0.93
Steve Hosch	KY Department for Public Health	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
derek guthrie	Gonzalez	2/28/2022 14:02	2/28/2022 14:57	55	55	0.92
Allison Smith# Louisvlle Metro	Advanced Planning	2/28/2022 14:03	2/28/2022 14:57	55	55	0.92
Amy	Emergency Services	2/28/2022 14:03	2/28/2022 14:57	55	55	0.92
Carrie Butler TARC	TARC	2/28/2022 14:03	2/28/2022 14:57	55	55	0.92
Rachael Hamilton - APCD	Air Pollution Control District	2/28/2022 14:03	2/28/2022 14:57	55	55	0.92
Ed Koubek	AECOM	2/28/2022 14:03	2/28/2022 14:58	55	55	0.92
jennifertwagira	South Louisville Community Ministries	2/28/2022 14:03	2/28/2022 14:03	1	1	0.02
Lori Rafferty	MSD	2/28/2022 14:03	2/28/2022 14:57	54	54	0.90
Ginny		2/28/2022 14:03	2/28/2022 14:59	56	56	0.93
Curt Bynum857947	LOJIC	2/28/2022 14:03	2/28/2022 14:57	54	54	0.90
Amy E Rose	Emergency Services	2/28/2022 14:04	2/28/2022 14:07	4	4	0.07
Paul Kern - LMPHW	Public Health and Wellness	2/28/2022 14:04	2/28/2022 14:57	53	53	0.88
Sarah Teeters	Office for Aging & Disabled Citizens	2/28/2022 14:04	2/28/2022 14:57	54	54	0.90
Rick Tonini	St. Matthews	2/28/2022 14:05	2/28/2022 14:58	54	54	0.90
Nick Grinstead	UK Mitigation Office	2/28/2022 14:05	2/28/2022 14:58	53	53	0.88
Katelyn Henry	AECOM	2/28/2022 14:06	2/28/2022 14:58	53	53	0.88
Tony’s iPad		2/28/2022 14:06	2/28/2022 14:07	2	2	0.03
M Swain	Louisville Metro Housing Authority	2/28/2022 14:07	2/28/2022 14:57	51	51	0.85
Kelly Stoll	AECOM	2/28/2022 14:07	2/28/2022 14:57	50	50	0.83
Tony’s iPad		2/28/2022 14:08	2/28/2022 14:11	4	4	0.07
Melodie Humphrey (Melodie I	PVA	2/28/2022 14:09	2/28/2022 14:57	49	49	0.82
Matt Meunier	Jeffersontown	2/28/2022 14:10	2/28/2022 14:58	48	48	0.80
Tony’s iPad		2/28/2022 14:11	2/28/2022 14:57	47	47	0.78
banderson	Codes and Regulations	2/28/2022 14:11	2/28/2022 14:57	46	46	0.77
Jason’s iPhone		2/28/2022 14:19	2/28/2022 14:51	33	33	0.55
Joshua Hunn	AECOM	2/28/2022 14:20	2/28/2022 14:58	38	38	0.63
Jason Brandt	Public Works	2/28/2022 14:20	2/28/2022 14:57	37	37	0.62
Peter Cinotto - US Geological S	USGS	2/28/2022 14:25	2/28/2022 14:57	33	33	0.55
JP Carsone (JP and Danielle Ca	MSD	2/28/2022 14:27	2/28/2022 14:58	31	31	0.52
Jason T. Canuel	Metro Parks	2/28/2022 14:29	2/28/2022 14:57	29	29	0.48
James McKinney	Emergency Services	2/28/2022 14:41	2/28/2022 14:47	6	6	0.10
James McKinney	Emergency Services	2/28/2022 14:45	2/28/2022 14:51	6	6	0.10
James McKinney	Emergency Services	2/28/2022 14:50	2/28/2022 14:58	8	8	0.13
Jason’s iPhone		2/28/2022 14:51	2/28/2022 14:57	6	6	0.10
Brandon Brummett	USGS	2/28/2022 14:03	2/28/2022 14:53	51	51	0.85
Jody Meiman	Emergency Services	2/28/2022 14:04	2/28/2022 14:58	54	54	0.90
James McKinney	Emergency Services	2/28/2022 14:20	2/28/2022 14:42	23	23	0.38
James McKinney	Emergency Services	2/28/2022 14:56	2/28/2022 14:59	3	3	0.05
James McKinney	Emergency Services	2/28/2022 14:06	2/28/2022 14:21	16	16	0.27

Title of Event: Mitigation Strategies Overview
Date of Event: September 13, 2022

Name	Join Time	Leave Time	Attendance Duration	Minutes	Hours
Rick Tonini	9/13/2022, 1:48:11 PM	9/13/2022, 2:59:58 PM	71	71	1.18
Christian, Mindy	9/13/2022, 1:48:42 PM	9/13/2022, 2:52:04 PM	63	63	1.05
Edelen, Janine (CHFS DPH DPHPS)	9/13/2022, 1:48:57 PM	9/13/2022, 3:00:32 PM	71	71	1.18
Koubek, Edward	9/13/2022, 1:50:57 PM	9/13/2022, 3:00:39 PM	0	0	0.00
Hunn, Joshua	9/13/2022, 1:51:10 PM	9/13/2022, 3:00:49 PM	0	0	0.00
Ryan Sharp (Guest)	9/13/2022, 1:56:16 PM	9/13/2022, 3:00:32 PM	64	64	1.07
Harral, Leslie	9/13/2022, 1:57:38 PM	9/13/2022, 2:09:26 PM	12	12	0.20
Harral, Leslie	9/13/2022, 2:12:28 PM	9/13/2022, 3:04:13 PM	52	52	0.87
Teeters, Sarah	9/13/2022, 1:58:11 PM	9/13/2022, 3:00:28 PM	62	62	1.03
15027801333	9/13/2022, 1:58:25 PM	9/13/2022, 3:00:59 PM	62	62	1.03
Allen, Susan E	9/13/2022, 1:58:25 PM	9/13/2022, 2:59:28 PM	61	61	1.02
Jennifer Kern	9/13/2022, 1:58:33 PM	9/13/2022, 3:00:31 PM	61	61	1.02
Holton, Lael	9/13/2022, 1:59:05 PM	9/13/2022, 3:00:38 PM	0	0	0.00
Laura Witt (Guest)	9/13/2022, 1:59:22 PM	9/13/2022, 5:43:43 PM	60	60	1.00
Brandt, Jason	9/13/2022, 1:59:23 PM	9/13/2022, 3:00:22 PM	60	60	1.00
Jones, Jonathan E	9/13/2022, 1:59:51 PM	9/13/2022, 3:00:32 PM	60	60	1.00
Holt, Frederick L (EEC)	9/13/2022, 2:00:05 PM	9/13/2022, 3:00:33 PM	60	60	1.00
Kern, Paul L	9/13/2022, 2:00:12 PM	9/13/2022, 3:00:33 PM	60	60	1.00
Tucker, Megan S.	9/13/2022, 2:00:47 PM	9/13/2022, 3:00:37 PM	60	60	1.00
Laird, Tameka	9/13/2022, 2:00:47 PM	9/13/2022, 3:00:30 PM	60	60	1.00
Matt Meunier	9/13/2022, 2:00:53 PM	9/13/2022, 3:03:34 PM	62	62	1.03
Bottom, Jim	9/13/2022, 2:00:59 PM	9/13/2022, 3:00:41 PM	60	60	1.00
Felicia Harper	9/13/2022, 2:01:00 PM	9/13/2022, 3:00:24 PM	60	60	1.00
Blair, Robert J (EEC)	9/13/2022, 2:01:06 PM	9/13/2022, 3:00:38 PM	60	60	1.00
Mendel, Connie	9/13/2022, 2:01:26 PM	9/13/2022, 2:54:51 PM	54	54	0.90
Rao, Sumedha	9/13/2022, 2:01:27 PM	9/13/2022, 3:00:40 PM	60	60	1.00
Jones, Chapin	9/13/2022, 2:01:28 PM	9/13/2022, 3:00:40 PM	60	60	1.00
Stephanie Laughlin	9/13/2022, 2:01:57 PM	9/13/2022, 3:00:38 PM	59	59	0.98
Curt Bynum	9/13/2022, 2:02:29 PM	9/13/2022, 3:00:28 PM	58	58	0.97
Richardson, Angela	9/13/2022, 2:02:38 PM	9/13/2022, 3:00:41 PM	58	58	0.97
Jess Hamner	9/13/2022, 2:02:40 PM	9/13/2022, 2:59:23 PM	56	56	0.93
McKinney, Andrew D	9/13/2022, 2:02:47 PM	9/13/2022, 2:32:18 PM	30	30	0.50
Rebecca Fleischaker	9/13/2022, 2:03:33 PM	9/13/2022, 2:07:39 PM	60	60	1.00
Lori Rafferty	9/13/2022, 2:03:33 PM	9/13/2022, 3:00:34 PM	58	58	0.97
15023227880	9/13/2022, 2:03:48 PM	9/13/2022, 3:00:39 PM	57	57	0.95
Gowin, Dirk L	9/13/2022, 2:05:29 PM	9/13/2022, 3:00:37 PM	56	56	0.93
Carrie Butler - TARC (Guest)	9/13/2022, 2:06:50 PM	9/13/2022, 3:00:28 PM	54	54	0.90
McCloud, James B (EEC)	9/13/2022, 2:07:10 PM	9/13/2022, 3:00:55 PM	54	54	0.90
Aida Copic (Guest)	9/13/2022, 2:07:16 PM	9/13/2022, 2:07:30 PM	13	13	0.22
Aida Copic (Guest)	9/13/2022, 2:09:08 PM	9/13/2022, 2:47:05 PM	37	37	0.62
Hamilton, Rachael	9/13/2022, 2:08:27 PM	9/13/2022, 3:00:46 PM	52	52	0.87
Melodie Humphrey (Jefferson County PVA O	9/13/2022, 2:08:49 PM	9/13/2022, 3:01:35 PM	52	52	0.87
15025746000	9/13/2022, 2:09:14 PM	9/13/2022, 3:01:31 PM	52	52	0.87
Nelson, Blake B (KYTC-D05)	9/13/2022, 2:10:27 PM	9/13/2022, 2:53:08 PM	43	43	0.72

Title of Event: Mitigation Strategies Overview
Date of Event: September 13, 2022

Canuel, Jason T	9/13/2022, 2:11:37 PM	9/13/2022, 3:00:37 PM	49 49	0.82
King, Michael M	9/13/2022, 2:16:12 PM	9/13/2022, 3:00:33 PM	45 45	0.75
michelle.king@louisvilleky.gov	9/13/2022, 2:18:04 PM	9/13/2022, 3:00:10 PM	42 42	0.70
Josh Dickerson	9/13/2022, 2:32:00 PM	9/13/2022, 2:52:32 PM	21 21	0.35

Title of Event: Mitigation Strategy Reviews
Date of Event: September 29, 2022

Name	Department/Agency	Join Time	Leave Time	Attendance Duration	Minutes	Hours
Jones, Jonathan E		9/29/22, 9:55:49 AM	9/29/22, 11:00:35 AM		65	1.08
Blair, Robert J (EEC)		9/29/22, 9:56:29 AM	9/29/22, 11:00:43 AM		65	1.08
Seidt, Chris		9/29/22, 9:57:01 AM	9/29/22, 10:58:49 AM		61	1.02
Self, Dave B		9/29/22, 9:58:04 AM	9/29/22, 11:00:05 AM		61	1.02
Keith McCarthy		9/29/22, 9:58:21 AM	9/29/22, 11:01:02 AM		61	1.02
Meiman III, Edward J.		9/29/22, 9:58:25 AM	9/29/22, 11:00:38 AM		62	1.03
Jennifer Kern		9/29/22, 9:58:45 AM	9/29/22, 11:01:18 AM		62	1.03
Aaron Dean		9/29/22, 9:58:49 AM	9/29/22, 11:00:35 AM		61	1.02
Laura Witt (Guest)		9/29/22, 9:59:05 AM	9/29/22, 11:00:33 AM		62	1.03
Edward Mosaisi		9/29/22, 9:59:34 AM	9/29/22, 11:00:36 AM		62	1.03
Jones, Chapin		9/29/22, 9:59:40 AM	9/29/22, 11:00:53 AM		62	1.03
Ethan Schrage		9/29/22, 9:59:40 AM	9/29/22, 11:00:44 AM		62	1.03
Sluss, Tamara D.		9/29/22, 9:59:54 AM	9/29/22, 11:00:37 AM		61	1.02
Bottom, Jim		9/29/22, 9:59:57 AM	9/29/22, 11:00:40 AM		61	1.02
Meghan Brown		9/29/22, 9:59:58 AM	9/29/22, 11:01:20 AM		63	1.05
Rao, Sumedha		9/29/22, 10:00:37 AM	9/29/22, 10:41:59 AM		44	0.73
Mike Kochasic (NWS Louisville) (Guest)		9/29/22, 10:00:43 AM	9/29/22, 10:32:24 AM		32	0.53
michelle.king@louisvilleky.gov		9/29/22, 10:00:48 AM	9/29/22, 11:00:49 AM		61	1.02
15024397694		9/29/22, 10:00:50 AM	9/29/22, 11:00:54 AM		60	1.00
15028172459		9/29/22, 10:01:03 AM	9/29/22, 10:03:25 AM		2	0.03
Paul Kern (Guest)		9/29/22, 10:02:56 AM	9/29/22, 11:00:40 AM		58	0.97
Rose, Amy E		9/29/22, 10:03:22 AM	9/29/22, 11:01:05 AM		32	0.53
15025693467		9/29/22, 10:03:47 AM	9/29/22, 11:00:40 AM		57	0.95
Rose, Amy E		9/29/22, 10:05:41 AM	9/29/22, 10:30:33 AM		25	0.42
Hamilton, Rachael		9/29/22, 10:06:38 AM	9/29/22, 11:00:40 AM		55	0.92
Matt swain		9/29/22, 10:12:10 AM	9/29/22, 3:32:33 PM		62	1.03
Rose, Amy E		9/29/22, 10:03:22 AM	9/29/22, 10:04:54 AM		2	0.03
Rose, Amy E		9/29/22, 10:30:43 AM	9/29/22, 11:01:05 AM		30	0.50
Rose, Amy E		9/29/22, 10:05:41 AM	9/29/22, 10:30:33 AM		25	0.42
15025693467		9/29/22, 10:03:47 AM	9/29/22, 11:00:40 AM		56	0.93

Name	Department/Agency	Description
Allison Smith	Advanced Planning and Sustainability	Provided information on hazards and climate change addressed by Advanced planning. Also provided information on mitigation strategies.
Michelle King	Air Pollution Control District	Received various email correspondence related to APCD Roles and Responsibilities. Also information on possibly including Air Quality as a hazard. Reviewed 2016 mitigation strategies and provided additional thoughts on strategies moving forward.
Keith Tally	Chief of Community Building	No response
Jim McKinney Jim Bottom Amy Rose	Emergency services	Provided general oversight and leadership. Reviewed presentations and strategies and provided HMP comments.
	Center for Neighborhoods	No response
Ben Anderson	Codes and Regulations	Provided listing of building codes that pertain to the built environment. These codes would relate to buildings ability to withstand shocks from some of the listed hazards. Also discussed work with MSD and Planning to ensure that the placement of new structures in the environment is compliant with regulations. Agreed with hazards presented and provided no new strategies.
Jeff O'Brien	Develop Louisville	Reviewed mitigation strategies and provided feedback for new initiatives.
Dave Self	Jefferson County Public Schools	Reviewed existing hazards and mitigation strategies and provided feedback for new initiatives.
Curt Bynum	GIS	Reviewed hazards and mitigation strategies and provided feedback for new initiatives.
Matthew W. Meunier	Jeffersontown	Reviewed hazards and mitigation strategies and provided feedback for new initiatives. Briefed elected leadership on planning efforts and funding opportunities.
Matt Crawford	Kentucky Geological Survey	Reviewed hazards and mitigation strategies and provided feedback for new initiatives. Researched landslide information for Jefferson County and provided feedback for identifying key events for planning efforts.

Olivia Ranseen	KIPDA	Provided feedback on hazards in the Louisville Metro area and provided examples of mitigation planning efforts. Worked with AECOM to utilize applicable information sources. Also invited AECOM to participate in Final Mitigation strategies meeting in January 2022.
Stephen Hosch	KY Department for Public Health	Deferred to local resources.
Amanda Hunter		
Geni Jo Brawner	KYEM	No response
Curt Bynum	LOJIC	Reviewed and confirmed that the hazards listed in the HIRA section have potential impact on Louisville Metro. Voiced concerns over how civil unrest would be modeled, analyzed, mitigated and reported in the plan update, but indicated that as evident in recent years, sadly it can and does happen.
Rebecca Fleischaker	Louisville Downtown Partnership	Downtown Partnership indicated that the only hazard they would have any sort of input on, which is not even official, would be of civil unrest. They further indicated that they are not an agency that deals with these kinds of hazards nor would they have any reports or mitigation strategies to address this scenario. No other information provided.
Chip Jones	Louisville Gas & Electric	Provided a detailed description of hazards and mitigation strategies. Focus is currently on ice storms, which is their most devastating hazard. The LG&E system is always vulnerable to weather and geologic hazards due to its above ground infrastructure.
Matt Swain	Louisville Metro Housing Authority	Conducted reviews of past hazards and mitigation strategies and worked with staff to generate new initiatives. Focus is mainly on security.
Eric Culver	Louisville Metro Police	Requested hazards and mitigation strategies. Requested project team review active shooter threats and include as hazard. Project Team decided to treat this type of incident as a criminal offense that is best addressed elsewhere.
Laura Witt	Louisville Zoo	Provided numerous files and reports associated with Emergency Preparedness and Mitigation. The Zoo has the potential to be impacted by numerous hazards. Some of the hazards – particularly severe storms/tornados and earthquakes – also elevate their risk of having a dangerous animal escape if containment infrastructure is impacted.

	Louisville Metro Fire	Provided limited information on fire hazards in Louisville Metro. Referred wildfire hazard info to Suburban fire departments.
Councilman Fox	Louisville Metro Council	Briefed on hazards and mitigation planning efforts. Spoke with head of Public Safety Committee on existing hazards, vulnerabilities and future strategies.
James Meece Chris Seidt	Metro IT	Provided numerous documents related to cyber attacks and system protection. Reviewed hazards and agreed that Cyber-attacks should be included in future efforts.
Meghan Brown Lori Rafferty Eric Wagoner Stephanie Laughlin	MSD	Numerous emails and information exchanges related to flood control, dam and levee protection and mitigation strategies. By far the most active participant in the planning process.
Michael Kochasic	NWS	Provided information on weather related hazards to include maps and initiatives being implemented or
	Planning & Design	Provided an email with applicable building codes and design regulations for Louisville Metro area.
Paul Kern	Public Health and Wellness	Provided detailed information on the roles and responsibilities of Public Health and Wellness and provided a copy of the agency's Emergency Operations Plan. This plan has numerous annex's that relate to public health emergency response and mitigation. Also provided info on Covid response and vaccination efforts.
Vanessa Burns Dirk Gowin	Public Works	Limited information via email. Agreed with hazards and strategies
	PVA	Reviewed mitigation strategies and provided feedback for new initiatives
	Resilience & Community Services	Reviewed mitigation strategies and provided feedback for new initiatives related to homelessness in the area.
Jason Meiman	Suburban Fire	Reviewed mitigation strategies and provided feedback for new wildfire fighting initiatives
	University of Louisville EM	Provided information on hazards and planning efforts for campus plan.
	UK Mitigation Office	Provided information on plan elements of focus. Provided overall plan review and comment
Brandon Brummett	USACE	Refereed to MSD for information on flooding.
	Dep. Dir. Of Communications for Metro	Provided information for public outreach and assisted in set up of virtual room.

Name	Department/Agency	Date	Description
Morgan Kee	Louisville MSD	1/15/2022	Prep Critical Facilities dataset and delivered to project team
Jim McKinney	EMA	1/25/2022	Discussion of Kickoff Meeting and next steps
Jim McKinney			
Jim Bottom	EMA	1/31/2022	Discussion on Report Format
Jim McKinney	EMA	2/16/2022	Discussion on Hazard Identification and Risk Assessment Process
Jim McKinney	EMA	2/21/2022	Initial run through of HIRA presentation
Jim McKinney	EMA	2/28/2022	Final run through of HIRA presentation
Jim McKinney			
Jim Bottom			
Amy Rose	EMA	3/14/2022	Progress update
Curt Bynum			
Jess Hammer	LOJIC	3/21/2022	GIS needs
Meghan Brown			
Stephanie Laughlin	MSD	4/7/2022	Discussion on MSD communication strategy related to FEMA Mitigation grant programs
Jim McKinney			Discussed Meghan's move to MSD and how it relates to the hazard mitigation plan. Also discussed schedule to meet the current metrics in reference to deliverables. Also discussed safe rooms and their integration into hazard mitigation plans. Finally discussed MS-Teams
Jim Bottom	EMA	4/12/2022	site and access.
Jim McKinney			
Meghan Brown	EMA, MSD	4/15/2022	Project Update
Meghan Brown	MSD	4/21/2022	Roles and Responsibilities at MSD
Jim McKinney			
Jim Bottom			
Amy Rose	EMA	4/26/2022	Progress update
Meghan Brown	MSD	6/3/2022	Floodplain information and mapping
Matt Swain	Housing Authority	6/8/2022	Housing Authority risks and capabilities
James Meece	Information Technology	6/8/2022	Discussed IT support for Louisville Metro Agencies and future potential for cyber mitigation grants
Paul Kern	Public Health and Wellness	6/9/2022	Hazard and capability discussion. Covid response discussion
Matt Crawford	KGS	6/9/2022	Geologic hazard discussion. Specific discussion on landslides
Venessa Burns	Department of Public Works and Assets	6/9/2022	Discussed the Department of Public Works role in hazard prevention specifically around civil unrest, and storm clean-up.
Ben Anderson	Codes and Regulations	6/9/2022	Discussed how building codes protect against hazards and provided information on the status of building codes in Louisville Metro area

Chapin Jones	LG&E	6/9/2022	Discussed LG&E hazard concerns and vulnerabilities. Also discussed LG&E mitigation activities to include vegetation management.
James McCloud	Kentucky DEP – Division of Waste Mgmt	6/10/2022	Provided limited info on DEP roles and responsibilities related to hazard mitigation
Peter Cinotto	USGS	6/10/2022	Limited Geologic info
William Grinstead	Uky	6/13/2022	Discussion on Plan elements and set up. Bill provided insight into what FEMA region 4 would be focused on.
Jason Canuel	Louisville Parks and Recreation	6/13/2022	Discussed aspects of mitigation related to Parks and Recreation to include dams and public parks.
Eric Culver	Louisville PD	6/13/2022	Discussed various police initiatives related to hazard mitigation and civil unrest
Mindy Christian	U of Louisville	6/13/2022	Discussed Hazard mitigation planning activities at the university and how it interacts with Louisville Metro planning.
Jim McKinney			
Jim Bottom	EMA	6/14/2022	Project Update
James Meece			Discussed the current cyber threats facing Louisville Metro and the actions being deployed
Chris Seidt	Louisville IT	6/16/2022	to mitigate against future attacks.
Allison Smith	Advance Planning	6/27/2022	Discussed various elements associated with hazards and vulnerabilities to include Climate change and Advance Louisville outputs.
Jim McKinney			
Jim Bottom	EMA	7/8/2022	Project Update
Jim McKinney			
Jim Bottom	EMA	7/12/2022	Project Update
Meghan Brown			Discuss MSD information pertaining to the 2022 Metro HMP Update. Went over info
Lori Laughlin			related to SRL properties, CRS, past flooding history and future mitigation projects since
	MSD	7/26/2022	2016. Also discussed grant funding opportunities
Jim McKinney			
Amy Rose	EMA	8/4/2022	In-Person meeting to discuss progress and mitigation strategies.
Meghan Brown			Meeting to discuss mitigation strategies to include acquisitions and floodplain
Stephanie Laughlin			management projects. Also reviewed RL and SRL efforts and CRS integration. NFIP
Lori Rafferty	MSD	8/4/2022	coordination was also discussed.
Matt Meunier	Jeffersontown	8/11/2022	Meeting to discuss mitigation strategies being discussed by the Jeffersontown council.
William Grinstead	Uky	6/13/2022	Discussion on schedule and key elements. Bill again provided insight into what FEMA region 4 would be focused on.
Jim Bottom			
Amy Rose	EMA	9/15/2022	Progress update and Mitigation Strategies discussion

Curt Bynum Jess Hammer	LOJIC	9/15/2022	Discussion on LOJIC capabilities and how GIS supports mitigation strategies through working with numerous Louisville Metro agencies.
Paul Kern	Public Health and Wellness	9/15/2022	Discussion on strategies associated with public health to include various vaccination efforts.
Ryan Sharp Josh Dickerson Meghan Brown Lori Rafferty	NOAA	9/15/2022	Meeting to discuss various mitigation strategies and programs being implemented by NOAA to support meteorological hazards. This included an in-depth discussion on NOAA pediatric vehicle heatstroke.
Nicole Refolo Stephanie Laughlin	MSD	9/16/2022	Meeting to discuss various MSD mitigation strategies and programs to include outreach, watershed-specific actions, dam safety and integration in planning with USACE.
Tamara Sluss Sumedha Rao	Advanced Planning	9/21/2022	Meeting to discuss mitigation strategies completed, currently active, and planned. Multiple new strategies submitted
Dave Self	JCPS	9/21/2022	Meeting to discuss mitigation strategies completed, currently active, and planned. Multiple new strategies submitted
Matt Swain	Housing Authority	9/26/2022	Meeting to discuss mitigation strategies completed, currently active, and planned. Multiple new strategies submitted
Melodie Humphrey	Jefferson PVA	9/26/2022	Meeting to discuss mitigation strategies completed, currently active, and planned. Multiple new strategies submitted
Jeremy Smith Michelle King	Louisville PD	9/26/2022	Meeting to discuss mitigation strategies completed, currently active, and planned. Multiple new strategies submitted
Rachael Hamilton	APCD	9/26/2022	Meeting to discuss mitigation strategies completed, currently active, and planned. Multiple new strategies submitted
Jason Meiman	Suburban Fire/Pleasure Ridge Park Fire Protection District	9/27/2022	Meeting to update and provide additional information on strategies and past actions.
Jeremy Smith	Louisville PD	9/27/2022	Meeting to update and provide additional information on strategies and past actions.
Steven Ott Mark Fox	Louisville Metro City Council		Councilman Fox was provided a overview of the Hazard Mitigation Plan development effort, including actions associated with planning, ranking hazards, assessing vulnerabilities, reviewing prior strategies and developing new ones.
Joe Haberman	Planning and Design	9/27/2022	Discussed various policies related to building codes and standards.
Jim McKinney	EMA	9/29/1930	Meeting to discuss Mitigation Strategies Prestation and next steps.
Sumedha Rao	Advance Planning	9/30/2022	Meeting to review strategies and provide update on future efforts

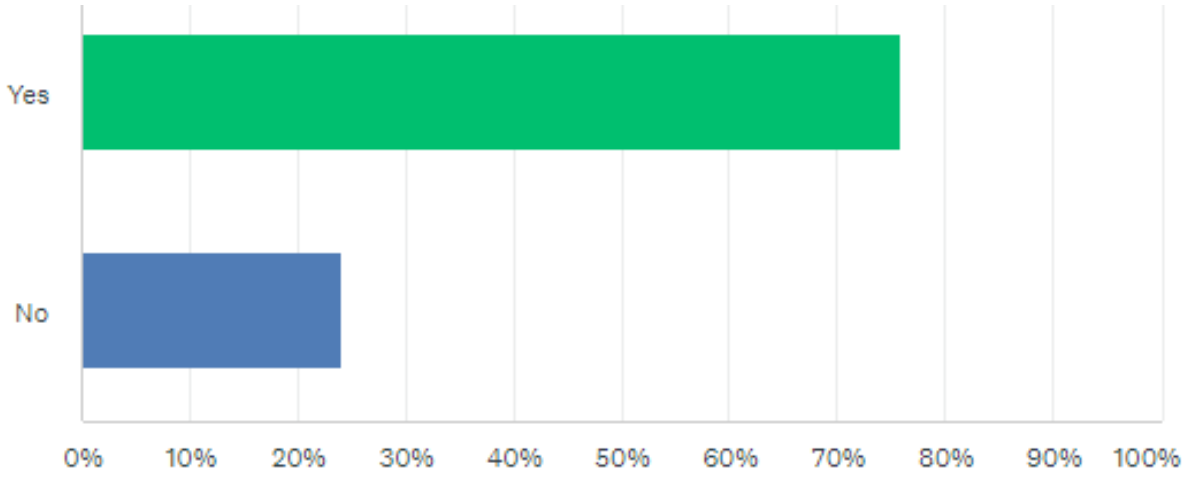
APPENDIX C

PUBLIC SURVEY RESULTS

PUBLIC SURVEY RESULTS

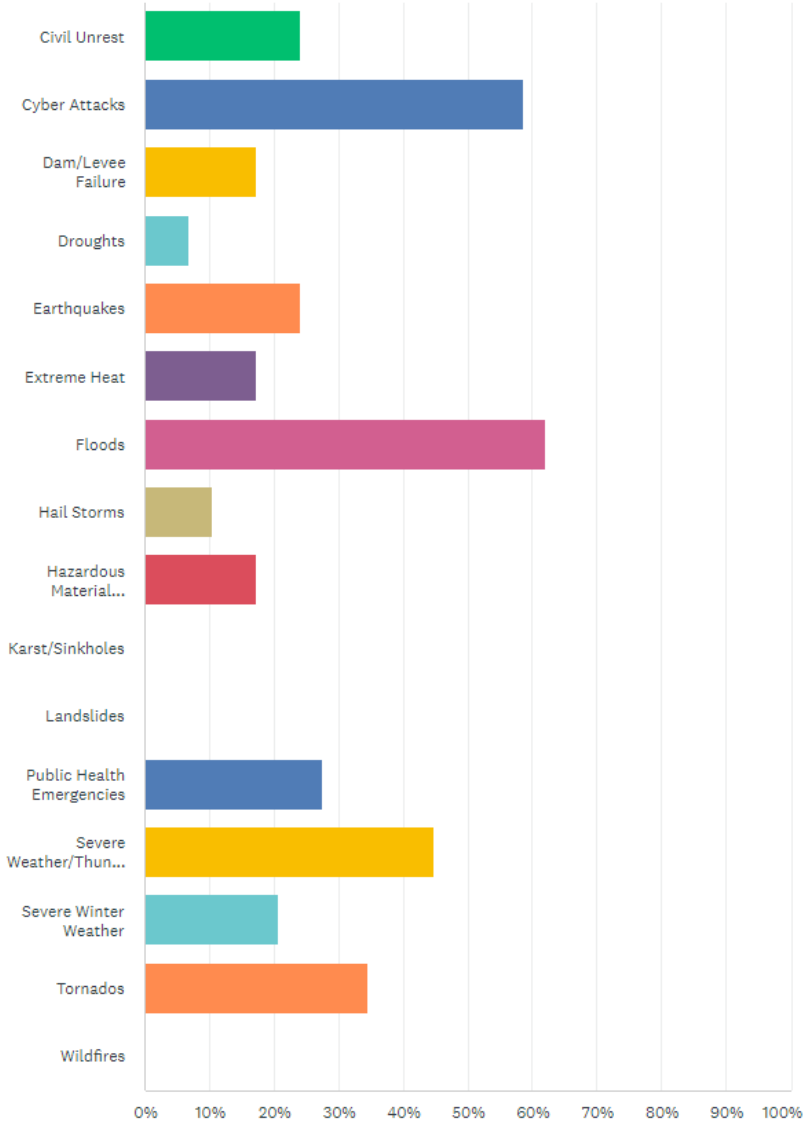
Question 1: Have you ever experienced or been impacted by a natural disaster in your current community?

Answer: Yes: 75.8%
No: 24.2%



Question 2: In your opinion, what are the top three hazards facing our community?

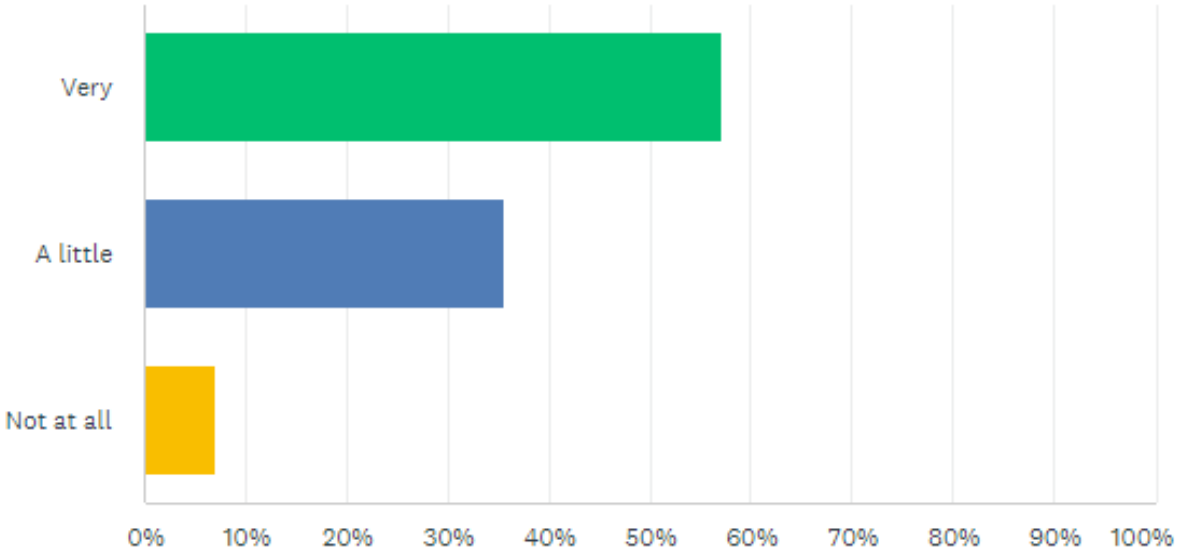
Answers:		
	Civil Unrest	24.1%
	Cyber Attacks	58.6%
	Dam/Levee Failure	17.2%
	Droughts	6.9%
	Earthquakes	24.1%
	Extreme Heat	17.2%
	Floods	62.1%
	Hail Storms	10.3%
	Hazardous Materials	17.2%
	Karst/Sinkholes	0.0%
	Landslides	0.0%
	Public Health Emergencies	27.6%
	Severe Weather/Thunderstorms	44.8%
	Severe Winter Weather	20.7%
	Tornados	34.5%
	Wildfires	0.0%



Question 3: How Concerned are you about the possibility of your community being affected by a natural disaster?

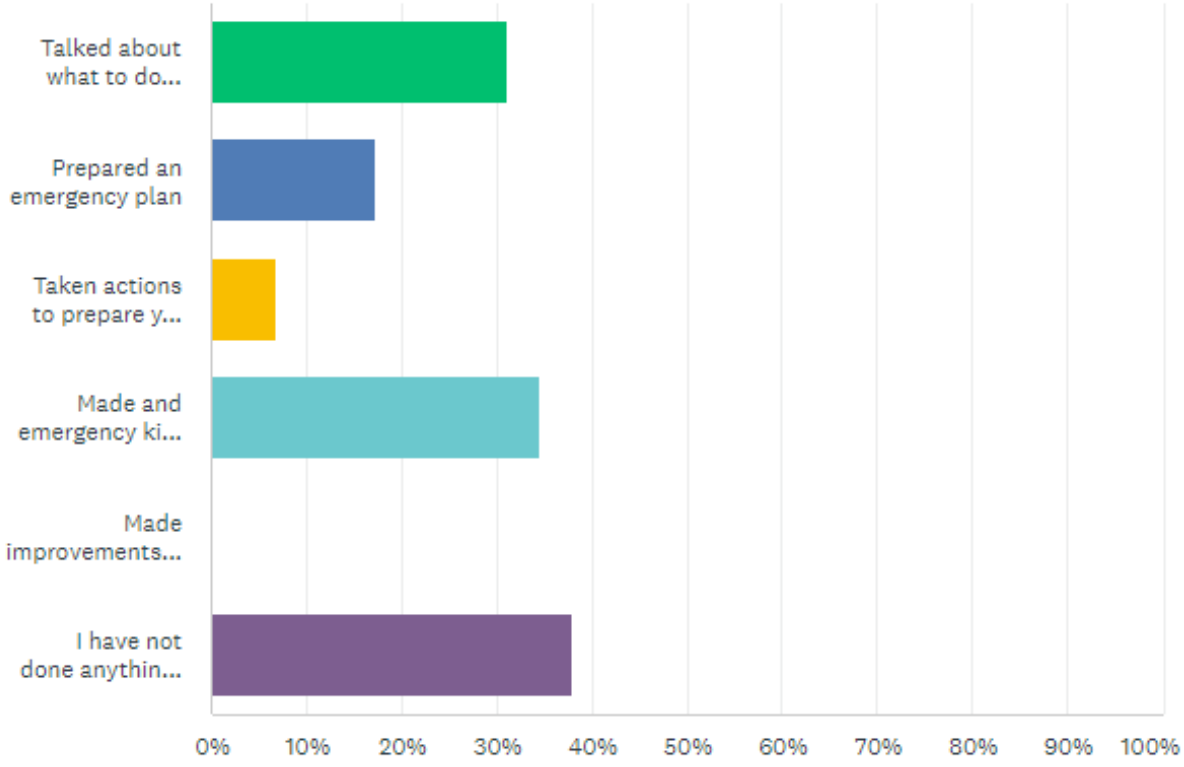
Answers:

Very:	57.1%
A little	35.7%
Not at all	7.2%



Question 4: In your household, has anyone done any of the following disaster mitigation actions?

Answers:		
	Talked about what to do during a emergency or natural disaster	31.5%
	Prepared an emergency plan	17.2%
	Taken actions to prepare your home to withstand disasters	6.9%
	Made and emergency kit or assembled emergency supplies	34.5%
	Made improvements to protect against natural disasters	0.0%
	I have not done anything in particular	37.9%



Question 5: Are there any other comments you would like to include regarding Louisville Metro's Hazard Mitigation Planning Strategies and hazards possibly affecting your local community?

Answers:

we are not ready for storms

We are screwed if the levee fails

Warming temps are a concern

Educate in schools

Please address climate change

Need to protect aganst floods

Address changing climate

City is pretty good at preparing for disasters

Tornado in December was a wake up call. Need to stop building mobile homes

Earthquake if you live along the Ohio is a big threat. No warning!

No issues

Floods happen because of thunderstorms and heavy rain. They are a result of a hazard, not a hazard

Made it though the Covid and it was tough. Need more money speant on electric grid

City is not ready for storms. Too much flooding

APPENDIX D

NATIONAL RISK INDEX COMMUNITY PROFILE

National Risk Index

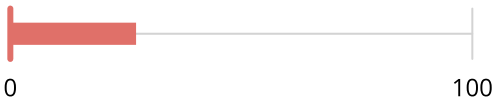
October 17, 2022

Jefferson County, Kentucky

Summary

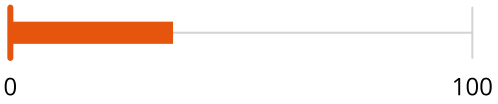
Risk Index is **Relatively High**

Score **27.46**



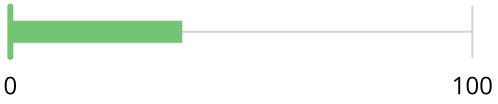
Expected Annual Loss is **Relatively High**

Score **35.72**



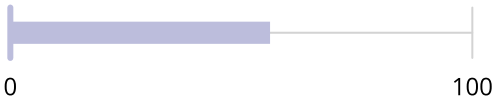
Social Vulnerability is **Relatively Moderate**

Score **37.56**



Community Resilience is **Relatively High**

Score **56.48**

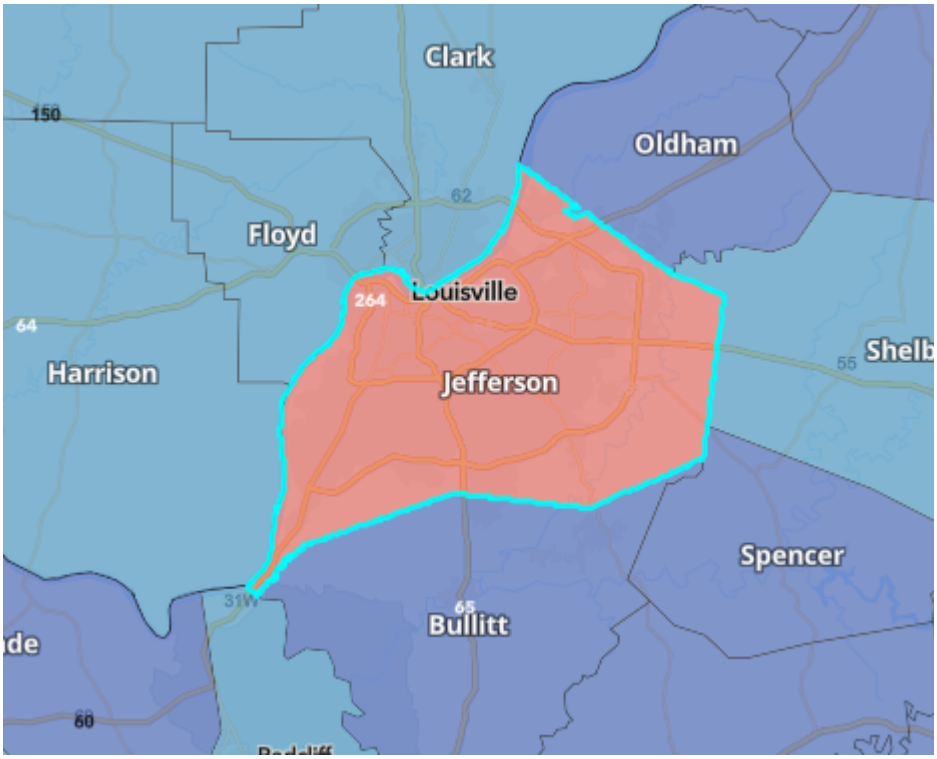


While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

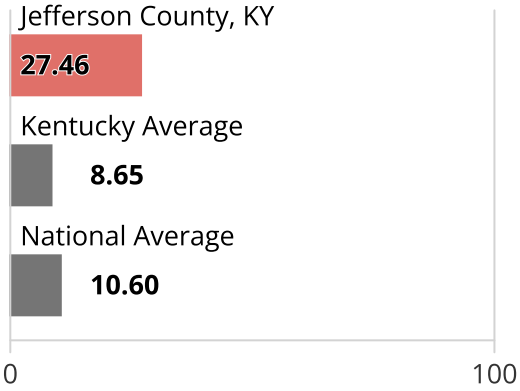
For more information about the National Risk Index, its data, and how to interpret the information it provides, please review the **About the National Risk Index** and **How to Take Action** sections at the end of this report. Or, visit the National Risk Index website at hazards.fema.gov/nri/learn-more to access supporting documentation and links.

Risk Index

The Risk Index rating is **Relatively High** for **Jefferson County, KY** when compared to the rest of the U.S.



Score	27.46



97.1% of U.S. counties have a lower Risk Index

100.0% of counties in Kentucky have a lower Risk Index

Risk Index Legend

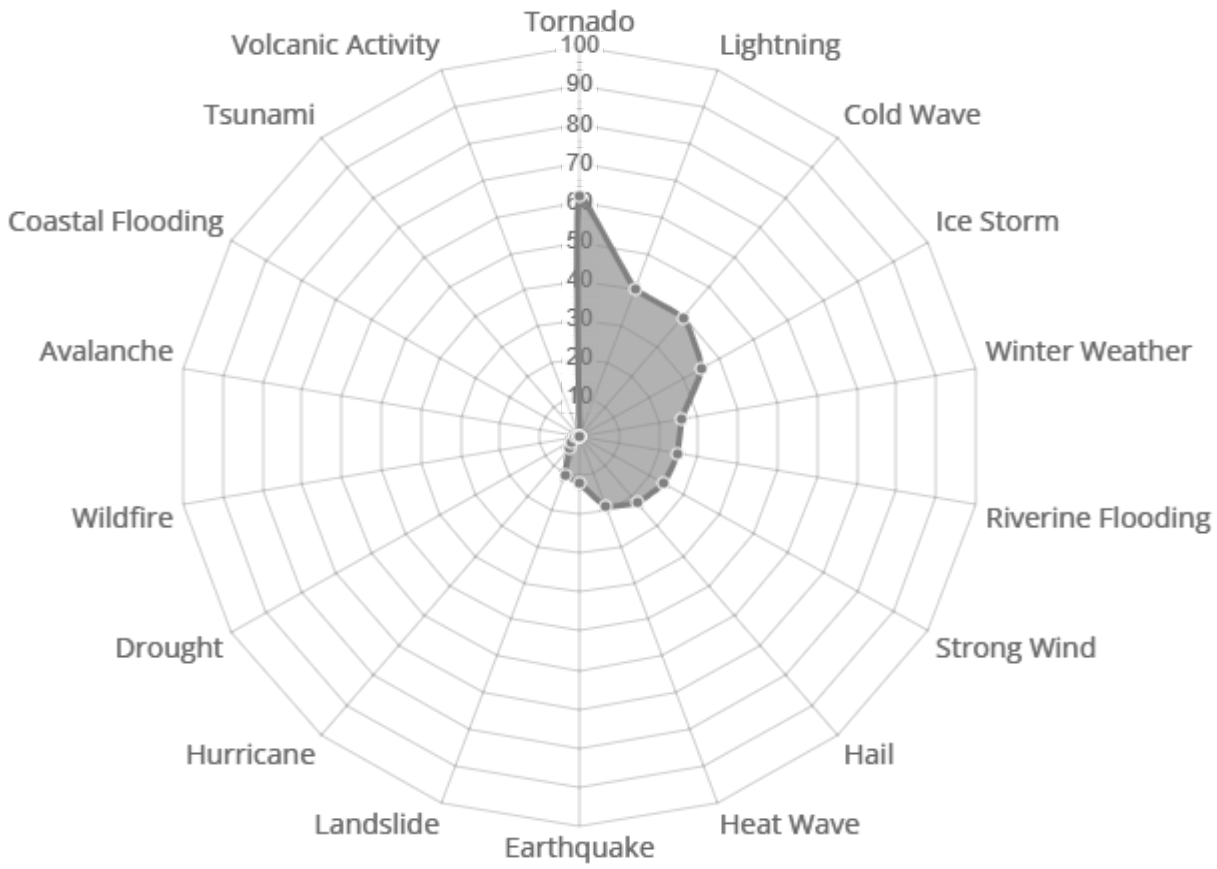
Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

No Rating | Not Applicable | Insufficient Data

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's relative risk for only that hazard type.

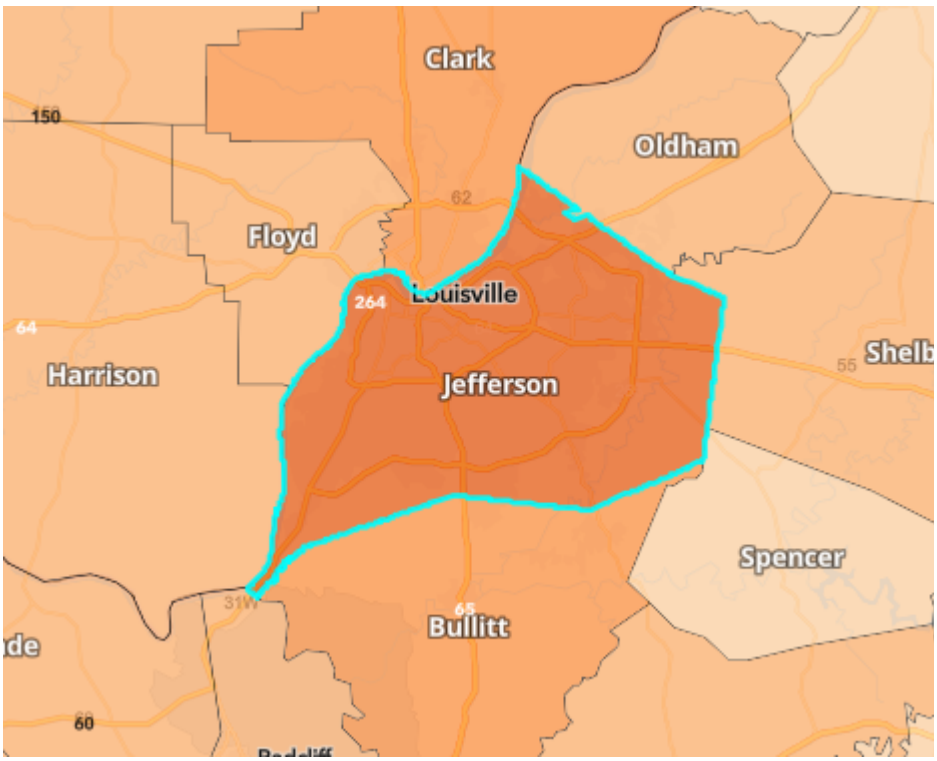
Hazard Type	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Not Applicable	--	
Cold Wave	Relatively High	39.89	0 100
Drought	Very Low	2.49	0 100
Earthquake	Relatively Moderate	12.10	0 100
Hail	Relatively Moderate	22.36	0 100
Heat Wave	Relatively High	18.84	0 100
Hurricane	Very Low	3.81	0 100
Ice Storm	Relatively High	35.31	0 100
Landslide	Relatively Low	10.53	0 100
Lightning	Relatively High	40.01	0 100
Riverine Flooding	Relatively High	24.84	0 100
Strong Wind	Relatively High	24.19	0 100
Tornado	Very High	61.93	0 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	Very Low	0.91	0 100
Winter Weather	Relatively High	25.65	0 100



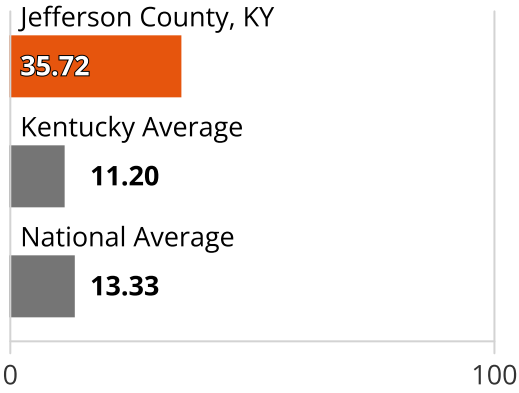
The chart above demonstrates the relative distribution of hazard type Risk Index scores for **Jefferson County, KY**. Risk Index scores are plotted for each hazard type included in the National Risk Index. Higher relative risk corresponds to larger colored areas inside a given hazard type chart slice.

Expected Annual Loss

In **Jefferson County, KY**, expected loss each year due to natural hazards is **Relatively High** when compared to the rest of the U.S.



Score	35.72



97.9% of U.S. counties have a lower Expected Annual Loss

100.0% of counties in Kentucky have a lower Expected Annual Loss

Expected Annual Loss Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

No Expected Annual Losses | Not Applicable | Insufficient Data

Composite Expected Annual Loss	**$71,844,731.40**

Building Value	**$25,271,536.10**	Population	**6.12** fatalities
Population Equivalence	**$46,529,619.53**	Agriculture Value	**$43,575.78**

Expected Annual Loss for Hazard Types

Expected Annual Loss scores for hazard types are calculated using data for only a single hazard type, and reflect a community's relative expected annual loss for only that hazard type. **14 of 18** hazard types contribute to the expected annual loss for **Jefferson County, KY**.

Hazard Type	Expected Annual Loss Rating	Expected Annual Loss Score
Avalanche	Not Applicable	--
Coastal Flooding	Not Applicable	--
Cold Wave	Relatively High	46.64
Drought	Very Low	2.66
Earthquake	Relatively Moderate	15.74
Hail	Relatively High	27.25
Heat Wave	Relatively Moderate	23.41
Hurricane	Relatively Low	4.27
Ice Storm	Relatively High	51.21
Landslide	Relatively Low	15.02
Lightning	Very High	67.04
Riverine Flooding	Relatively High	27.82
Strong Wind	Relatively High	46.74
Tornado	Very High	69.36
Tsunami	Not Applicable	--
Volcanic Activity	Not Applicable	--
Wildfire	Very Low	1.02
Winter Weather	Relatively High	35.76

Expected Annual Loss Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	--	--	--	--	--
Cold Wave	$660,377	$19,089	$634,569	0.08	$6,719
Drought	$4,591	n/a	n/a	n/a	$4,591
Earthquake	$5,514,235	$5,013,317	$500,918	0.07	n/a
Hail	$1,356,546	$677,975	$677,825	0.09	$746
Heat Wave	$900,796	$34	$900,715	0.12	$47
Hurricane	$40,628	$24,542	$14,737	0.00	$1,348
Ice Storm	$1,474,985	$1,203,323	$271,662	0.04	n/a
Landslide	$29,447	$16,222	$13,225	0.00	n/a
Lightning	$2,300,255	$34,215	$2,266,040	0.30	n/a
Riverine Flooding	$10,788,827	$9,761,257	$998,812	0.13	$28,758
Strong Wind	$1,831,660	$203,453	$1,627,235	0.21	$972
Tornado	$46,647,796	$8,306,960	$38,340,476	5.04	$360
Tsunami	--	--	--	--	--
Volcanic Activity	--	--	--	--	--
Wildfire	$167	$155	$13	0.00	$0
Winter Weather	$294,422	$10,995	$283,393	0.04	$34

Exposure Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	--	--	--	--	--
Cold Wave	$5,731,437,892,267	$99,101,963,101	$5,632,329,566,166	741,096.00	$6,363,000
Drought	$5,793,459	n/a	n/a	n/a	$5,793,459
Earthquake	$5,731,431,564,000	$99,101,964,000	$5,632,329,600,000	741,096.00	n/a
Hail	$5,731,437,927,000	$99,101,964,000	$5,632,329,600,000	741,096.00	$6,363,000
Heat Wave	$5,731,437,892,267	$99,101,963,101	$5,632,329,566,166	741,096.00	$6,363,000
Hurricane	$5,731,437,927,000	$99,101,964,000	$5,632,329,600,000	741,096.00	$6,363,000
Ice Storm	$5,730,383,003,160	$99,006,372,679	$5,631,376,630,481	740,970.61	n/a
Landslide	$998,494,114,632	$17,871,532,833	$980,622,581,799	129,029.29	n/a
Lightning	$5,731,431,564,000	$99,101,964,000	$5,632,329,600,000	741,096.00	n/a
Riverine Flooding	$257,116,713,846	$4,308,690,162	$252,807,085,367	33,264.09	$938,318
Strong Wind	$5,731,437,927,000	$99,101,964,000	$5,632,329,600,000	741,096.00	$6,363,000
Tornado	$5,731,437,927,000	$99,101,964,000	$5,632,329,600,000	741,096.00	$6,363,000
Tsunami	--	--	--	--	--
Volcanic Activity	--	--	--	--	--
Wildfire	$471,122,099	$8,848,016	$462,267,946	60.82	$6,137
Winter Weather	$5,731,437,892,267	$99,101,963,101	$5,632,329,566,166	741,096.00	$6,363,000

Annualized Frequency Values

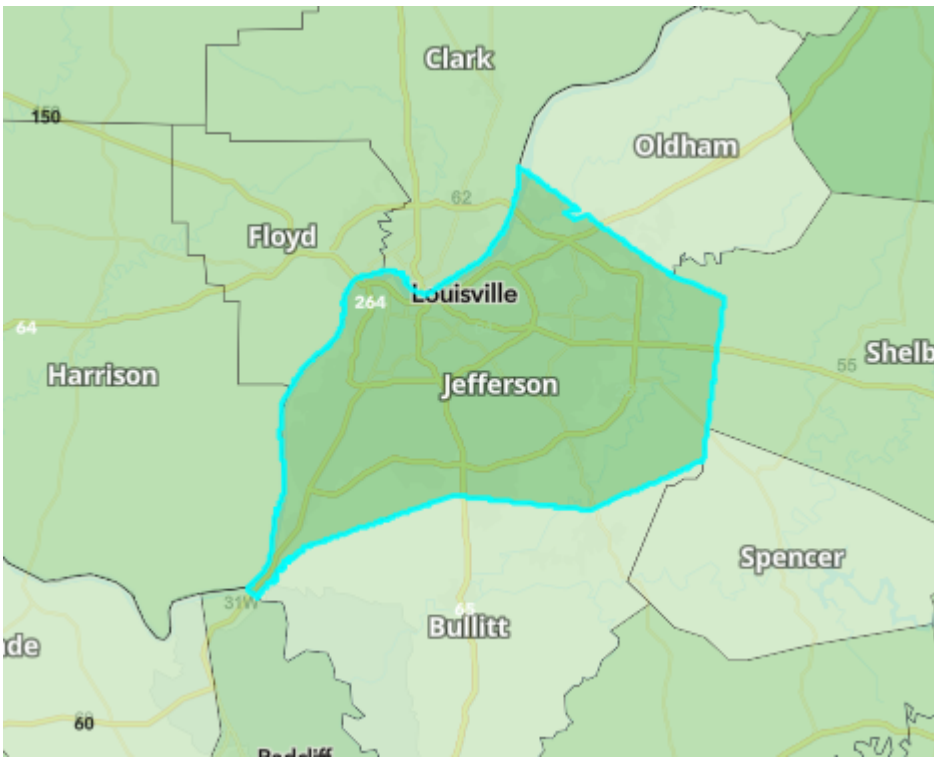
Hazard Type	Annualized Frequency	Events on Record	Period of Record
Avalanche	--	--	--
Coastal Flooding	--	--	--
Cold Wave	0.2 events per year	2	2005-2017 (12 years)
Drought	3.2 events per year	77	2000-2017 (18 years)
Earthquake	0.072% chance per year	n/a	2017 dataset
Hail	3.4 events per year	110	1986-2017 (32 years)
Heat Wave	1.2 events per year	15	2005-2017 (12 years)
Hurricane	0 events per year	0	East 1851-2017 (167 years) / West 1949-2017 (69 years)
Ice Storm	0.8 events per year	51	1946-2014 (67 years)
Landslide	0 events per year	0	2010-2019 (10 years)
Lightning	106.8 events per year	2,350	1991-2012 (22 years)
Riverine Flooding	4 events per year	96	1996-2019 (24 years)
Strong Wind	6.2 events per year	200	1986-2017 (32 years)
Tornado	0.3 events per year	18	1986-2019 (34 years)
Tsunami	--	--	--
Volcanic Activity	--	--	--
Wildfire	0.002% chance per year	n/a	2016 dataset
Winter Weather	2.1 events per year	26	2005-2017 (12 years)

Historic Loss Ratios

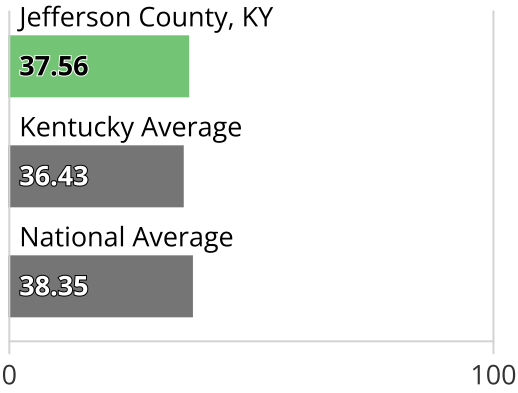
Hazard Type	Overall Rating	Building Value	Population	Agriculture Value
Avalanche	--	--	--	--
Coastal Flooding	--	--	--	--
Cold Wave	Very Low	$1.17 per $1M	6.84 per 10M	$6.41 per $1K
Drought	Very Low	n/a	n/a	$2.77 per $10K
Earthquake	Relatively Moderate	$1.72 per $1B	1.40 per 10K	n/a
Hail	Very Low	$2.01 per $1M	3.53 per 100M	$3.42 per $100K
Heat Wave	Very Low	$2.77 per $10B	1.29 per 10M	$6.01 per $1M
Hurricane	Very Low	$4.14 per $100K	4.37 per 10M	$3.54 per $100
Ice Storm	Very Low	$1.63 per $100K	6.45 per 100M	n/a
Landslide	Very Low	$9.08 per $100K	1.35 per 1M	n/a
Lightning	Very Low	$3.15 per $1B	3.68 per 1B	n/a
Riverine Flooding	Very Low	$5.66 per $10K	9.88 per 10M	$7.66 per $1K
Strong Wind	Very Low	$3.31 per $10M	4.66 per 100M	$2.43 per $100K
Tornado	Relatively Low	$3.26 per $10K	2.65 per 100K	$2.20 per $10K
Tsunami	--	--	--	--
Volcanic Activity	--	--	--	--
Wildfire	Very Low	$4.00 per $10	6.04 per 10K	$1.36 per $100
Winter Weather	Very Low	$5.18 per $100M	2.35 per 100M	$2.51 per $1M

Social Vulnerability

Social groups in **Jefferson County, KY** have a **Relatively Moderate** susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.



Score	37.56



46.9% of U.S. counties have a lower Social Vulnerability

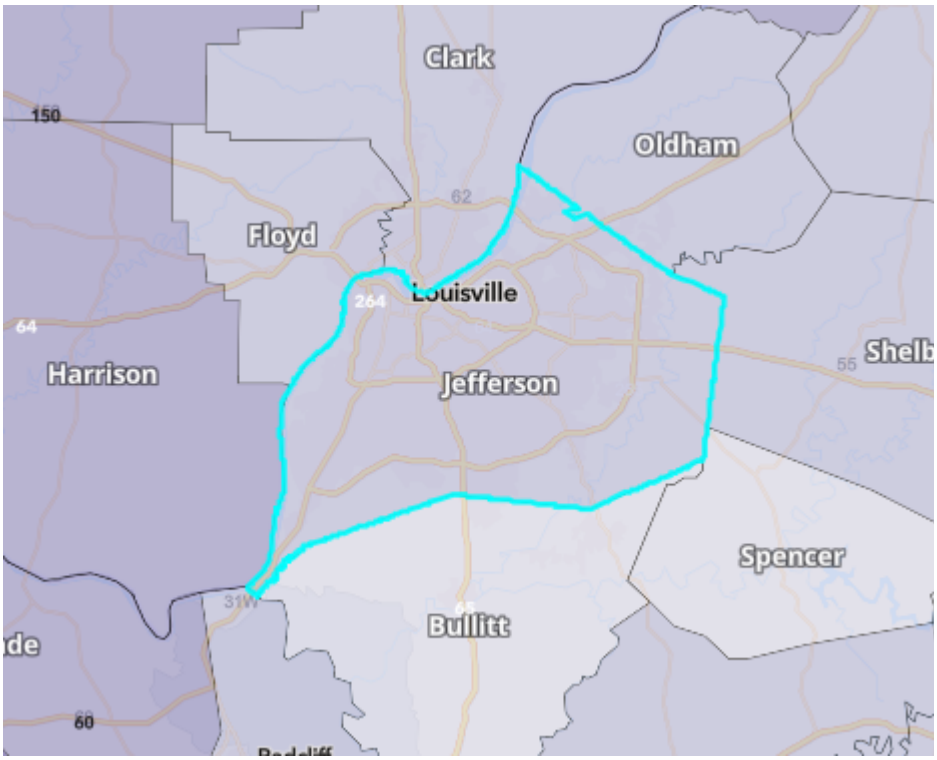
57.5% of counties in Kentucky have a lower Social Vulnerability

Social Vulnerability Legend

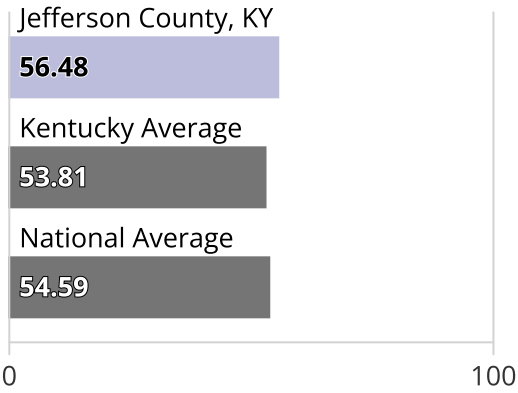
Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low | Data Unavailable

Community Resilience

Communities in **Jefferson County, KY** have a **Relatively High** ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.



Score **56.48**



28.0% of U.S. counties have a higher Community Resilience

15.9% of counties in Kentucky have a higher Community Resilience

Community Resilience Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low | Data Unavailable

About the National Risk Index

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Explore the National Risk Index Map at **hazards.fema.gov/nri/map**.

Visit the National Risk Index website at **hazards.fema.gov/nri/learn-more** to access supporting documentation and links.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

$$\text{Risk Index} = \text{Expected Annual Loss} \times \text{Social Vulnerability} \div \text{Community Resilience}$$

Risk Index scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit **hazards.fema.gov/nri/determining-risk**.

Calculating Expected Annual Loss

Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios for 18 hazard types:

$$\text{Expected Annual Loss} = \text{Exposure} \times \text{Annualized Frequency} \times \text{Historic Loss Ratio}$$

Expected Annual Loss scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit **hazards.fema.gov/nri/expected-annual-loss**.

Calculating Social Vulnerability

Social Vulnerability is measured using the Social Vulnerability Index (SoVI) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

For more information, visit **hazards.fema.gov/nri/social-vulnerability**.

Calculating Community Resilience

Community Resilience is measured using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

For more information, visit **hazards.fema.gov/nri/community-resilience**.

How to Take Action

There are many ways to reduce natural hazard risk through mitigation. Communities with high National Risk Index scores can take action to reduce risk by decreasing Expected Annual Loss due to natural hazards, decreasing Social Vulnerability, and increasing Community Resilience.

For information about how to take action and reduce your risk, visit **hazards.fema.gov/nri/take-action**.

Disclaimer

The National Risk Index (the Risk Index or the Index) and its associated data are meant for planning purposes only. This tool was created for broad nationwide comparisons and is not a substitute for localized risk assessment analysis. Nationwide datasets used as inputs for the National Risk Index are, in many cases, not as accurate as available local data. Users with access to local data for each National Risk Index risk factor should consider substituting the Risk Index data with local data to recalculate a more accurate risk index. If you decide to download the National Risk Index data and substitute it with local data, you assume responsibility for the accuracy of the data and any resulting data index. Please visit the **Contact Us** page if you would like to discuss this process further.

The methodology used by the National Risk Index has been reviewed by subject matter experts in the fields of natural hazard risk research, risk analysis, mitigation planning, and emergency management. The processing methods used to create the National Risk Index have produced results similar to those from other natural hazard risk analyses conducted on a smaller scale. The breadth and combination of geographic information systems (GIS) and data processing techniques leveraged by the National Risk Index enable it to incorporate multiple hazard types and risk factors, manage its nationwide scope, and capture what might have been missed using other methods.

The National Risk Index does not consider the intricate economic and physical interdependencies that exist across geographic regions. Keep in mind that hazard impacts in surrounding counties or Census tracts can cause indirect losses in your community regardless of your community's risk profile.

Nationwide data available for some risk factors are rudimentary at this time. The National Risk Index will be continuously updated as new data become available and improved methodologies are identified.

The National Risk Index Contact Us page is available at **hazards.fema.gov/nri/contact-us**.

APPENDIX E

CRITICAL FACILITIES

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE FLOODING		
NAME	**ADDRESS**	**FACILITY TYPE**
CORAL RIDGE ELEMENTARY SCHOOL	10608 NATIONAL TURNPIKE	Warning Sirens
CHRISTINA RAUPP-WHITE	2406 LAMBORNE BLVD	Childcare
FAIRDALE, PRE-SCHOOL & DAYCARE	905 FAIRDALE RD	Childcare
FAIRDALE VOCATIONAL BUILDING	1001 FAIRDALE RD	School
BRIGHT FUTURES CHILD CARE	8319 OLD 3RD ST RD	Childcare
CIRCLE K #3222	8320 OLD 3RD STREET RD	Grocery
JEFFERSON CO PUBLIC WORKS	617 OUTER LOOP	Warning Sirens
DOLLAR VALUE	161 OUTER LOOP	Grocery
LENICE ROBERSON	8211 ATLANTA PKWY	Childcare
ANGELA ROBINSON	3614 BRIARCLIFF CT	Childcare
CARDINAL ALUMINUM CO	4005 OAKLAWN DR	Warning Sirens
A PLACE FOR KIDS	7100 PRESTON HWY	Childcare
MSD MELCO BASIN	6701 GRADE LN	Warning Sirens
DAYS INN LOUISVILLE AIRPORT FAIR AND EXPO CENTER	2905 FERN VALLEY RD.	HOTEL
LITTLE RAYS OF SUNSHINE DAYCARE/ PRESCHOOL II	3203 E INDIAN TRAIL	Childcare
MARY RYAN ACADEMY	3307 E INDIAN TL	School
FISHERVILLE	15125 OLD TAYLORSVILLE RD	USPS
DOROTHY WILLIAMS	4910 DELAWARE DR	Childcare
BUECHEL	2259 HIKES LANE	USPS
SENECA HIGH SCHOOL	3510 GOLDSMITH LN	Warning Sirens
JOHN PAUL II ACADEMY	3525 GOLDSMITH LN	Childcare
ST. PIUS X PRE-KINDERGARTEN	3525 GOLDSMITH LN	Childcare
ST. PIUS AFTER SCHOOL CARE	3521GOLDSMITH LN	Childcare
SOUTHSIDE CHRISTIAN CHILD CARE #LL	3620 KLONDIKE LN	Childcare
AL WATAN BAKERY	3711 KLONDIKE LANE	Grocery
BOYS & GIRLS HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOY'S HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOYS' HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOYS' HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOYS' HAVEN	2301 GOLDSMITH LN	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE FLOODING		
NAME	**ADDRESS**	**FACILITY TYPE**
Parkway Medical Center	1155 Eastern Pkwy	Nursing Home
KENNEDY ELEMENTARY CHILD CARE	3800 GIBSON LN	Childcare
ST. MATTHEWS AREA MINISTRIES	201 BILTMORE RD	Community Ministries
KFC YUM! CENTER		Theatre/Stadium
MSD SUBSTATION	151 CABEL ST	Warning Sirens
WATERFRONT PARK	129 RIVER RD	Warning Sirens
B.P. OIL	1035 ZORN AVENUE	Grocery
GALEN COLLEGE OF NURSING	1031 Zorn Avenue	College
WEBSTER UNIVERSITY -- LOUISVILLE CAMPUS	1031 Zorn Ave.	College
RAMADA INN	1041 ZORN AVE.	INN
MSD MUDDY FORK PUMP STATION	2120 INDIAN HILLS TRAIL	Warning Sirens
INDIAN HILLS CLASS CITY	3738 RIVER RD	LMPD
Eden Care	901 Blankenbaker Rd	Nursing Home
EDEN TERRACE OF LOUISVILLE	901 BLANKENBAKER RD	Shelter
GLENVIEW	4330 GLENVIEW AVENUE	USPS
HARRODS CREEK FPD #2	5230 RIVER RD	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #11	5320 UPPER RIVER RD	Fire Dept
HARRODS CREEK	6319 RIVER RD	USPS
PROSPECT CLASS CITY	9200 U S HWY 42	LMPD

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EARTHQUAKE		
NAME	**ADDRESS**	**FACILITY TYPE**
4607 BLEVINS GAP RD	4607 BLEVINS GAP RD	Warning Sirens
11350 BEARCAMP RD	11350 BEARCAMP RD	Warning Sirens
PLEASURE RIDGE PARK FPD STA. #8	6501 BETHANY LN	Warning Sirens
FAIRDALE ELEMENTARY	10104 MITCHELL HILL RD	Childcare
FAIRDALE, ELEMENTARY CHILD CARE	10104 MITCHELL HILL RD	Childcare
BRIGHT FUTURES CHILD CARE	8319 OLD 3RD ST RD	Childcare
CIRCLE K #3222	8320 OLD 3RD STREET RD	Grocery
FAST TRAK	7249 DIXIE HWY	Grocery
JOWANDA DUCKWORTH	4608 MILE OF SUNSHINE DR	Childcare
CAL"JR. ACADEMY"	7839 ST ANDREWS CHURCH RD	Childcare
SOUTHSIDE CHRISTIAN DAY CARE 3	7419 ST ANDREWS CHURCH RD	Childcare
CARDINAL KEY MARKET	7312 ST. ANDREWS CHURCH RD	Grocery
PLEASURE RIDGE PARK FIRE DEPARTMENT #9	6902 MANSLICK RD	Fire Dept
ENGINE 23	706 KENWOOD DR	Fire Dept
ANGELIA HOWARD	601 ALGER AVE	Childcare
Iroquois Manor	5300 S. Third St.	Shopping
CVS	5330 S. 3RD STREET	Grocery
FAMILY DOLLAR STORE #2117	5312 S. 3RD STREET	Grocery
BINH PHUOC ORIENTAL FOODS	5301 S. THIRD STREET ROAD	Grocery
WALGREEN'S	5201 S. 3RD STREET	Grocery
RUTHERFORD ELEMENTARY	301 W SOUTHLAND BV	Childcare
RUTHERFORD CHILD CARE	301 SOUTHLAND BLVD	Childcare
BOSANKA EKI INTERNATIONAL FOODS	5113 S. 3RD STREET	Grocery
A-CHAU GROCERY	5107 S. 3RD STREET	Grocery
SPEEDWAY #9684	306 W AMHERST	Grocery
T & L GROCERY & BEER	4836 SOUTHSIDE DRIVE	Grocery
4002 S POPE LICK RD	4002 S POPE LICK RD	Warning Sirens
REBECCA SHEARIN	4662 CLIFF AVE	Childcare
FISHERVILLE	15125 OLD TAYLORSVILLE RD	USPS
BUECHEL DAY CARE IV	4200 BARDSTOWN RD	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EARTHQUAKE		
NAME	**ADDRESS**	**FACILITY TYPE**
Westminster Terrace-Continuous Care Reti	2116 Beuchel Bank Rd	Nursing Home
Westminster Terrace-Continuous Care Reti	2116 Beuchel Bank Rd	Nursing Home
Presbyterian Homes & Services of Kentucky Louisvil	2116 Buechel Bank Rd	Nursing Home
KIDS & FUN, INC.	105 BUECHEL TERRACE	Childcare
EASTWOOD FPD #2	15000 TAYLORSVILLE RD	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #6	15000 TAYLORSVILLE RD	Fire Dept
G & D GROCERY & STATION	14800 TAYLORSVILLE RD	Grocery
DOROTHY WILLIAMS	4910 DELAWARE DR	Childcare
POSH POSH CLUB CHILD & FAMILY ENRICHMENT CENTER	1512 CRUMS LN	Childcare
LENA'S KWIK SHOP	4000 LEES LANE	Grocery
BUECHEL	2259 HIKES LANE	USPS
KINDER CARE LEARNING CENTER	2990 NEWBURG RD	Childcare
MOTEL 6	3200 KEMMONS DR	MOTEL
LOUISVILLE ADVENTIST ACADEMY	2988 NEWBURG RD	School
SENECA HIGH SCHOOL	3510 GOLDSMITH LN	Warning Sirens
USPIRITUS BROOKLAWN	2125 GOLDSMITH LN	Childcare
BROOKLAWN RESIDENTIAL TREATMENT PROGRAMS	2125 GOLDSMITH LN	Childcare
BROOKLAWN CHILD & FAMILY SERVICES	2125 GOLDSMITH LN	Childcare
BROOKLAWN CHILD & FAMILY SERVICES	2125 GOLDSMITH LN	Childcare
QUALITY INN & SUITES	3255 BARDSTOWN RD.	INN
ENGINE 8	2900 HIKES LN	Fire Dept
SOUTHSIDE CHRISTIAN CHILD CARE #LL	3620 KLONDIKE LN	Childcare
AL WATAN BAKERY	3711 KLONDIKE LANE	Grocery
LA PAZ TIENDA MEXICANA	3612 KLONDIKE LANE	Grocery
SHELBY TRADITIONAL ACADEMY	735 ZIEGLER ST	School
Parkway Medical Center	1155 Eastern Pkwy	Nursing Home
KFC YUM! CENTER		Theatre/Stadium

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EARTHQUAKE		
NAME	**ADDRESS**	**FACILITY TYPE**
GALT HOUSE, THE	140 N. FOURTH ST.	GRAND HOTEL
MUHAMMAD ALI CENTER		Museum
MSD SUBSTATION	151 CABEL ST	Warning Sirens
KINDER CARE LEARNING CENTERS	730 ZORN AVE	Childcare
B.P. OIL	1035 ZORN AVENUE	Grocery
GALEN COLLEGE OF NURSING	1031 Zorn Avenue	College
WEBSTER UNIVERSITY -- LOUISVILLE CAMPUS	1031 Zorn Ave.	College
RAMADA INN	1041 ZORN AVE.	INN
MSD MUDDY FORK PUMP STATION	2120 INDIAN HILLS TRAIL	Warning Sirens
INDIAN HILLS CLASS CITY	3738 RIVER RD	LMPD
GLENVIEW	4330 GLENVIEW AVENUE	USPS

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
MINORS LANE ELEMENTARY	8510 MINOR LN	Childcare
MINORS LANE ELEMENTARY	8510 MINORS LN	Childcare
JOHNSON'S 2 INC. CHILD CARE	8010 OLD 3RD ST RD	Childcare
FAIRDALE FIRE DEPARTMENT #2	7940 3RD STREET RD	Fire Dept
BROWN MACKIE COLLEGE - LOUISVILLE	3605 Fern Valley Rd	College
BEHIND DODGE DEALER ON PRESTON	1122 ULRICH AVE	Warning Sirens
CHANGES BARBER SHOP	5627 PRESTON HIGHWAY	Grocery
RIVER SMOKE SHOPE	5623 PRESTON HIGHWAY	Grocery
LOUISVILLE INTERNATIONAL FIRE DEPARTMENT	600 TERMINAL DR	Fire Dept
BEECHMONT	307 W WOODLAWN AVENUE	USPS
MALE TRADITIONAL HIGH	4409 PRESTON HY	School
CIRCLE K #114	4301 PRESTON HGWY	Grocery
THE LAST STOP	600 TERMINAL DRIVE - BOX #7	Grocery
CONCEPTS FOR KIDS I	2204 RICHLAND AVE	Childcare
CONCEPTS FOR KIDS	2206 RICHLAND AVE	Childcare
STANDIFORD	4440 CRITTENDEN DRIVE	USPS
HOLIDAY INN SOUTHWEST	4110 DIXIE HWY.	INN
RODEWAY INN	571 PHILLIPS LANE	Grocery
RESIDENCE INN BY MARRIOT LOUISVILLE AIRPORT	700 PHILLIPS LN	EXTENDED STAY
RODEWAY INN AIRPORT	571 PHILLIPS LN	INN
ASHTON BEST WESTERN	653 PHILLIPS LANE	Grocery
SPRINGHILL SUITES BY MARRIOT LOUISVILLE AIRPORT	820 PHILLIPS LN	EXTENDED STAY
HAMPTON INN	800 PHILLIPS LN.	INN
HOWARD JOHNSON	709 PHILLIPS LANE	Grocery
HAMPTON INN	800 PHILLIPS LANE	Grocery
HOWARD JOHNSON EXPRESS	709 PHILLIPS LN	HOTEL
COMFORT INN & SUITES AIRPORT AND EXPO	653 PHILLIPS LN.	INN
EXECUTIVE WEST HOTEL	830 PHILLIPS LN	INN

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
AIRPORT AND EXPO LA QUINTA INN AND SUITES	4125 PRESTON HWY	INN
COURTYARD BY MARRIOT AIRPORT	819 PHILLIPS LN	HOTEL
LAQUINTA INN & SUITES	4125 PRESTON HIGHWAY	Grocery
DERBY CITY BILLARDS	4100 PRESTON STREET	Grocery
ACCESS DATA SERVICES	1441 LINCOLN AVE	Warning Sirens
SUGAR PLUM	937 PHILLIPS LANE	Grocery
CART #2	937 PHILLIPS LANE	Grocery
CART #4	937 PHILLIPS LANE	Grocery
CART #6	937 PHILLIPS LANE	Grocery
CART #10	937 PHILLIPS LANE	Grocery
CART #8	937 PHILLIPS LANE	Grocery
CART #1	937 PHILLIPS LANE	Grocery
CART #3	937 PHILLIPS LANE	Grocery
CART #5	937 PHILLIPS LANE	Grocery
CART #7	937 PHILLIPS LANE	Grocery
CART #9	937 PHILLIPS LANE	Grocery
THE COFFEE SHOP #1	937 PHILLIPS LANE	Grocery
THE COFFEE SHOP #2	937 PHILLIPS LANE	Grocery
GERMAN ROASTED NUTS #1	937 PHILLIPS LANE	Grocery
GERMAN ROASTED NUTS #2	937 PHILLIPS LANE	Grocery
GERMAN ROASTED NUTS #3	937 PHILLIPS LANE	Grocery
NUTS & STUFF	4017 PRESTON STREET	Grocery
ALDI INC.	3442 PRESTON HIGHWAY	Grocery
VALUE CITY #11200	3430 PRESTON HIGHWAY	Grocery
CAMP TAYLOR ELEMENTARY	1446 BELMAR DR	School
ACTIVE DAY OF LOUISVILLE THIRD STREET	4028 S THIRD ST	Shelter
KY FAIR & EXPOSITION CENTER	3923 CRITTENDEN DR	Warning Sirens
AIRPORT EXPO CENTER SLEEP INN	3330 PRESTON HWY	INN
AUDUBON PARK CLASS CITY	3340 ROBIN RD	LMPD
MINISTRIES UNITED SOUTH CENTRAL LOUISVILLE	1207 HART ST	Community Ministries

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
RAMADA LIMITED AIRPORT AND FAIR/EXPO CENTER	2912 CRITTENDEN DR	HOTEL
RAMADA SUITES & LIMITED	2912 CRITTENDEN DRIVE	Grocery
COUNTRY INN AND SUITES LOUISVILLE AIRPORT	2850 CRITTENDEN DR	INN
SUPER 8 MOTEL LOUISVILLE/EXPO CENTER	101 CENTRAL AVE	HOTEL
CARDINAL STADIUM		Theatre/Stadium
HILTON GARDEN INN LOUISVILLE AIRPORT	2735 CRITTENDEN DR	INN
AAF International	215 Central Ave	Manufacturing
SERVICE AMERICA BAR #16	2800 S. FLOYD STREET	Grocery
FOURTH PRESBYTERIAN PRE-SCHOOL	3016 PRESTON HIGHWAY	Childcare
CHURCHILL PARK	435 BOXLEY AV	Childcare
ETA TEEN CENTER, INC.	435 BOXLEY AVE	Childcare
PATTERSON STADIUM		Theatre/Stadium
KIDS INSIGHT CHILD CARE &	2791 FLOYD ST	Childcare
U OF L PAPPA JOHN'S STADIUM	2800 S FLOYD ST	Warning Sirens
SUMER FOOD MART	3027 S. 4TH STREET 4-D	Grocery
SANTA FE GROCERY	3000 S. 3RD STREET	Grocery
Fetter Printing Co.	700 Locust Lane PO Box 33128	Manufacturing
CATHOLIC CHARITIES	2911 S 4TH ST	Childcare
QUMANE STORE	2909 PRESTON HIGHWAY	Grocery
CHEKEDA EVERSLEY	2824 S 5TH ST	Childcare
KLEIN DRUGS	2800 S. 4TH STREET	Grocery
LA PAZ TIENDA MEXICANA	3612 KLONDIKE LANE	Grocery
WALGREEN'S DRUG STORE	2701 S. 4TH STREET	Grocery
YOUR KID'S PLACE	502 WINKLER AVE	Childcare
SPEEDY MART	401 WINKLER AVENUE	Grocery
TAYLOR BLVD NUTRITION CENTER	2710 TAYLOR BLVD	Grocery
YMCA SAFE PLACE SERVICES	2400 CRITTENDEN DR	Childcare
YMCA SAFE PLACE SERVICES	2400 CRITTENDEN DR	Childcare
YMCA SAFE PLACE SERVICES	2400 CRITTENDEN DR	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
CIRCLE K #3229	2703 PRESTON HWY	Grocery
AP FOODMART	2631 SOUTH 3RD STREET	Grocery
ENGINE 18	2600 S 4TH ST	Fire Dept
CHILD PALACE (THE)	2607 RODMAN ST	Childcare
JENNIFER CECIL	2332 MT CLAIRE AVE	Childcare
OUR MOTHER OF SORROWS	770 EASTERN PKWY	Childcare
DAWN URRUTIA	707 CREEL AVE	Childcare
UNIVERSITY OF LOUISVILLE	2520 S 3RD ST	Warning Sirens
PIC-PAC	786 MILLER AVE	Grocery
SHELBY STATION	2312 S PRESTON STREET	USPS
FAMILY DOLLAR STORE #1351	790 EASTERN PARKWAY	Grocery
WALGREENS	810 EASTERN PKWY	Grocery
UNIVERSITY OF LOUISVILLE/BELKNAP CAMPUS	2301 S. Third St	College
SMALL WORLD CHILD DEVELOPMENT	2337 ALEXANDER AVE	Childcare
SPEEDY MART	2210 ARTHUR ST	Grocery
TRAGER STADIUM		Theatre/Stadium
BIG LOTS	3938 TAYLORSVILLE ROAD	Grocery
UNIVERSITY OF LOUISVILLE BELKNAP CAMPUS	2010 S AVERY COURT WALK	Warning Sirens
MANUAL STADIUM		Theatre/Stadium
U OF L P.A.C.T. PROGRAM	100 CARDINAL AV	School
B-LINE 2	3636 CANE RUN ROAD	Grocery
A Comerce Center	3240 Commerce Center Place	Office
PROPERTY ROOM LMPD	635 INDUSTRY RD	LMPD
DOMESTIC VIOLENCE LMPD	635 INDUSTRY RD	LMPD
DUPONT MANUAL HIGH	120 W LEE ST	School
ROBERTS HALL	1032 E BURNETT AVE	Shelter
AMSHOFF'S KIDCARE	1037 E BURNETT AVE	Childcare
SHELBY TRADITIONAL ACADEMY	735 ZIEGLER ST	School
COLUMBINE BED AND BREAKFAST	1707 S 3RD ST	BED AND BREAKFAST
DAYS INN CENTRAL	1620 ARTHUR ST.	INN

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
BLUEGRASS SHELL	1400 S. HURSTBOURNE PKWY	Grocery
DAYS INN	1620 ARTHUR STREET	Grocery
NOE MIDDLE	121 W LEE ST	School
QUALITY INN AND SUITES AIRPORT	311 E GAULBERT AVE	INN
The Carbide/Graphite Group Inc.	4400 Bells Lane	Manufacturing
SAM MEYERS HALL	1517 S 2ND ST	School
COCHRAN ELEMENTARY	500 W GAULBERT AV	School
AUDREY LANIER	702 E BURNETT AVE	Childcare
NOE MIDDLE SCHOOL	121 W LEE ST	Childcare
YOUTH PERFORMING ARTS SCHOOL	1517 S 2ND ST	School
ENGINE 16 / TRUCK 3	1500 S 6TH ST	Fire Dept
CAROLYN BRECKENRIDGE	232 E BURNETT AVE	Childcare
FREEDOM HOUSE/SHELBY MEN'S CENTER	1432 S SHELBY ST	Shelter
MO'S FOOD MARKET	1036 GOSS AVENUE	Grocery
SARA LEE BAKERY STORE	1465 SOUTH 7TH STREET	Grocery
SAMUEL CULBERSTSON MANSION HISTORIC INN	1432 S 3RD ST	BED AND BREAKFAST
HAUCK'S HANDY STORE	1000 GOSS AVE	Grocery
WELLSPRING	1382 S 3RD ST	Shelter
ENGINE 15	1328 S PRESTON ST	Fire Dept
JEWISH HOSPITAL MEDICAL CENTER EAST	3920 Dutchmans Ln	Hospital
4TH DIVISION LMPD	1340 S 4TH ST	LMPD
FAMILY EMERGENCY SHELTER	1321 S PRESTON ST	Shelter
FOLLOW-UP FOR SUCCESS	1319 S PRESTON ST	Shelter
CENTRAL PARK BED & BREAKFAST	1353 S 4TH ST	BED AND BREAKFAST
INN AT THE PARK	1332 S 4TH ST	BED AND BREAKFAST
R.E.A.C.H. OF LOUISVILLE	501 PARK AVE	Childcare
NEW BEGINNINGS FOR WOMEN	1261 S BROOK ST	Shelter
MORE GRACE CHRISTIAN ACADEMY	100 W ORMSBY AVE	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
ALL MY CHILDREN CHILD DEVELOPMENT CENTER	523 PARK AVE	Childcare
DUPONT MANSION BED AND BREAKFAST	1317 S 4TH ST	BED AND BREAKFAST
SYLVIA SMITH	716 GWENDOLYN ST	Childcare
DAIRY MART #726	1056 E. OAK ST	Grocery
ASIA INSTITUTE - CRANE HOUSE		Museum
THE MAYFLOWER	425 W ORMSBY ST	EXTENDED STAY
CAMPION HOUSE	1238 S 3RD ST	BED AND BREAKFAST
YMCA SACC BLOOM CHILDCARE ENRICHMENT PROGRAM	930 MARY ST	Childcare
EL SHADDAI CHRISTIAN CHILD CARE CENTER	1230 S 3RD ST	Childcare
JANICE MERGERSON	502 E OAK ST	Childcare
1882 ALEKSANDER HOUSE BED AND BREAKFAST	1213 S 1ST ST	BED AND BREAKFAST
HILLEBRAND HOUSE GROCERY	1235 S 3RD ST	Grocery
PURITAN MINI MART	1244 SOUTH 4TH STREET	Grocery
DISMAS CHARITIES LOUISVILLE	124 W Oak	CHARITY
GLOBAL INERNET COFFEE	1213 S. 4TH STREET, SUITE 100	Grocery
BS SMOKE FOR LESS	125 W. OAK STREET	Grocery
Treyton Oak Towers/Independent & Convalescent	211 W. Oak St	Nursing Home
RITE AID #4629	409 W. OAK ST	Grocery
United Catalysts Inc.	1227 S. Twelfth St	Manufacturing
FAMILY DOLLAR STORE #1434	431 W OAK ST	Grocery
HOUSE OF RUTH	607 E ST. CATHERINE ST	Shelter
B-LINE	700 WEST OAK STREET	Grocery
ST. JUDE WOMEN'S RECOVERY CENTER	431 ET ST. CATHERINE ST	Shelter
MAUD BOOTH HOUSE	1131 S 1ST ST	Shelter
OZANAM INN	1034 S JACKSON ST	Shelter
EMISHA DARBY	214 E ST CATHERINE ST	Childcare
CIRCLE K #57	309 E ST CATHERINE ST	Grocery
SIMON HALL	1022 S JACKSON ST	Shelter

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
SHIRLEY POINDEXTER	323 E ST CATHERINE ST	Childcare
BAPTIST HEALTH LOUISVILLE	4000 Kresge Way	Hospital
BAPTIST HOSPITAL EAST CENTER	4000 KRESGE WAY	Childcare
BUCKHORN OF LOUISVILLE	1115 GARVIN PL	Childcare
DEPAUL TRANSITIONAL APARTMENTS	1015 S PRESTON ST	Shelter
ENGINE 11 / TRUCK 7	1025 RUBEL AV	Fire Dept
SHIRTIKA COLEMAN	531 E KENTUCKY ST	Childcare
LOUISVILLE METRO FIRE DEPT ENGINE 11 TRUCK 7	1025 RUBEL AVE	Warning Sirens
1888 HISTORIC ROCKING HORSE MANOR	1022 S 3RD ST	BED AND BREAKFAST
ENGELHARD ELEMENTARY	1004 S 1ST ST	School
MEMORIAL AUDITORIUM PARKING LOT	1000 S 5TH ST	Warning Sirens
HEUSER HEARING & LANGUAGE ACADEMY	117 E KENTUCKY ST	School
WALGREENS #6443	990 BAXTER AVENUE	Grocery
LOGAN & BRECKINRIDGE STREETS LOT	907 LOGAN ST	Warning Sirens
MEMORIAL AUDITORIUM		Theatre/Stadium
CRIMES AGAINST CHILDREN LMPD	512 W KENTUCKY ST	LMPD
HIGHLANDS COMMUNITY MINISTRIES	1228 E BRECKENRIDGE ST	Community Ministries
SIMMONS COLLEGE OF KENTUCKY	1018 S. 7TH St	College
PATHFINDER SCHOOL OF INNOVATION	900 S FLOYD ST	School
JEFF CNTY TRADITIONAL MIDDLE	1418 MORTON AV	School
BAXTER	1527 HIGHLAND AVENUE	USPS
Christian Health Center - - Assisted Living	960 S. 4th St	Nursing Home
A PLACE FOR US CHILD DEVELOPMENT CENTER	1015 S 8TH ST	Childcare
CHAPEL HOUSE GROCERY	945 SOUTH 5TH STREET	Grocery
ENGINE 9	617 E BRECKINRIDGE ST	Fire Dept
Christian Health Center - - Independent Living	945 S. 5th St	Nursing Home

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
DAWSON ORMAN EDUCATION CENTER	900 S FLOYD ST	School
DOWNTOWN CHILD CARE	911 S BROOK ST	Childcare
DAWSON ORMAN EDUCATION CENTER	900 S FLOYD ST	Childcare
PUBLIC INTEGRITY LMPD	810 BARRETT AVE	LMPD
EAST NEIGHBORHOOD PLACE	810 BARRET AVENUE	LMPD
HAWTHORN SUITES	751 CYPRESS STATION DR	EXTENDED STAY
AUSTINS INN PLACE	915 S 1ST ST	BED AND BREAKFAST
Parr's Rest Inc	969 Cherokee Rd	Nursing Home
Christian Health Center & Convalescent Home	920 S. Fourth St	Nursing Home
HIGHLAND PRESBYTERIAN CHURCH	2114 HIGHLAND AVE	Childcare
HIGHLAND PRESBYTERIAN WEEKDAY	2114 HIGHLAND AVE	Childcare
Moorman, Charles Home for Women	966 Cherokee Rd	Nursing Home
SERVICE CENTER LMPD	768 BARRET AVE	LMPD
SALVATION ARMY DAY CARE (THE)	237 E BRECKINRIDGE ST	Childcare
PRESBYTERIAN CHILD DEVELOPMENT	600 E LAMPTON ST	Childcare
MEYZEEK MIDDLE	828 S JACKSON ST	School
NEIGHBORHOOD FOOD MART	542 LAMPTON ST	Grocery
GUARDIACARE	215 W BRECKINRIDGE ST	Shelter
PRESENTATION ACADEMY HIGH	861 S 4TH ST	School
Eastern Star Home in Kentucky	923 Eastern Star Court	Nursing Home
C. Lee Cook, A Dover Resources Company	PO Box 1038 916 S Eighth St	Manufacturing
SPALDING UNIVERSITY	851 S. Fourth St	College
KINDRED HOSPITAL LOUISVILLE	1313 St. Anthony Pl	Hospital
SOUTHSIDE CHRISTIAN DAY CARE 5	817 S 2ND ST	Childcare
AYINDE CHILD YOUTH & FAMILY DEVELOPMENT CENTER, IN	517 W BRECKINRIDGE ST	Childcare
HIGHLANDS COMMUNITY MINISTRIES - CHEROKEE	917 EASTERN STAR CT	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
SMOKETOWN SUPER DOLLAR PLUS	755 S. PRESTON STREET	Grocery
BRECKINRIDGE METROPOLITAN	1128 E BROADWAY	School
CENTRAL LOUISVILLE COMMUNITY MINISTRIES	809 S 4TH ST	Community Ministries
KIDS KORNER DAY CARE CENTER	204 E JACOB ST	Childcare
DOWNTOWN	835 S 7TH STREET	USPS
W W SPRADLING REST HOME	726 S PRESTON ST	Shelter
HAMPTON HALL HOTEL	209 YORK ST.	HOTEL
Spradling W W Rest Home	726 Preston Hwy	Nursing Home
Brown-Forman Corp.	850 Dixie Hwy	Manufacturing
MAIN LIBRARY		Library
WALGREEN'S #9005	200 EAST BROADWAY	Grocery
ENRICHMENT CENTER (THE)	702 E GRAY ST	Childcare
HOLIDAY INN LOUISVILLE-DOWNTOWN	120 W. BROADWAY	INN
504 BED AND BREAKFAST	709 S 3RD ST	BED AND BREAKFAST
Portland Office Building	200 W. Broadway	Office
Bank of Louisville Building	500 W Broadway	Office
TUBERCULOSIS CLINIC	400 EAST GRAY STREET	Clinic
NORTON HEALTHCARE PAVILLION	315 E. Broadway	Hospital
Heyburn Building	323 W. Broadway	Office
Home of the Innocents/Emergency Youth Shelter	522 East Gray St	Nursing Home
JEFFERSON COMMUNITY AND TECH. COLLEGE- DOWNTOWN	109 E. Broadway	College
ST FRANCIS HIGH	233 W BROADWAY	School
THE BROWN HOTEL	335 W BROADWAY	HOTEL
THE CLOISTER	806 E CHESTNUT ST	Shelter
WALDEN THEATRE		Theatre/Stadium
L&N BRANCH	908 WEST BROADWAY	Clinic
BLIND BOYZ CAFE	908 W. BROADWAY	Grocery
BIG Q GROCERY	1001 W. BROADWAY	Grocery
COMMUNITY CORRECTIONS CENTER	316 E. Chesnut St	CORRECTIONAL CENTER

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
NORTON HOSPITAL	200 E. Chestnut St	Hospital
PRO-KIDS CHILD DEVELOPMENT	632 S 4TH AVE	Childcare
ACKERLY	200 E CHESTNUT ST	School
LIL' GENIUS CHILD CARE CENTER LLC	1121 W BROADWAY	Childcare
THE LOUISVILLE PALACE THEATRE		Theatre/Stadium
Wilson Building	620 S. Third St.	Office
NORTON CHILDREN'S HOSPITAL	231 E. Chestnut St	Hospital
KATHY MATHIES	1018 MAGAZINE ST	Childcare
FRAZIER REHAB INSTITUTE	220 Abraham Flexner Way	Hospital
BARNES & NOBLE COLLEGE #254	555 S. FLOYD STREET	Grocery
UNCLE SAM'S PLACE CHILDCARE	600 DR MARTIN LUTHER KING JR PL	Childcare
UNIVERSITY OF LOUISVILLE HOSPITAL	530 S. Jackson St	Hospital
JEWISH HOSPITAL	200 Abraham Flexner Way	Hospital
Chestnut Centre	410 W. Chestnut St.	Office
Taylor James Memorial Home	1015 Magazine St	Nursing Home
BRECKINRIDGE/FRANKLIN ELEM	1351 PAYNE ST	School
BROWN SCHOOL CHILDCARE	546 S 1ST ST	Childcare
Hilliard Lyons Center	501 S. Fourth St.	Office
NORMA'S HOUSE	830 MARSHALL ST	Shelter
MARYJANE TONEY HOUSE	828 MARSHALL ST	Shelter
JEFFERSON STATE DAY CARE	800 WCHESTNUT ST	Childcare
RUDD HEART AND LUNG CENTER	201 Abraham Flexner Way	Hospital
Distillery Commons	200 Distillery Commons	Office
CAFE DOSKER STOP & SHOP	413 E. MUHAMMAD ALI BLVD	Grocery
JEFFERSON STREET BAPTIST COMMUNITY AT LIBERTY	800 E LIBERTY ST	Shelter
CHESTNUT STREET BRANCH YMCA	930 W CHESTNUT ST	Childcare
CENTRAL HIGH	1130 W CHESTNUT ST	Childcare
YMCA SACC COLERIDGE-TAYLOR CHILDCARE ENRICHMENT PR	1130 W CHESTNUT ST	Childcare
Meidinger Tower	462 Fourth St.	Office
WESTERN LIBRARY		Library

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
DOLLAR MAX	548 S. 4TH STREET	Grocery
BROWN SCHOOL	546 S 1ST ST	School
Starks Building	455 S.Fourth St.	Office
JEFFERSON COMMUNITY AND TECH. COLLEGE - TECH	727 W. Chestnut St	College
SEELBACH HOTEL, THE	500 FOURTH ST.	HOTEL
Brown & Williamson Tower	401 S. Fourth St.	Office
COLERIDGE TAYLOR MONTESSORI	1115 W CHESTNUT ST	School
FIRST LINK SUPERMARKET	431 E LIBERTY ST	Grocery
NATIVITY ACADEMY AT ST BONIFAC	529 E LIBERTY ST	School
SPEEDY MART	316 WALLACE AVE	Grocery
CARL NUSSBAUM JR. CHILD	225 S SHELBY ST	Childcare
4TH STREET LIVE	411 S 4TH STREET	USPS
HOME OF THE INNOCENTS	1100 E MARKET ST	Shelter
HOME OF THE INNOCENTS PREGNANT & PARENTING TEEN PROGRAM	1020 E MARKET ST	Shelter
HOME OF THE INNOCENTS PREGNANT & PARENTING TEEN PROGRAM	1020 E MARKET ST	Shelter
HOME OF THE INNOCENTS PREG & PARENT TEEN	1100 E MARKET ST	Childcare
HOME OF THE INNOCENTS EMERGENCY SHELTER	1100 E MARKET ST	Childcare
HOME OF THE INNOCENTS EMERGENCY SHELTER	1100 E MARKET ST	Childcare
HOME OF THE INNOCENTS EMERGENCY SHELTER	1100 E MARKET ST	Childcare
JEFFERSON STREET BAPTIST CENTER	733 E JEFFERSON ST	Shelter
LOUISVILLE GARDENS		Theatre/Stadium
YENNES FOOD MART	850 W. MUHAMMAD ALI BLVD	Grocery
DATA INFORMATION CENTER LMPD	400 S 1ST ST	LMPD
SAFE HAVEN, TRANSITIONAL AND DAY SHELTER FOR WOMEN	215 S SHELBY ST	Shelter
CVS PHARMACY #6210	432 S. 4TH STREET	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
Louisville Galleria	400 S. Fourth St.	Shopping
Pavillion Health Care Center	432 E. Jefferson St	Nursing Home
COMFORT INN DOWNTOWN	401 S. 2ND ST	INN
MEN'S ADULT DAY SHELTER	822 E MARKET ST	Shelter
FAMILY TRANSITIONAL SHELTER	812 E MARKET ST	Shelter
SINGLE WOMEN'S EMERGENCY, TRANSITIONAL AND DAY SHELTER	804 E MARKET ST	Shelter
FAIRFIELD INN & SUITES LOUISVILLE DOWNTOWN	100 EAST JEFFERSON STREET	HOTEL
JOINT EMERGENCY SERVICES (JOINT ESU) LMPD	410 S 5TH ST	LMPD
INSPECTIONS AND COMPLIANCE LMPD	400 S 4TH ST	LMPD
Landmark Building, The	304 W. Liberty St.	Office
LOUISVILLE MARRIOTT DOWNTOWN	280 W JEFFERSON ST	GRAND HOTEL
UNSELD CHILD CARE & DEVELOPMENT CENTER - EAST	219 S PRESTON ST	Childcare
ENGINE 5 / TRUCK 2	235 E JEFFERSON ST	Fire Dept
RISE & SHINE DAY CARE CENTER	207 S HANCOCK	Childcare
JEFFERSON COUNTY JAIL	400 S 6th st	COUNTY JAIL
HYATT REGENCY LOUISVILLE	320 W. JEFFERSON ST.	HOTEL
HAMPTON INN DOWNTOWN LOUISVILLE	101 E JEFFERSON ST	INN
LINCOLN ELEMENTARY	930 E MAIN ST	School
COPPERFIELDS	320 W. JEFFERSON STREET	Grocery
SUMSHEE FAMILY ROOM	204 S. PRESTON STREET	Grocery
MARKET ON MARKET	445 E. MARKET STREET	Grocery
TAMARA WALKER	1607 W MUHAMMAD ALI BLVD	Childcare
QUIZNO'S VENDING	5TH & JEFFERSON STREET	Grocery
JEFFERSON COUNTY JAIL	600 W Jefferson St	COUNTY JAIL
JEFFERSON COUNTYYOUTH CENTER	720 W. Jefferson St	YOUTH CENTER
Citizens Plaza	500 W. Jefferson St.	Office
RESIDENCE INN BY MARRIOT DOWNTOWN	333 E MARKET ST	INN

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
LOUISVILLE METRO YOUTH CENTER	720 W JEFFERSON ST	School
CENTRAL STADIUM		Theatre/Stadium
CONVENTION CENTER		Theatre/Stadium
MINI-VERSITY DOWNTOWN CHILD	306 ROY WILKINS	Childcare
Kentucky Home Life Building	239 S. Fifth St.	Office
Porter Paint Courtaulds Coatings	400 S. 13th St	Manufacturing
METRO POLICE HEADQUARTERS LMPD	633 W JEFFERSON ST	LMPD
RESEARCH AND DEVELOPMENT LMPD	633 W JEFFERSON ST	LMPD
CRIME INFORMATION CENTER LMPD	633 W JEFFERSON ST	LMPD
TECHNICAL SERVICES LMPD	633 W JEFFERSON ST	LMPD
PUBLIC SERVICE COUNTER LMPD	633 W JEFFERSON ST	LMPD
FALSE ALARM REDUCTION LMPD	633 W JEFFERSON ST	LMPD
HOMICIDE LMPD	633 W JEFFERSON ST	LMPD
COLD CASE LMPD	633 W JEFFERSON ST	LMPD
MISSING PERSONS LMPD	633 W JEFFERSON ST	LMPD
ROBBERY LMPD	633 W JEFFERSON ST	LMPD
FINANCIAL CRIMES (FRAUD) LMPD	633 W JEFFERSON ST	LMPD
SEX CRIMES LMPD	633 W JEFFERSON ST	LMPD
CRIMES AGAINST SENIORS LMPD	633 W JEFFERSON ST	LMPD
VIDEO FORENSICS LMPD	633 W JEFFERSON ST	LMPD
CRIME SCENE LMPD	633 W JEFFERSON ST	LMPD
POLYGRAPH LMPD	633 W JEFFERSON ST	LMPD
PHOTO LAB LMPD	633 W JEFFERSON ST	LMPD
MEDIA AND PUBLIC RELATIONS LMPD	633 W JEFFERSON ST	LMPD
NARCOTICS LMPD	633 W JEFFERSON ST	LMPD
OPEN RECORDS LMPD	633 W JEFFERSON ST	LMPD
COMMUNITY RELATIONS LMPD	633 W JEFFERSON ST	LMPD
DIVE TEAM LMPD	633 W JEFFERSON ST	LMPD
HOSTAGE NEGOTIATING (HNT) LMPD	633 W JEFFERSON ST	LMPD

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
RIVER PATROL LMPD	633 W JEFFERSON ST	LMPD
SPECIAL EVENTS LMPD	633 W JEFFERSON ST	LMPD
SPECIAL WEAPONS AND TACTICS (SWAT) LMPD	633 W JEFFERSON ST	LMPD
BUSSMAN'S BAKERY	1906 FRANKFORT AVENUE	Grocery
FISCAL COURT SNACK BAR	531 COURT PLACE	Grocery
LOUISVILLE METRO FISCAL COURT BLDG	531 COURT PLACE	Warning Sirens
First Trust Center	200 S. Fifth St.	Office
UNITED CRESCENT HILL MINISTRIES	150 STATE ST	Community Ministries
Aegon Center	400 W. Market St	Office
SMOKER'S CORNER CAFE	440 WEST MARKET STREET	Grocery
WESLEY HOUSE EARLY LEARNING	803 E WASHINGTON ST	Childcare
COTTON CANDY WEST	401 EAST MAIN STREET	Grocery
COTTON CANDY EAST	401 EAST MAIN STREET	Grocery
COCO BONGOS	401 EAST MAIN STREET	Grocery
Swift & Co.	1200 Story Ave	Manufacturing
Legal Arts	200 S. Seventh St.	Office
RIVER CITY CORRECTIONS	214 S. 8th St	CORRECTIONAL CENTER
LITTLE HOUSE OF LOUISVILLE	138 S 3RD	Childcare
American Printing House for the Blind Inc.	1839 Frankfort Ave PO Box 6085	Manufacturing
COURTYARD BY MARRIOTT DOWNTOWN	100 S. 2ND ST	HOTEL
ENGINE 2 / TRUCK 1	1135 W JEFFERSON ST	Fire Dept
515 Building	515 W Market St	Office
FAMILY DOLLAR #2087	1419 WEST JEFFERSON STREET	Grocery
Humana Waterside Building	101 E. Main St	Office
ACTORS THEATRE		Theatre/Stadium
BYCK ELEMENTARY	2328 CEDAR ST	School
ENGINE 21	300 N SPRING ST	Fire Dept
ADRENALINE ZONE	147 N. CLAY STREET	Grocery
HEALING PLACE MEN	1020 W MARKET ST	Shelter

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
BOBBIE'S BEE-Z BABIES III INC.	1407 W JEFFERSON ST	Childcare
HAIFA'S LOBBY SHOP	220 WEST MAIN STREET	Grocery
SLUGGER FIELD		Theatre/Stadium
LG&E Building	220 W. Main St.	Office
Waterfront Plaza	325 W. Main St.	Office
PLAZA CONVENIENCE	325 W. MAIN STREET	Grocery
DERBY CITY PRODUCE	301 S. 18TH ST	Grocery
One Riverfront Plaza	401 W. Main St.	Office
STRAUS	101 S. 5TH STREET, SUITE 111	Grocery
CHILD CARE UNIVERSITY #1	522 W MAIN ST	Childcare
ELAINA HAYES	1631 W JEFFERSON ST	Childcare
National City Tower	101 S. Fifth St.	Office
ARAMARK - THE TOWER	500 WEST MAIN STREET	Grocery
B-LINE	1648 MELLWOOD AVENUE	Grocery
21C MUSEUM		Museum
Humana Building	500 W. Main St.	Office
21C MUSEUM HOTEL	700 WEST MAIN ST	HOTEL
SLUGGER MUSEUM		Museum
ADOPTIONS OF KENTUCKY	401 W MAIN ST	Childcare
ST. JOSEPH EARLY CHILDHOOD	114 ADAMS ST	Childcare
AMERICAN PRINTING HOUSE FOR THE BLIND		Museum
DONUT KASTLE	608 LYNDON LANE	Grocery
DISMAS CHARITIES ST PATRICK	1301 W Market	CHARITY
CENTER FOR THE ARTS		Theatre/Stadium
Hillerich & Bradsby Co.	800 W Main St	Manufacturing
KFC YUM! CENTER		Theatre/Stadium
SCIENCE CENTER		Museum
HOUSING AND COMMUNITY DEVELOPMENT TRANSITIONAL HOUSE	745 W MAIN ST	Shelter
FRAZIER INTERNATIONAL HISTORY MUSEUM		Museum
GALT HOUSE, THE	140 N. FOURTH ST.	GRAND HOTEL
MUHAMMAD ALI CENTER		Museum

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE HAZARDOUS MATERIALS		
NAME	**ADDRESS**	**FACILITY TYPE**
MSD SUBSTATION	151 CABEL ST	Warning Sirens
PASRGAD GROCERY	2026 BROWNSBORO ROAD	Grocery
BABAN BAKEKRY	2018 BROWNSBORO ROAD	Grocery
JELLYBEAN CLUBHOUSE DAYCARE	210 S 24TH ST	Childcare
SISTER VISITOR CENTER	2235 W MARKET ST	Community Ministries
WATERFRONT PARK	129 RIVER RD	Warning Sirens
PIC-PAC	2421 W MARKET ST	Grocery
SHALONDA ALLEN	2124 W MAIN ST	Childcare
DAIRY MART	2728 W. MARKET ST	Grocery
HEVERIN HOUSE	1700 ROWAN ST	Shelter
VEHICLE IMPOUNDMENT LMPD	1487 FRANKFORT AVE	LMPD
GLENNETTA WINSTEAD	2525 W MAIN ST	Childcare
DISMAS CHARITIES PORTLAND	1501 Lytle St	CHARITY
NEIGHBORHOOD HOUSE PRESCHOOL	201 N 25TH ST	Childcare
GRANNY'S ANGELS II	1710 BANK ST	Childcare
ATKINSON ELEMENTARY	2811 DUNCAN ST	School
ENGINE 6	2500 GRIFFITH AV	Fire Dept
CIRCLE K #3231	2100 PORTLAND AVE	Grocery
1ST DIVISION LMPD	416 N 29TH ST	LMPD
BOMB LMPD	416 N 29TH ST	LMPD
PORTLAND GROCERY	2644 PORTLAND AVE	Grocery
Holiday Manor	4900 Brownsboro Rd	Shopping
SERVICE PLUS #4	4900 BROWNSBORO RD	Grocery
B.P. FOOD MART #146	4740 CHAMBERLAIN LANE	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
WATSON LANE ELEMENTARY	7201 WATSON LN	Childcare
WATSON LANE ELEMENTARY CHILD	7201 WATSON LN	Childcare
STACIE'S CHILD CARE	11719 POND CREEK DR	Childcare
NANNY'S HOME CHILD CARE	11702 LEEMONT DR	Childcare
OUR LADY OF CONSOLATION SCHOOL	10803 DEERING RD	Childcare
WEE WALKERS DAY CARE	10706 GRECIAN RD	Childcare
SOUTHSIDE CHRISTIAN DAY CARE VI	10315 DEERING RD	Childcare
DIXIE ELEMENTARY	10201 CASA LANDA DR	School
JEFFERSON COMMUNITY AND TECH. COLLEGE - SOUTHWEST	1000 Community College Dr.	College
JEWISH HOSPITAL MEDICAL CENTER SOUTHWEST	9700 Stonestreet Road	Hospital
PLEASURE RIDGE PARK FIRE DEPARTMENT #2	9500 STONESTREET ROAD	Fire Dept
JOHNSONTOWN ROAD ELEMENTARY	7201 JOHNSONTOWN RD	Childcare
YMCA SACC JOHNSONTOWN CHILDCARE ENRICHMENT PROGRAM	7201 JOHNSONTOWN RD	Childcare
Regency Health Care Center	1550 Raydale Dr	Nursing Home
WILKERSON ELEMENTARY	5601 JOHNSONTOWN RD	School
WILKERSON ELEMENTARY SCHOOL	5601 JOHNSONTOWN RD	Warning Sirens
FELICIA RUDOLPH	5809 JERRY LN	Childcare
SANDERS ELEMENTARY	8408 TERRY RD	School
SANDERS ELEMENTARY SCHOOL	8408 TERRY RD	Warning Sirens
SHORT STOP FOOD MART #3	8105 TERRY RD	Grocery
EISENHOWER ELEMENTARY	5300 JESSAMINE LN	School
EISENHOWER SCHOOL	5300 JESSAMINE LN	Warning Sirens
KIDDIE KORNER DAY CARE CENTER	4823 COFFER AVE	Childcare
A MOTHER'S TOUCH CHILD CARE	5000 MARGO AVE	Childcare
ST ANDREW ACADEMY	7724 COLUMBINE DR	School
ST. POLYCARP CHILD DEVELOPMENT	7716 COLUMBINE DR	Childcare
KWIK SHOP INTERNATIONAL	5114 GREENWOOD RD	Grocery
PLEASURE RIDGE CHILDCARE CENTER LLC	5607 GREENWOOD RD	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
GREENWOOD DISCOUNT & LIQUORS	6511 GREENWOOD RD	Grocery
JOHNSON'S DAY CARE	5533 BRUCE AVE	Childcare
PLEASURE RIDGE PARK	6121 GREENWOOD ROAD	USPS
GREENWOOD ELEMENTARY	5801 GREENWOOD RD	School
RIDGEWOOD CHILD DEVELOPMENT	6209 GREENWOOD RD	Childcare
TRACY HALL	5514 YUCCA LN	Childcare
PRP PERFORMING ARTS	5901 GREENWOOD RD	School
PLEASURE RIDGE PARK HIGH	5901 GREENWOOD RD	School
PRP TECH BUILDING	5901 GREENWOOD RD	School
GREENWOOD MARKET	7701 GREENWOOD RD	Grocery
FRAZIER REHAB INSTITUTE - SOUTHWEST	6801 Dixie Manor	Hospital
JUDITH KAELIN	8211 GRANWOOD LN	Childcare
G-N-K'S FAMILY MART	1937 LOWER HUNTERS TR	Grocery
MOTHER GOOSE CHILD CARE	1945 LOWER HUNTERS TR	Childcare
SHACKLETTE ELEMENTARY	5310 MERCURY DR	Childcare
YMCA SACC SHACKLETTE CHILD CARE ENRICHMENT PROGRAM	5310 MERCURY DR	Childcare
BIG LOTS #1686	6201 PRESTON HIGHWAY	Grocery
ELSIE'S DAY CARE & PRESCHOOL 1	2301 LOWER HUNTERS TR	Childcare
AMIE HIGGS	7710 LEGLER DR	Childcare
LILLIE DYE	4112 MELDA LN	Childcare
CHESS' LITTLE RAINBOWS	4118 PIXLEY WAY	Childcare
ELSIE'S DAY CARE & PRESCHOOL 2	2503 RODDY RD	Childcare
MARY TILFORD	5703 JEANINE DR	Childcare
CHRISTINE THOMAS	4110 NORENE LN	Childcare
HOLY CROSS HIGH SCHOOL	5144 DIXIE HY	School
LORETHIA BYRD	6709 HUNTERS CREEK BLVD	Childcare
KERRICK ELEMENTARY	2210 UPPER HUNTERS TC	School

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
KERRICK ELEMENTARY SCHOOL	2212 UPPER HUNTERS TRACE	Warning Sirens
HAPPY FACES	228 GHEENS AVE	Childcare
SOUTHSIDE CHRISTIAN CHILD CARE #12	6301 LOWER HUNTERS TRACE	Childcare
GWANDA CHILDRESS	5400 STEPHEN FOSTER AVE	Childcare
IROQUOIS MIDDLE SCHOOL CEP	5650 SOUTHERN PKWY	Childcare
OLMSTED ACADEMY SOUTH	5650 SOUTHERN PWY	School
LYNN ACRES DAY CARE	5007 SOUTHSIDE DR	Childcare
IROQUOIS HIGH SCHOOL	4615 TAYLOR BLVD	Warning Sirens
NOTRE DAME ACADEMY	1925 LEWISTON DR	Childcare
ST. LAWRENCE CHILD CARE CENTER	1925 LEWISTON DR	Childcare
ALADDIN FOOD MART	2323 ROCKFORD LN	Grocery
T & L GROCERY & BEER	4836 SOUTHSIDE DRIVE	Grocery
WALLER ENVIRONMENTAL	2415 ROCKFORD LN	School
WESTERN HIGH	2501 ROCKFORD LN	School
CHAPEL HILL PRESCHOOL	2307 EMBASSY LN	Childcare
DOLLAR GENERAL STORE	2625 ROCKFORD LANE	Grocery
SAVELLA DICKERSON	4918 ROCKAWAY CI	Childcare
WANDA WRIGHT	2007 KENDALL LN	Childcare
RITE AID #4639	4149 TAYLOR BLVD	Grocery
SAVE-A-LOT	4148 TAYLOR BLVD	Grocery
JANEEN NOBLE	4408 LEEDS RD	Childcare
BEECHMONT	307 W WOODLAWN AVENUE	USPS
FAMILY DOLLAR	4126 TAYLOR BLVD	Grocery
IROQUOIS LIBRARY		Library
REBECCA SHEARIN	4662 CLIFF AVE	Childcare
STACY RICH	1415 DELMAR LN	Childcare
ANGEL HAYES	1406 GARVEY DR	Childcare
HELEN'S HIDEWAY LAKE	2530 @ GUELAT AVENUE	Grocery
SOUTH LOUISVILLE COMMUNITY MINISTRIES	415 1/2 W ASHLAND AVE	Community Ministries

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
SOUTHSIDE CHRISTIAN DAY CARE II	4014 TAYLOR BLVD	Childcare
ENGINE 10 \ TRUCK 8	501 ASHLAND AV	Fire Dept
SUZETTE COX	3230 ROSEWEDGE WAY	Childcare
PATRICIA DUNCAN	4420 TARA AVE	Childcare
SOUTHERN MIDDLE SCHOOL	4530 BELLEVUE AVE	Warning Sirens
STACY TAYLOR	1020 W ASHLAND AVE	Childcare
LATIN CORNER	4000 TAYLOR BLVD	Grocery
CIRCLE K #3224	1255 ASHLAND AVENUE	Grocery
OLMSTED ACADEMY NORTH	4530 BELLEVUE AV	School
KELLY STURGILL	2105 AUBURN DR	Childcare
MARY CLARK	4449 CHARLOTTE ANN DR	Childcare
MARIE TROWEL	3003 TEAKWOOD CI	Childcare
ROSE ANNA HUGHES HOME	2120 BUECHEL BANK RD	Shelter
CANE RUN DAY CARE CENTER	4715 CANE RUN RD	Childcare
THE EARTHGRAINS STORE #203	4119 BARDSTOWN ROAD	Grocery
LAS PALMAS MEXICANA GROCERY	2202 BUECHEL AVENUE-STE. 101	Grocery
DAROU SALAM	2202 BUECHEL AVENUE	Grocery
KENTUCKY HERITAGE MEATS	2221 BUECHEL AVENUE	Grocery
BUECHEL FIRE DEPARTMENT #1	4101 BARDSTOWN RD	Fire Dept
LITTLE ROCKIN ROBINS PRE-SCHOOL AND DAYCARE CENTER	4014 BARDSTOWN RD	Childcare
BUECHEL FPD	4101 BARDSTOWN RD	Warning Sirens
TRAFFIC LMPD	3672 TAYLOR BLVD	LMPD
MILLENIUM MARKET PLACE	4010 BARDSTOWN ROAD	Grocery
LENA'S KWIK SHOP	4000 LEES LANE	Grocery
JACOB ELEMENTARY	3701 E WHEATMORE DR	School
JACOB ELEM. CHILD CARE	3701 E WHEATMORE DR	Childcare
LAKE DREAMLAND FIRE DEPARTMENT #1	4603 CANE RUN RD	Warning Sirens
PLEASURE RIDGE PARK FIRE DEPARTMENT #5	4603 CANE RUN RD	Fire Dept
HELEN'S DAY CARE CENTER INC.	4527 CANE RUN RD	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
SOUTH LOUISVILLE COMM MINISTRIES ADULT DAY CENTER	4100 SOUTHERN PKY	Shelter
KENWOOD MONTESSORI SCHOOL	4102 SOUTHERN PKWY	Childcare
RESURRECTION LIFE CHURCH DAY	4415 OBOE DR	Childcare
LITTLE FRIENDS ACADEMY CHILD DEVELOPMENT	2814 CRUMS LN	Childcare
SEMPLE ELEMENTARY	724 DENMARK ST	School
MOST BLESSED SACRAMENT	1128 BERRY BLVD	Childcare
J.C. CIGARETTE OUTLET #18	2714 CRUMS LN	Grocery
DENMARK GROCERY	901 DENMARK AVE	Grocery
J.C. CIGARETTE OUTLETT	6620 SIX MILE LANE	Grocery
EL SHADDAI CHRISTIAN CHILDCARE CENTER II	1340 BERRY BLVD	Childcare
WHEN I GROW UP CHILD CARE CENTER, LLC	1400 BERRY BLVD	Childcare
SCHAFFNER ELEMENTARY	2701 CRUMS LN	School
ANDY'S MARKET	1638 BERRY BLVD	Grocery
ACTIVE DAY OF LOUISVILLE THIRD STREET	4028 S THIRD ST	Shelter
EDIE CLAYTON	1010 DRESDEN AVE	Childcare
LITTLE PEOPLE'S CHILD CARE	1507 BERRY BOULEVARD	Childcare
BY-PASS LIQUOR STORE	3632 SOUTH 7TH STREET ROAD	Grocery
SISSY'S LIQUORS	3947 SOUTH 5TH STREET	Grocery
LUCY YELDER	1428 SALE AVE	Childcare
GINGER SMITH	3504 SCHAFFNER DR	Childcare
MILL CREEK ELEMENTARY	3816 DIXIE HY	School
FAMILY DOLLAR STORE #1031	3214 HARTLAGE CT	Grocery
THE MEAT PACKAGE STORE & GROCERY	1307 CLARA AVENUE	Grocery
Bashford Manor Mall	3600 Bardstown Rd	Shopping
BEST WESTERN AIRPORT EAST/EXPO CENTER	1921 BISHOP LN	INN
Watterson City Office Park	1930 Bishop Ln.	Office
JANET'S CHILD CARE	2234 MARY CATHERINE DR	Childcare
NEW BEGINNINGS FAMILY SERVICES	1949 GOLDSMITH LN	Childcare
Summerfield Health & Rehab. Center	1877 Farnsley Rd	Nursing Home

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
B-LINE	3291 TAYLOR BLVD.	Grocery
FAMILY DOLLAR STORE #928	3277 TAYLOR BLVD	Grocery
MOTEL 6	3200 KEMMONS DR	MOTEL
RENA MCKISSACK	2319 FARNSLEY RD	Childcare
THERESA RANDOLPH	3236 OLEANDA AVE	Childcare
PIXIE PALACE DAY CARE	3121 TAYLOR BLVD	Childcare
ARCADIA COMMUNITY CENTER FOOD BANK	1426 ARCADE AVENUE #1	Grocery
DERBY DOLLAR STORE	3122 TAYLOR BLVD	Grocery
SUMER FOOD MART	3027 S. 4TH STREET 4-D	Grocery
DENISE BLAIR-SANDERS	1415 EARL AVE	Childcare
PIC PAC	3110 TAYLOR BLVD	Grocery
IRENE CHAMBERS	2607 RALPH AVE	Childcare
TRUCK 9	3511 FINCASTLE RD	Fire Dept
KLONDIKE ELEMENTARY SCHOOL	3807 KLONDIKE LN	Warning Sirens
KIDDIE KAMPUS DAY CARE	3685 POPLAR LEVEL RD	Childcare
AUDUBON SCHOOL	1051 HESS LN	Warning Sirens
JOHN PAUL II ACADEMY	3525 GOLDSMITH LN	Childcare
ST. PIUS X PRE-KINDERGARTEN	3525 GOLDSMITH LN	Childcare
AUDUBON TRADITIONAL ELEM	1051 HESS LN	School
KATHY SMITH	2623 NEBLETT AVE	Childcare
ST. PIUS AFTER SCHOOL CARE	3521GOLDSMITH LN	Childcare
TRAINING LMPD	2911 TAYLOR BLVD	LMPD
CHEKEDA EVERSLEY	2824 S 5TH ST	Childcare
FRAYSER ELEMENTARY	1230 LARCHMONT AV	School
KLEIN DRUGS	2800 S. 4TH STREET	Grocery
LITTLE ANGELS PALACE CHILDCARE	3201 RALPH AVE	Childcare
MONICA BRYANT	3198 MILDRED DR	Childcare
CANE RUN ELEMENTARY SCHOOL	3951 CANE RUN RD	Warning Sirens
WANDA PERKINS	3103 ALTUS DR	Childcare
DRAME'S	1316 CENTRAL AVENUE	Grocery
WALGREEN'S DRUG STORE	2701 S. 4TH STREET	Grocery
LOTS OF TOTS DAY CARE	2901 PINDELL AVE	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
YOUR KID'S PLACE	502 WINKLER AVE	Childcare
CANE RUN ELEMENTARY	3951 CANE RUN RD	Childcare
CANE RUN ELEMENTARY CHILDCARE	3951 CANE RUN RD	Childcare
SPEEDY MART	401 WINKLER AVENUE	Grocery
EMMA'S DAY CARE	1026 TENNESSEE AVE	Childcare
TAYLOR BLVD NUTRITION CENTER	2710 TAYLOR BLVD	Grocery
YMCA SAFE PLACE SERVICES	2400 CRITTENDEN DR	Childcare
YMCA SAFE PLACE SERVICES	2400 CRITTENDEN DR	Childcare
YMCA SAFE PLACE SERVICES	2400 CRITTENDEN DR	Childcare
CARTOON CAPERS/ST. BARNABAS	3044 HIKES LN	Childcare
NORMA CONNOR	3204 KINGSWOOD WAY	Childcare
ENGINE 18	2600 S 4TH ST	Fire Dept
CHILD PALACE (THE)	2607 RODMAN ST	Childcare
KIDDIE KINGDOM DAY CARE	2615 DIXIE HIGHWAY	Childcare
DAWN URRUTIA	707 CREEL AVE	Childcare
DOLLAR GENERAL STORE #7927	2817 DEL RIO PLACE	Grocery
BON AIR REGIONAL LIBRARY		Library
JONETTA ANDERSON	1147 LINCOLN AVE	Childcare
SMALL WORLD CHILD DEVELOPMENT	2337 ALEXANDER AVE	Childcare
Louisville Ladder Corp.	1163 Algonquin Pkwy	Manufacturing
SOUTHSIDE CHRISTIAN DAY CARE	2220 DIXIE HWY	Childcare
DOLLAR TREE #1898	4060 TAYLORSVILLE ROAD	Grocery
FIRST GETHSEMANE CHILD CARE	1159 ALGONQUIN PKWY	Childcare
ST. PAUL'S PRE-SCHOOL &	4700 LOWE RD	Childcare
NEW HORIZON CHILD ENRICHMENT CENTER II LLC	2204 DIXIE HWY	Childcare
ST XAVIER HIGH	1609 POPLAR LEVEL RD	School
MANUAL STADIUM		Theatre/Stadium
Christopher East Health Care	4200 Browns Ln	Nursing Home
B-LINE FOOD MART	2133 DIXIE HWY	Grocery
CATIRA BENEDICT	1802 ALLSTON AVE	Childcare
JANICE BRANCH-WHITE	1806 ALLSTON AVE	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
JOHNETTE HOUSTON-BARTON	1826 OREGON AVE	Childcare
Pine Tree Villa	4604 Lowe Rd	Nursing Home
LA'NEESE FLIPPINS	2123 OREGON AVE	Childcare
DUPONT MANUAL HIGH	120 W LEE ST	School
ST. MARK UNITED METHODIST PRE	4611 LOWE RD	Childcare
HENRIETTA TAYLOR	2108 DIXDALE AVE	Childcare
AMSHOFF'S KIDCARE	1037 E BURNETT AVE	Childcare
COLUMBINE BED AND BREAKFAST	1707 S 3RD ST	BED AND BREAKFAST
DAYS INN CENTRAL	1620 ARTHUR ST.	INN
JOYCE GREEN	1825 DIXDALE AVE	Childcare
DAYS INN	1620 ARTHUR STREET	Grocery
Twinbrook Nursing Home & Rehabilitation Center	3526 Dutchmans Ln	Nursing Home
NOE MIDDLE	121 W LEE ST	School
QUALITY INN AND SUITES AIRPORT	311 E GAULBERT AVE	INN
Algonquin Manor	3400 Cane Run Road	Shopping
SAM MEYERS HALL	1517 S 2ND ST	School
SAVE-A-LOT	1806 DIXIE HIGHWAY	Grocery
JEWISH DAY SCHOOL	3700 DUTCHMANS LN	School
HADORN BAKERY	1800 DIXIE HWY	Grocery
AUDREY LANIER	702 E BURNETT AVE	Childcare
NOE MIDDLE SCHOOL	121 W LEE ST	Childcare
SHALOM TOWERS GROCERY	3650 DUTCHMANS LANE	Grocery
YOUTH PERFORMING ARTS SCHOOL	1517 S 2ND ST	School
SHANNEN HEYMAN	3520 ALGONQUIN PKWY	Childcare
THE GRAND MARKET	1731 DIXIE HGWY	Grocery
CAROLYN BRECKENRIDGE	232 E BURNETT AVE	Childcare
KETA'S KIDS FAMILY DAY CARE	1815 BURWELL AVE	Childcare
FREEDOM HOUSE/SHELBY MEN'S CENTER	1432 S SHELBY ST	Shelter
BETTY DOZIER	2804 CONESTOGA AVE	Childcare
MO'S FOOD MARKET	1036 GOSS AVENUE	Grocery
MATTINGLY CENTER, INC.	1520 BAXTER AVE	Shelter

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
LEE EDNA FLOYD	2108 W LEE ST	Childcare
HIGHLANDS EDUCATIONAL CENTER	1436 EASTERN PKWY	Childcare
HIGHLANDS EDUCATIONAL CENTER FOR KIDS	1436 EASTERN PKWY	Childcare
HIGHLANDS EDUCATIONAL CENTER FOR KIDS	1444 EASTERN PKWY	Childcare
SAMUEL CULBERSTSON MANSION HISTORIC INN	1432 S 3RD ST	BED AND BREAKFAST
HAUCK'S HANDY STORE	1000 GOSS AVE	Grocery
Kentucky Nursing Home Association	1705 Stevens Ave	Nursing Home
CARTER TRADITIONAL ELEM	3600 BOHNE AV	Childcare
THE SALVATION ARMY CHILD DEVELOPMENT CENTER-FAMILY	3600 BOHNE AVE	Childcare
EARLY HEAD START PROGRAM	3610 BOHNE AVE	Childcare
UJIMA NEIGHBORHOOD PLACE	3610 BOHNE AVENUE	Childcare
DUVALLE EDUCATION CENTER	3610 BOHNE AV	School
NINA HILL	2330 W GAULBERT AVE	Childcare
WALGREEN'S #3776	1475 DIXIE HIGHWAY	Grocery
2ND DIVISION LMPD	3419 BOHNE AVE	LMPD
CAROLYN ROSS	1705 LANG CT	Childcare
WELLSPRING	1382 S 3RD ST	Shelter
ENGINE 19	3401 BOHNE AV	Fire Dept
ROLONDA SMITH	1613 S 32ND ST	Childcare
ENGINE 15	1328 S PRESTON ST	Fire Dept
4TH DIVISION LMPD	1340 S 4TH ST	LMPD
TAMMIE BROWN	3718 STRATTON AVE	Childcare
FAMILY EMERGENCY SHELTER	1321 S PRESTON ST	Shelter
FOLLOW-UP FOR SUCCESS	1319 S PRESTON ST	Shelter
CENTRAL PARK BED & BREAKFAST	1353 S 4TH ST	BED AND BREAKFAST
SANDRA JOHNSON	1532 S 30TH ST	Childcare
INN AT THE PARK	1332 S 4TH ST	BED AND BREAKFAST
R.E.A.C.H. OF LOUISVILLE	501 PARK AVE	Childcare
LOUISVILLE METRO POLICE 4TH DISTRICT/KENNEDY SCHOOL	3807 YOUNG AVE	Warning Sirens
NEW BEGINNINGS FOR WOMEN	1261 S BROOK ST	Shelter

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
YVONNE WILLIAMSON	3518 CHAUNCEY AVE	Childcare
MORE GRACE CHRISTIAN ACADEMY	100 W ORMSBY AVE	Childcare
ALL MY CHILDREN CHILD DEVELOPMENT CENTER	523 PARK AVE	Childcare
DUPONT MANSION BED AND BREAKFAST	1317 S 4TH ST	BED AND BREAKFAST
KENNEDY MONTESSORI ELEMENTARY	3800 GIBSON LN	School
DAIRY MART #726	1056 E. OAK ST	Grocery
ASIA INSTITUTE - CRANE HOUSE		Museum
THE MAYFLOWER	425 W ORMSBY ST	EXTENDED STAY
CAMPION HOUSE	1238 S 3RD ST	BED AND BREAKFAST
YMCA SACC BLOOM CHILDCARE ENRICHMENT PROGRAM	930 MARY ST	Childcare
WILLIE WILSON	1435 HAZEL ST	Childcare
EL SHADDAI CHRISTIAN CHILD CARE CENTER	1230 S 3RD ST	Childcare
JANICE MERGERSON	502 E OAK ST	Childcare
1882 ALEKSANDER HOUSE BED AND BREAKFAST	1213 S 1ST ST	BED AND BREAKFAST
HILLEBRAND HOUSE GROCERY	1235 S 3RD ST	Grocery
PURITAN MINI MART	1244 SOUTH 4TH STREET	Grocery
CHILDREN ARE OUR FUTURE	2202 ST LOUIS AVE	Childcare
DISMAS CHARITIES LOUISVILLE	124 W Oak	CHARITY
GLOBAL INERNET COFFEE	1213 S. 4TH STREET, SUITE 100	Grocery
BS SMOKE FOR LESS	125 W. OAK STREET	Grocery
EARLENE TAYLOR	2310 ST LOUIS AVE	Childcare
Treyton Oak Towers/Independent & Convalescent	211 W. Oak St	Nursing Home
DAILY MART	1320 DIXIE HWY	Grocery
TYRA SUTTON	3108 WOODLAND AVE	Childcare
RITE AID #4629	409 W. OAK ST	Grocery
FAMILY DOLLAR STORE #1434	431 W OAK ST	Grocery
HOUSE OF RUTH	607 E ST. CATHERINE ST	Shelter
B-LINE	700 WEST OAK STREET	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
ST. JUDE WOMEN'S RECOVERY CENTER	431 ET ST. CATHERINE ST	Shelter
MAUD BOOTH HOUSE	1131 S 1ST ST	Shelter
JOHNSON TRADITIONAL MIDDLE	2509 WILSON AV	School
OZANAM INN	1034 S JACKSON ST	Shelter
EMISHA DARBY	214 E ST CATHERINE ST	Childcare
CIRCLE K #57	309 E ST CATHERINE ST	Grocery
SIMON HALL	1022 S JACKSON ST	Shelter
SHIRLEY POINDEXTER	323 E ST CATHERINE ST	Childcare
VINE STREET BAPTIST CHURCH	960 VINE ST	Childcare
BUCKHORN OF LOUISVILLE	1115 GARVIN PL	Childcare
DEPAUL TRANSITIONAL APARTMENTS	1015 S PRESTON ST	Shelter
SHIRTIKA COLEMAN	531 E KENTUCKY ST	Childcare
FOSTER TRADITIONAL ACADEMY	1401 S 41ST ST	Childcare
YMCA SACC FOSTER CHILDCARE ENRICHMENT PROGRAM	1401 S 41ST ST	Childcare
MATTIE LITTLE	2208 W OAK ST	Childcare
1888 HISTORIC ROCKING HORSE MANOR	1022 S 3RD ST	BED AND BREAKFAST
LIL' KINGS & QUEENS I	3216 DUMESNIL ST	Childcare
ENGELHARD ELEMENTARY	1004 S 1ST ST	School
KIDDIE LAND DAY CARE CENTER	1152 DIXIE HWY	Childcare
GERALDINE JONES	2104 HALE AVE	Childcare
The Altenheim	936 Barret Ave	Nursing Home
MEMORIAL AUDITORIUM PARKING LOT	1000 S 5TH ST	Warning Sirens
JUANITA RICHARDSON	2216 HALE AVE	Childcare
JUST LIKE MOM'S	3509 DUMESNIL	Childcare
COMMUNITY CARE CENTER	1321 CECIL AVE	Childcare
EMMA BYARS	2215 HALE AVE	Childcare
LOGAN & BRECKINRIDGE STREETS LOT	907 LOGAN ST	Warning Sirens
MEMORIAL AUDITORIUM		Theatre/Stadium
BIG GENE'S GROCERY	3328 VIRGINIA AVE	Grocery
CRIMES AGAINST CHILDREN LMPD	512 W KENTUCKY ST	LMPD

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
HIGHLANDS COMMUNITY MINISTRIES	1228 E BRECKENRIDGE ST	Community Ministries
WHEATLEY ELEMENTARY	1107 S 17TH ST	School
BELMONT VILLAGE	4600 BOWLING BLVD	Shelter
JEFF CNTY TRADITIONAL MIDDLE	1418 MORTON AV	School
Christian Health Center - - Assisted Living	960 S. 4th St	Nursing Home
LETITIA MCBROOM	3237 VIRGINIA AVE	Childcare
SPECIALTY (STD) CLINIC	850 BARRET AVENUE	Clinic
SANDRA BELL	4206 WINNROSE WAY	Childcare
CHAPEL HOUSE GROCERY	945 SOUTH 5TH STREET	Grocery
ANNA BODDIE	4141 WINNROSE WAY	Childcare
ENGINE 9	617 E BRECKINRIDGE ST	Fire Dept
Christian Health Center - - Independent Living	945 S. 5th St	Nursing Home
PUBLIC INTEGRITY LMPD	810 BARRETT AVE	LMPD
EAST NEIGHBORHOOD PLACE	810 BARRET AVENUE	LMPD
HAWTHORN SUITES	751 CYPRESS STATION DR	EXTENDED STAY
GRANNY GAIL'S CHILDCARE	1137 S 32ND ST	Childcare
PATRICIA WARD	1825 GRAND AVE	Childcare
ANNIE SUMMERS	1839 GRAND AVE	Childcare
DEBORAH INGRAM	1140 S 34TH ST	Childcare
HAPPY'S MARKET	1201 CECIL	Grocery
Christian Health Center & Convalescent Home	920 S. Fourth St	Nursing Home
PRESBYTERIAN CHILD DEVELOPMENT	600 E LAMPTON ST	Childcare
MEYZEEK MIDDLE	828 S JACKSON ST	School
NEIGHBORHOOD FOOD MART	542 LAMPTON ST	Grocery
EDNA JORDON	1124 CECIL AVE	Childcare
PRESENTATION ACADEMY HIGH	861 S 4TH ST	School
MILDRED WILLIAMS	1846 W KENTUCKY ST	Childcare
SPALDING UNIVERSITY	851 S. Fourth St	College
AYINDE CHILD YOUTH & FAMILY DEVELOPMENT CENTER, IN	517 W BRECKINRIDGE ST	Childcare
NATASHA GERARD	1530 GARLAND AVE	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
IRIE LUCAS	2621 GREENWOOD AVE	Childcare
RIB & ED'S SUPER MARKET	2300 W. KENTUCKY ST	Grocery
HIGHLAND LATIN SCHOOL	10901 SHELBYVILLE RD	School
LADONNA WASHBURN	4220 SUNSET AVE	Childcare
GLADYS NICHOLS	4226 SUNSET AVE	Childcare
ST. BENEDICT CENTER FOR EARLY	946 S 25th ST	Childcare
WILLIE BETHEL	3326 GREENWOOD AVE	Childcare
DOWNTOWN	835 S 7TH STREET	USPS
CAROL FLOYD	4107 GRAND AVE	Childcare
SPRING MEADOWS CHILDREN'S HOME	10901 SHELBYVILLE RD	Childcare
CECIL PAYNE CAFE	1010 S. 32ND ST	Grocery
TARA GOODLETT	2308 GARLAND AVE	Childcare
NIKKI COOK	2320 GARLAND AVE	Childcare
TWEETIE BIRD'S CHILD CARE CENTER	4106 GREENWOOD AVE	Childcare
KIMBERLY MELSON	3329 W KENTUCKY ST	Childcare
LITTLE HONEY'S DAYCARE	3333 W KENTUCKY ST	Childcare
BEST OF FRIENDS ENRICHMENT CTR., INC.	908 S 32ND ST	Childcare
E & R QUICK STOP	4501 GREENWOOD AVENUE	Grocery
SUNNY ANGELS DAY CARE	903 S32ND ST	Childcare
SUNNY ANGELS DAY CARE II	856 S 32ND ST	Childcare
GREATER GOOD HOPE CHRISTIAN ACADEMY	840 S 26TH ST	Childcare
WALDEN THEATRE		Theatre/Stadium
BETTIE FLETCHER	829 DEARBORN AVE	Childcare
KIDS PLACE CHILD CARE PROGRAM	844 DEARBORN AVE	Childcare
SHARENA ALLEN-MASK	2302 MAPLE ST	Childcare
ACKERLY	200 E CHESTNUT ST	School
TODDLER BEAR DAY CARE	819 S 39TH ST	Childcare
MARSHA RICHARDSON	830 SO 41ST ST	Childcare
NORTON CHILDREN'S HOSPITAL	231 E. Chestnut St	Hospital
DONNA DAUGHERTY	802 S 35TH ST	Childcare
FRAZIER REHAB INSTITUTE	220 Abraham Flexner Way	Hospital
BARNES & NOBLE COLLEGE #254	555 S. FLOYD STREET	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
UNIVERSITY OF LOUISVILLE HOSPITAL	530 S. Jackson St	Hospital
JEWISH HOSPITAL	200 Abraham Flexner Way	Hospital
B J'S CHILD CARE	734 S 38TH ST	Childcare
RANA BAILEY	734 S 42ND ST	Childcare
JEFFERSON STATE DAY CARE	800 WCHESTNUT ST	Childcare
CORNERSTONE CHILD DEVELOPMENT CENTER, INC.	211 BROWNS LN	Childcare
RUDD HEART AND LUNG CENTER	201 Abraham Flexner Way	Hospital
CAFE DOSKER STOP & SHOP	413 E. MUHAMMAD ALI BLVD	Grocery
WALTETTA RHODES	723 DEARBORN AVE	Childcare
CHESTNUT STREET BRANCH YMCA	930 W CHESTNUT ST	Childcare
BELINDA SHONTEE	725 S 43RD ST	Childcare
WESTERN LIBRARY		Library
CHRIST THE KING LEARNING CENTER	724 S 44TH ST	Childcare
ETA DAYCARE CENTER, LLC	724 S 44TH ST	Childcare
GRANNY'S ANGELS	1517 MAGAZINE ST	Childcare
JEFFERSON COMMUNITY AND TECH. COLLEGE - TECH	727 W. Chestnut St	College
FAMILY LEARNING CENTER	3620 W BROADWAY	Childcare
KIDS KRADLE CHILD CARE AND DEVELOPMENT CENTER	3632 W BROADWAY	Childcare
SHAWNEE LIBRARY		Library
ETA DAYCARE CENTER	724 S 44TH ST	Childcare
WALGREEN'S	3421 WEST BROADWAY	Grocery
B-LINE FOOD MART #A	3501 WEST BROADWAY	Grocery
BIG LOTS #226	4121 SHELBYVILLE RD	Grocery
EMMA L MINNIS JR ACADEMY	1939 MAGAZINE ST	School
LIL ANGELS ENRICHMENT	3719 W BROADWAY	Childcare
MARTHA DOYLE	4111 W BROADWAY	Childcare
KIDDIE HOTEL	4141 W BROADWAY	Childcare
GWENDOLYN JORDAN	692 MADELON CT	Childcare
LIL ANGELS CHILD CARE DEVELOPMENT CENTER	687 S 38TH ST	Childcare
TASHIBA JORDAN	683 MADELON CT	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
CELESTE NICHOLS	656 S 34TH ST	Childcare
YENNES FOOD MART	850 W. MUHAMMAD ALI BLVD	Grocery
VERNA JONES	671 S 40TH ST	Childcare
LANITA BELL	675 S 38TH ST	Childcare
MINI-VERSITY WEST CHILD	631 S 28TH ST	Childcare
ELDERCLUB AT OAK AND ACORN	631 S 28TH ST	Childcare
CVS PHARMACY #6210	432 S. 4TH STREET	Grocery
Louisville Galleria	400 S. Fourth St.	Shopping
METRO VILLAGE	669 S 41ST ST	Childcare
METRO VILLAGE	669 S 41ST ST	Childcare
METRO VILLAGE	669 S 41ST ST	Childcare
FAIRFIELD INN & SUITES LOUISVILLE DOWNTOWN	100 EAST JEFFERSON STREET	HOTEL
JOINT EMERGENCY SERVICES (JOINT ESU) LMPD	410 S 5TH ST	LMPD
WALGREENS #02924	2368 FRANKFORT AVENUE	Grocery
INSPECTIONS AND COMPLIANCE LMPD	400 S 4TH ST	LMPD
UNSELD CHILD CARE & DEVELOPMENT CENTER - EAST	219 S PRESTON ST	Childcare
ENGINE 5 / TRUCK 2	235 E JEFFERSON ST	Fire Dept
JEFFERSON COUNTY JAIL	400 S 6th st	COUNTY JAIL
HAMPTON INN DOWNTOWN LOUISVILLE	101 E JEFFERSON ST	INN
BETTY'S CHILD CARE	626 S 35TH ST	Childcare
SUMSHEE FAMILY ROOM	204 S. PRESTON STREET	Grocery
TAMARA WALKER	1607 W MUHAMMAD ALI BLVD	Childcare
QUIZNO'S VENDING	5TH & JEFFERSON STREET	Grocery
JEFFERSON COUNTY JAIL	600 W Jefferson St	COUNTY JAIL
JEFFERSON COUNTYYOUTH CENTER	720 W. Jefferson St	YOUTH CENTER
Citizens Plaza	500 W. Jefferson St.	Office
RESIDENCE INN BY MARRIOT DOWNTOWN	333 E MARKET ST	INN
LOUISVILLE METRO YOUTH CENTER	720 W JEFFERSON ST	School
CENTRAL STADIUM		Theatre/Stadium

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
FAMILY VALUES CHILDCARE	2516 W MADISON ST	Childcare
SARETHA'S WEST END CHILD	2331 WMADISON ST	Childcare
MINI-VERSITY DOWNTOWN CHILD	306 ROY WILKINS	Childcare
Kentucky Home Life Building	239 S. Fifth St.	Office
METRO POLICE HEADQUARTERS LMPD	633 W JEFFERSON ST	LMPD
RESEARCH AND DEVELOPMENT LMPD	633 W JEFFERSON ST	LMPD
CRIME INFORMATION CENTER LMPD	633 W JEFFERSON ST	LMPD
TECHNICAL SERVICES LMPD	633 W JEFFERSON ST	LMPD
PUBLIC SERVICE COUNTER LMPD	633 W JEFFERSON ST	LMPD
FALSE ALARM REDUCTION LMPD	633 W JEFFERSON ST	LMPD
HOMICIDE LMPD	633 W JEFFERSON ST	LMPD
COLD CASE LMPD	633 W JEFFERSON ST	LMPD
MISSING PERSONS LMPD	633 W JEFFERSON ST	LMPD
ROBBERY LMPD	633 W JEFFERSON ST	LMPD
FINANCIAL CRIMES (FRAUD) LMPD	633 W JEFFERSON ST	LMPD
SEX CRIMES LMPD	633 W JEFFERSON ST	LMPD
CRIMES AGAINST SENIORS LMPD	633 W JEFFERSON ST	LMPD
VIDEO FORENSICS LMPD	633 W JEFFERSON ST	LMPD
CRIME SCENE LMPD	633 W JEFFERSON ST	LMPD
POLYGRAPH LMPD	633 W JEFFERSON ST	LMPD
PHOTO LAB LMPD	633 W JEFFERSON ST	LMPD
MEDIA AND PUBLIC RELATIONS LMPD	633 W JEFFERSON ST	LMPD
NARCOTICS LMPD	633 W JEFFERSON ST	LMPD
OPEN RECORDS LMPD	633 W JEFFERSON ST	LMPD
COMMUNITY RELATIONS LMPD	633 W JEFFERSON ST	LMPD
DIVE TEAM LMPD	633 W JEFFERSON ST	LMPD
HOSTAGE NEGOTIATING (HNT) LMPD	633 W JEFFERSON ST	LMPD
RIVER PATROL LMPD	633 W JEFFERSON ST	LMPD
SPECIAL EVENTS LMPD	633 W JEFFERSON ST	LMPD
SPECIAL WEAPONS AND TACTICS (SWAT) LMPD	633 W JEFFERSON ST	LMPD
FISCAL COURT SNACK BAR	531 COURT PLACE	Grocery
LOUISVILLE METRO FISCAL COURT BLDG	531 COURT PLACE	Warning Sirens
First Trust Center	200 S. Fifth St.	Office

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
SMOKER'S CORNER CAFE	440 WEST MARKET STREET	Grocery
Legal Arts	200 S. Seventh St.	Office
RIVER CITY CORRECTIONS	214 S. 8th St	CORRECTIONAL CENTER
DEANA MCATEE	3503 RIVERPARK DR	Childcare
MOTHER'S FRIEND DAY CARE	3800 RIVER PARK DR	Childcare
515 Building	515 W Market St	Office
BOBBIE'S BEE-Z BABIES II INC.	608 S 41ST ST	Childcare
KADER #1	3801 RIVER PARK DRIVE	Grocery
JESSE MILLER	3723 RIVERPARK DR	Childcare
BYCK ELEMENTARY	2328 CEDAR ST	School
MARCHMAN LEARNING CENTER (THE)	3725 RIVER PARK DR	Childcare
YVETTE BROWN	4110 RIVER PARK DR	Childcare
BERNADETTE HEREFORD	3540 VERMONT AVE	Childcare
One Riverfront Plaza	401 W. Main St.	Office
STRAUS	101 S. 5TH STREET, SUITE 111	Grocery
CHILD CARE UNIVERSITY #1	522 W MAIN ST	Childcare
National City Tower	101 S. Fifth St.	Office
21C MUSEUM		Museum
21C MUSEUM HOTEL	700 WEST MAIN ST	HOTEL
SLUGGER MUSEUM		Museum
YOUNG ELEMENTARY	3526 W MUHAMMAD ALI BV	School
Hillerich & Bradsby Co.	800 W Main St	Manufacturing
ADRIANN GATEWOOD	2700 W JEFFERSON ST	Childcare
KING ELEMENTARY	4325 VERMONT AV	Childcare
KING ELEMENTARY CHILD CARE	4325 VERMONT AVE	Childcare
KADER'S MARKET	4100 MUHAMMAD ALI BLVD	Grocery
JELLYBEAN CLUBHOUSE DAYCARE	210 S 24TH ST	Childcare
SISTER VISITOR CENTER	2235 W MARKET ST	Community Ministries

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
PIC-PAC	2421 W MARKET ST	Grocery
APRICOT HOUSE CHILD CARE II	400 S 41ST ST	Childcare
APRICOT HOUSE CHILD CARE	4140 LARKWOOD AVE	Childcare
LA-NITA BRYANT	4204 LARKWOOD AVE	Childcare
Beverly Healthcare-Mt Holly	446 Mount Holly Ave	Nursing Home
SHALONDA ALLEN	2124 W MAIN ST	Childcare
Bashford East Healthcare	446 Mt. Holly Ave	Nursing Home
DAIRY MART	2728 W. MARKET ST	Grocery
HEVERIN HOUSE	1700 ROWAN ST	Shelter
GLENNETTA WINSTEAD	2525 W MAIN ST	Childcare
WESTERN MIDDLE	2201 W MAIN ST	School
MISS MARY'S DAYCARE	3509 W MARKET ST	Childcare
NEIGHBORHOOD HOUSE PRESCHOOL	201 N 25TH ST	Childcare
GRANNY'S ANGELS II	1710 BANK ST	Childcare
DORIS SHACKLETT	244 S 43RD ST	Childcare
ANGELA STONER	317 N 19TH ST	Childcare
FAMILY CIRCLE HOME DAY	111 N 34TH ST	Childcare
SHAWNEE HIGH SCHOOL	4018 W MARKET ST	Warning Sirens
MISS MARY'S DAYCARE TOO!	100 N 38TH ST	Childcare
WEST END FOOD MART	4301 WEST MARKET STREET	Grocery
FORTY-FIRST STREET CHILD CARE	119 S 41ST ST	Childcare
JESSIE GREEN	109 N 38TH ST	Childcare
DOMINIQUE WICKER	4425 W MARKET ST	Childcare
ATKINSON ELEMENTARY	2811 DUNCAN ST	School
SHOP RIGHT TOBACCO OUTLET	2001 BANK ST	Grocery
SHERYL'S KIDDIE KASTLE	205 N 38TH ST	Childcare
ENGINE 6	2500 GRIFFITH AV	Fire Dept
SHERICKA REED	218 N 39TH ST	Childcare
Episcopalian Church Home	1201 Lyndon Ln	Nursing Home
HARAMBEE PRE-SCHOOL ACADEMY	300 N42ND ST	Childcare
CIRCLE K #3231	2100 PORTLAND AVE	Grocery
1ST DIVISION LMPD	416 N 29TH ST	LMPD

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE EXTREME HEAT		
NAME	**ADDRESS**	**FACILITY TYPE**
BOMB LMPD	416 N 29TH ST	LMPD
PORTLAND MUSEUM		Museum
PORTLAND CHRISTIAN SCHOOL	2500 PORTLAND AV	School
ANGELETTE YOUNG	412 N 42ND ST	Childcare
PORTLAND WIC CLINIC	2215 PORTLAND AVENUE	Clinic
SUBURBAN CHRISTIAN CHURCH	7515 WESTPORT RD	Childcare
PITT ACADEMY	7515 WESTPORT RD	School
PORTLAND BOYS & GIRLS CLUB	2509 PORTLAND AVE	Warning Sirens
2ND STOP FOOD MART	441 N 41ST ST	Grocery
PORTLAND GROCERY	2644 PORTLAND AVE	Grocery
WALT HILL CHILD DEVELOPMENT	3935 BANK ST	Childcare
Jefferson Place	1705 Herr Ln	Nursing Home
ARNETTA MOORE	531 N 42ND ST	Childcare
FAMILY DOLLAR STORE #750	3022 W PORTLAND AVE	Grocery
PHYLLIS MOSLEY	3800 NORTHWESTERN PKWY	Childcare
CVS/PHARMACY #6199	3130 PORTLAND	Grocery
PORTLAND ELEMENTARY	3410 NORTHWESTERN PW	School
Jefferson Manor	1801 Lynn Way	Nursing Home
PORTLAND LIBRARY		Library

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
TIFFANY BUNTON	5404 HASBROOK DR	Childcare
PEDDLERS MALL	11310 PRESTON HIGHWAY	Grocery
PEDDLERS MALL BOOTH #285	11310 PRESTON HIGHWAY	Grocery
PEDDLERS MALL	11310 PRESTON HIGHWAY	Grocery
PEDDLER'S MALL BOOTH	11310 PRESTON HIGHWAY	Grocery
PEDDLERS MALL HIGHVIEW	11310 PRESTON HIGHWAY	Grocery
SHARA BROM	11310 PRESTON HIGHWAY	Grocery
CVS/PHARMACY #6206	5121 ANTLE DRIVE	Grocery
WALGREEN'S #05813	11930 STANDIFORD PLAZA DR	Grocery
OKOLONA FIRE DEPARTMENT #2	10508 OLD PRESTON HWY	Fire Dept
TERRY LUNDGREN	5111 MAPLE SPRING DR	Childcare
BEVERLY MATTINGLY	5700 ARCHTREE PL	Childcare
LAUKHUF ELEMENTARY	5100 CAPEWOOD DR	Childcare
LAUKHAUF ELEMENTARY CHILD CARE	5100 CAPEWOOD DR	Childcare
WILLADEAN GNADINGER	9901 CHAPEL HILL RD	Childcare
KNIGHT MIDDLE	9803 BLUE LICK RD	School
ANGELA WATHEN	9819 INDIAN FALLS DR	Childcare
BLUE LICK ELEMENTARY	9801 BLUE LICK RD	Childcare
YMCA SACC BLUE LICK CHILDCARE ENRICHMENT PROGRAM	9801 BLUE LICK RD	Childcare
Silver Heights Plaza	3811 Freedom Way	Shopping
A-Z 1.2.3 DAY CARE, INC.	9310 PRESTON HIGHWAY	Childcare
ANGELS ARE US CHILD CARE	9218 BLUE LICK RD	Childcare
DOLLAR GENERAL STORE #0992	9308 BLUE LICK ROAD	Grocery
IGA PIC PAC	9304 BLUE LICK RD	Grocery
ELIZABETH SHINKLE	5800 MIDNIGHT LN	Childcare
TONYA CALBERT	8500 LONG RIFLE CT	Childcare
BEST STOP FOOD MART	9200 BLUE LICK RD	Grocery
SHONTA WARE	9210 MATILDA CT	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
CIRCE K #109	9111 BLUE LICK ROAD	Grocery
Wesley Manor Retirement Community	5012 E. Manslick Rd	Nursing Home
MS. PAM & PATTYS KIDDIE KARE, INC. NORTH	4603 E MANSLICK RD	Childcare
MAPLE GROVE BAPTIST DAY CARE	5911 E MANSLICK RD	Childcare
Regency Health Care Center	1550 Raydale Dr	Nursing Home
LOUISVILLE BIBLE COLLEGE	8013 Damascus Rd	College
SOUTHERN HIGH	8620 PRESTON HY	School
PAM SNAWDER	8102 FLORIST RD	Childcare
ST RITA	8709 PRESTON HY	Childcare
ST. RITA AFTERCARE	8709 PRESTON HIGHWAY	Childcare
RITE AID #4648	8651 PRESTON HIGHWAY	Grocery
DOLLAR GENERAL STORE #2571	8641 PRESTON HIGHWAY	Grocery
TODDLERS AND TOTS DAY CARE	8301 OLD SHEPHERDSVILLE RD	Childcare
OKOLONA FIRE DEPARTMENT #1	8501 PRESTON HWY	Fire Dept
HIGHVIEW FPD #2	8001 SMYRNA PKY	Warning Sirens
HIGHVIEW FIRE DEPARTMENT #2	8001 SMYRNA PKY	Fire Dept
VICTORIA WILDT	8100 APPLEGATE CT	Childcare
RITA BLACKWELL	7209 RAMBO WAY	Childcare
SPEEDY MART #246	8003 OLD SHEPHERDSVILLE ROAD	Grocery
KIDS OF THE FUTURE	7803 LAUREL RIDGE RD	Childcare
BATES ELEM. SCHOOL	7601 BARDSTOWN RD	Warning Sirens
BATES ELEMENTARY	7601 BARDSTOWN RD	Childcare
BATES ELEMENTARY CHILDCARE	7601 BARDSTOWN RD	Childcare
SUMMIT HEIGHTS UNITED	7400 OUTER LOOP	Childcare
ROBBIENAI SMITH	6600 OUTER LOOP	Childcare
DOLLAR GENERAL STORE	7513 OUTER LOOP	Grocery
CHILDREN'S UNIVERSE #4	8019 BEULAH CHURCH RD	Childcare
JC'S CIGARETTE OUTLET #19	6720 OUTER LOOP	Grocery
FOR HEAVEN'S SAKE CHRISTIAN ACADEMY	4910 OUTER LOOP	Childcare
DORIS OECHSLE FAMILY CHILD	10304 WINGFIELD RD	Childcare
7TH DIVISION LMPD	7201 OUTER LOOP	LMPD
LEARNING TREE (THE)	6701 OUTER LOOP	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
SPEEDY MART	7920 FEGENBUSH LANE	Grocery
WAL-MART STORE #1246	4840 OUTER LOOP	Grocery
HICKORY FARMS	4800 OUTER LOOP	Grocery
GREAT AMERICAN COOKIE	4801 OUTER LOOP	Grocery
THE DOLLAR TREE STORE #861	4801 OUTER LOOP BLDG #861	Grocery
JOY-TI CHILD CARE	8600 BEULAH CHURCH RD	Childcare
WALGREEN'S	7914 FEGENBUSH LANE	Grocery
R'S DONUTS	5919 OUTER LOOP	Grocery
Jefferson Mall	4801 Outer Loop Rd.	Shopping
SMYRNA ELEMENTARY	6401 OUTER LOOP	School
SPECIAL RESPONSE TEAM (SRT) LMPD	4711 OUTER LOOP	LMPD
SONSHINE HOUSE CHRISTIAN	6105 OUTER LOOP	Childcare
NANCY'S HOUSE OF CERAMIC'S	5718 OUTER LOOP	Grocery
PEDDLER'S MALL #902	5718 OUTER LOOP	Grocery
ELMER FOSTER	5718 OUTER LOOP	Grocery
RITE AID #4647	5615 OUTER LOOP	Grocery
FAMILY DOLLAR #4618	5609 OUTER LOOP	Grocery
MOORE HIGH	6415 OUTER LOOP	School
ST ATHANASIUS	5915 OUTER LOOP	Childcare
S.A.F.E. PROGRAM	5915 OUTER LOOP	Childcare
WHITEFIELD ACADEMY	7711 FEGENBUSH LN	Childcare
YMCA/HIGHVIEW BAPTIST SCHOOL	7711 FEGENBUSH LN	Childcare
HIGHVIEW BAPTIST PRESCHOOL	7711 FEGENBUSH LN	Childcare
HARTSTERN ELEMENTARY	5200 MORNINGSIDE WY	School
HIGHVIEW CHILDRENS ACADEMY	7406 FEGENBUSH LN	Childcare
PASTRY PLUS	7407-B FEGENBUSH LANE	Grocery
PLAYWORLD CHILD DEVELOPMENT	7200 PEPPERMILL LN	Childcare
HIGHVIEW FIRE DEPARTMENT #1	7308 FEGENBUSH LN	Fire Dept
HIGHVIEW FPD #1	7308 FEGENBUSH LN	Warning Sirens
VALARIE WILSON	6202 WHISPERING HILLS BLVD	Childcare
FERN CREEK/HIGHVIEW UNITED MINISTRIES ADULT	7502 TANGELO DR	Shelter

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
ST. ALBANS CHILD CARE	9004 BEULAH CHURCH	Childcare
ST. BERNARD PRESCHOOL & AFTER	7501 TANGELO DR	Childcare
ST BERNARD	7500 TANGELO DR	School
FERN CREEK/HIGHVIEW UNITED MINISTRIES	9300 BEULAH CHURCH RD	Community Ministries
BEULAH PRE-SCHOOL	6704 BARDSTOWN RD	Childcare
LUHR ELEMENTARY	6900 FEGENBUSH LN	Childcare
LUHR ELEMENTARY CHILD CARE	6900 FEGENBUSH LN	Childcare
CORNERSTONE ACADEMY	6300 BILLTOWN RD	School
DOLLAR GENERAL STORE	6800 OLD SHEPHERDSVILLE ROAD	Grocery
BUNTON, TIFFANY	6500 MONTEGO BAY RD	Childcare
FERN CREEK	6302 BARDSTOWN RD	USPS
DAIRY MART #703	6325 BARDSTOWN ROAD	Grocery
LA SIERRA TARASCA	6501 OLD SHEPHERDSVILLE ROAD	Grocery
HIGHVIEW	9100 FERN CREEK ROAD	USPS
A-Z,1-2-3 DAY CARE	6100 BILLTOWN RD	Childcare
FERN CREEK FIRE DEPARTMENT #1	6200 BARDSTOWN RD	Fire Dept
FERN CREEK TRADITIONAL HIGH	9115 FERN CREEK RD	Childcare
FERN CREEK TRADITIONAL HIGH	9115 FERN CREEK RD	Childcare
FERN CREEK FPD #1	6200 BARDSTOWN RD	Warning Sirens
LINDA'S HOME DAY CARE	6706 CONCORD HILL RD	Childcare
FERN CREEK ELEMENTARY	8815 FERNDALE RD	Childcare
YMCA SACC FERN CREEK ELEMENTARY CHILDCARE ENRICHME	8815 FERNDALE RD	Childcare
FERN CREEK CHILD CARE LLC	6123 BARDSTOWN RD	Childcare
SPEEDY MART #169	6102 BARDSTOWN RD	Grocery
DAY CARE UNIVERSITY	9208 FERN CREEK RD	Childcare
FERN CREEK BAPTIST CHILD	5920 BARDSTOWN RD	Childcare
DOLLAR TREE	5622-B BARDSTOWN ROAD	Grocery
SUGAR AND SPICE	5613 BARDSTOWN RD	Grocery
LISA RYAN	5507 DEA DEA DR	Childcare
RITE AID #4638	5601 BARDSTOWN ROAD	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
WHEELER ELEMENTARY SCHOOL	5700 CYNTHIA DR	Warning Sirens
HAPPY ACRES SWIM CLUB	8408 HUDSON LANE	Grocery
WHEELER ELEMENTARY	5700 CYNTHIA DR	School
VILLAGE CHILD CARE CENTER	5313 HAMES TR	Childcare
LADESHA WHEELER	5515 IDLEWOOD LN	Childcare
ST. GABRIEL CHILD CARE	5503 BARDSTOWN RD	Childcare
ST GABRIEL	5503 BARDSTOWN RD	School
MERCY ACADEMY HIGH	5801 FEGENBUSH LN	School
DELK'S KIDS COUNT	5306 BILLTOWN RD	Childcare
BIG LOTS #175	5318 BARDSTOWN RD	Grocery
FAMILY DOLLAR STORE #3575	5316 BARDSTOWN ROAD	Grocery
SPEEDY MART #56	5301 BARDSTOWN ROAD	Grocery
CHARLES INTERNATION STORE	5430 DEL MARIA WAY	Grocery
HURSTBOURNE PRESCHOOL	5206 ST GABRIEL LN	Childcare
MARYHURST FAMILY TREATMENT HOMES	5227 BARDSTOWN RD	Childcare
MARYHURST TREASURE HOME	5227 BARDSTOWN RD	Childcare
MARYHURST - TREASURE HOME	5227 BARDSTOWN RD	Childcare
MARYHURST - TREASURE HOME	5227 BARDSTOWN RD	Childcare
COLLIER'S MOTEL	4812 BARDSTOWN RD	MOTEL
General Electric Co.	4000 Buechel Bank Rd	Manufacturing
WALGREENS	4800 BARDSTOWN ROAD	Grocery
MARA DICKERSON	6506 COTTAGE MEADOW DR	Childcare
LA PREFERIDA HISPANIC STORE	4756 BARDSTOWN ROAD	Grocery
INDIAN SPICES.COM	4746 BARDSTOWN ROAD	Grocery
DOLLAR GENERAL STORE	4744 BARDSTOWN ROAD	Grocery
FELICIA HICKS	4914 CAWOOD DR	Childcare
ALMOST HOME INFANT DAY CARE	4313 BILLTOWN RD	Childcare
CARRITHERS MIDDLE	4320 BILLTOWN RD	School
OUR HOUSE CHILD CARE	4310 BILLTOWN RD	Childcare
CARE-A-LOT DAY CARE CENTER	4701 FEGENBUSH LN	Childcare
KIMBERLY COLAVECCHIA	8604 WAYFIELD CT	Childcare
GARDEN GATE FRUIT MARKET	4411 BRECKENRIDGE LANE	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
UNSELD CHILD CARE &	4314 NORFOLK DR	Childcare
ST. BARTHOLOMEW AFTER SCHOOL	2036 BUECHEL BANK RD	Childcare
MALE TRADITIONAL HIGH	4409 PRESTON HY	School
DAIRY MART #716	4310 FEGENBUSH LANE	Grocery
ALDI #39	4305 BARDSTOWN ROAD	Grocery
CIRCLE K #114	4301 PRESTON HGWY	Grocery
BLUEGRASS ACADEMY CHILD CARE	3841 RUCKRIEGEL PKWY	Childcare
BUECHEL DAY CARE IV	4200 BARDSTOWN RD	Childcare
BP FOOD MART #6330	4213 BARSTOWN ROAD	Grocery
JEFFERSONTOWN	3801 BILLTOWN ROAD	USPS
Westminster Terrace-Continuous Care Reti	2116 Beuchel Bank Rd	Nursing Home
Westminster Terrace-Continuous Care Reti	2116 Beuchel Bank Rd	Nursing Home
Presbyterian Homes & Services of Kentucky Louisvil	2116 Buechel Bank Rd	Nursing Home
KIDS & FUN, INC.	105 BUECHEL TERRACE	Childcare
PAULA SANFORD	318 WELBURN DR	Childcare
JEFFERSONTOWN ELEMENTARY	3610 CEDARWOOD WY	Childcare
JEFFERSONTOWN ELEMENTARY	3610 CEDARWOOD WAY	Childcare
ANA ACOSTA	2213 BEARGRASS AVE	Childcare
ROSE ANNA HUGHES HOME	2120 BUECHEL BANK RD	Shelter
CONCEPTS FOR KIDS I	2204 RICHLAND AVE	Childcare
CONCEPTS FOR KIDS	2206 RICHLAND AVE	Childcare
JOYCELYNE ELLIOTT	2210 RICHLAND AVE	Childcare
WATTERSON ELEMENTARY	3900 BRECKENRIDGE LN	Childcare
WATTERSON ELEMENTARY CEP	3900 BRECKINRIDGE LN	Childcare
RESIDENCE INN BY MARRIOT LOUISVILLE AIRPORT	700 PHILLIPS LN	EXTENDED STAY
THE EARTHGRAINS STORE #203	4119 BARDSTOWN ROAD	Grocery
LAS PALMAS MEXICANA GROCERY	2202 BUECHEL AVENUE-STE. 101	Grocery
DAROU SALAM	2202 BUECHEL AVENUE	Grocery
SPRINGHILL SUITES BY MARRIOT LOUISVILLE AIRPORT	820 PHILLIPS LN	EXTENDED STAY
HAMPTON INN	800 PHILLIPS LN.	INN
KENTUCKY HERITAGE MEATS	2221 BUECHEL AVENUE	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
LITTLE ROCKIN ROBINS PRE-SCHOOL AND DAYCARE CENTER	4014 BARDSTOWN RD	Childcare
HOWARD JOHNSON	709 PHILLIPS LANE	Grocery
HAMPTON INN	800 PHILLIPS LANE	Grocery
Apparel Group Ltd., "The	4300 Leghorn Dr	Manufacturing
ST EDWARD	9610 SUE HELEN DR	Childcare
ST. EDWARD CHILD DEVELOPMENT	9610 SUE HELEN DR	Childcare
YMCA ST. EDWARD PROGRAM	9610 SUE HELEN DR	Childcare
HOWARD JOHNSON EXPRESS	709 PHILLIPS LN	HOTEL
MILLENIUM MARKET PLACE	4010 BARDSTOWN ROAD	Grocery
EXECUTIVE WEST HOTEL	830 PHILLIPS LN	INN
AIRPORT AND EXPO LA QUINTA INN AND SUITES	4125 PRESTON HWY	INN
COURTYARD BY MARRIOT AIRPORT	819 PHILLIPS LN	HOTEL
LAQUINTA INN & SUITES	4125 PRESTON HIGHWAY	Grocery
DERBY CITY BILLARDS	4100 PRESTON STREET	Grocery
ACCESS DATA SERVICES	1441 LINCOLN AVE	Warning Sirens
TREE HOUSE DAYCARE, LLC	3309 COLLEGE DR	Childcare
SUGAR PLUM	937 PHILLIPS LANE	Grocery
CART #2	937 PHILLIPS LANE	Grocery
CART #4	937 PHILLIPS LANE	Grocery
CART #6	937 PHILLIPS LANE	Grocery
CART #10	937 PHILLIPS LANE	Grocery
CART #8	937 PHILLIPS LANE	Grocery
CART #1	937 PHILLIPS LANE	Grocery
CART #3	937 PHILLIPS LANE	Grocery
CART #5	937 PHILLIPS LANE	Grocery
CART #7	937 PHILLIPS LANE	Grocery
CART #9	937 PHILLIPS LANE	Grocery
THE COFFEE SHOP #1	937 PHILLIPS LANE	Grocery
THE COFFEE SHOP #2	937 PHILLIPS LANE	Grocery
GERMAN ROASTED NUTS #1	937 PHILLIPS LANE	Grocery
GERMAN ROASTED NUTS #2	937 PHILLIPS LANE	Grocery
GERMAN ROASTED NUTS #3	937 PHILLIPS LANE	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
B & H INTERNATIONAL MARKET	3914 BARDSTOWN ROAD	Grocery
NUTS & STUFF	4017 PRESTON STREET	Grocery
TULLY ELEMENTARY	3300 COLLEGE DR	Childcare
TULLY ELEMENTARY CHILDCARE	3300 COLLEGE DR	Childcare
DIXIE ORIENAL MARKET	3900 BARDSTOWN ROAD	Grocery
DEAL'S #3416	3560 S. HURSTBOURNE PARKWAY	Grocery
BRIGHT START CHILD CARE &	5925 SIX MILE LN	Childcare
MAIN	1420 GARDINER LANE	USPS
GOLDEN KEY MART	3821 BARDSTOWN ROAD	Grocery
BUECHEL INFANT & TODDLER	2116 OLD SHEPHERDSVILLE RD	Childcare
*BUECHEL DAY CARE PRESCHOOL	2119 OLD SHEPHERDSVILLE RD	Childcare
ADVANCED LEARNING CENTER 2	3809 BARDSTOWN RD	Childcare
Atria Stony Brook (Assisted Living Facility)-open	3451 S. Hursbourne Pkwy	Nursing Home
NUR ISLAMIC SCHOOL OF LOU.	6500 SIX MILE LN	School
TINY HANDS CHILD DEVELOPMENT	6718 SIX MILE LN	Childcare
ALDI INC.	3442 PRESTON HIGHWAY	Grocery
KIDS ACADEMY III	4200 WALLINGFORD LN	Childcare
VALUE CITY #11200	3430 PRESTON HIGHWAY	Grocery
CAMP TAYLOR ELEMENTARY	1446 BELMAR DR	School
RAINBOW NURSERY SCHOOL	8420 SIX MILE LN	Childcare
J.C. CIGARETTE OUTLETT	6620 SIX MILE LANE	Grocery
CHILDCARE ACADEMY	3200 COLLEGE DR	Childcare
CANDLEWOOD SUITES	1367 GARDINER LANE	Grocery
EL PAISANO	9111 GALENE DRIVE	Grocery
THE POPCORN STATION	9109 GALENE DRIVE	Grocery
CIRCLE K #107	9003 GALENE DRIVE	Grocery
DEBORAH BRADFORD	1901 BASHFORD MANOR LN	Childcare
MINOR DANIELS ACADEMY	1960 BASHFORD MANOR LN	School
LITTLE WORLD CHILD CARE	3439 BRECKINRIDGE LN	Childcare
WALGREENS	2021 HIKES LANE	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
MELEM INTERNATIONAL GROCERY STORE	2213 STEIER LANE	Grocery
CANDLEWOOD SUITES LOUISVILLE AIRPORT	1367 GARDINER LN	HOTEL
KIDDIE KEEPERS OF BASHFORD	1951 BASHFORD MANOR LN	Childcare
BUECHEL-CHEVRON FOOD MART	3700 BARDSTOWN ROAD	Grocery
LANCETA TRADING COMPANY	3435 BRECKENRIDGE LANE	Grocery
KAYFIELD ACADEMY	2930 SIX MILE LN	Childcare
ACTIVE DAY OF LOUISVILLE HIKES POINT	3403 BROOKENRIDGE LN	Shelter
SAVE-A-LOT	3417 BRECKINRIDGE LN	Grocery
FAMILY DOLLAR STORE 3185	3417 BRECKENRIDGE LANE	Grocery
AIRPORT EXPO CENTER SLEEP INN	3330 PRESTON HWY	INN
DOLLAR TREE #1944	2221 HIKES LANE	Grocery
PRE SCHOOL PREPARATORY	3332 NEWBURG RD	School
PRE SCHOOL PREPARATORY	3332 NEWBURG RD	School
BOARD OF EDUCATION	3332 NEWBURG RD	Warning Sirens
JEFFERSONTOWN HIGH	9600 OLD SIX MILE LN	School
NEWBURG CHEVRON FOOD MART	3333 NEWBURG RD	Grocery
AUDUBON PARK CLASS CITY	3340 ROBIN RD	LMPD
HOLIDAY INN AIRPORT EAST	1465 GARDNIER LN.	INN
PROVIDENCE CHILD CARE	9810 TAYLORSVILLE RD	Childcare
LOUISVILLE TECHNICAL INSTITUTE	3901 Atkinson Dr	College
MINISTRIES UNITED SOUTH CENTRAL LOUISVILLE	1207 HART ST	Community Ministries
RED ROOF INN	3322 RED ROOF INN PL.	INN
ORIENTAL GARDEN GROCERY STORE	4210 BISHOP LANE	Grocery
B.P. FOOD MART #59	3301 NEWBURG ROAD	Grocery
BUECHEL	2259 HIKES LANE	USPS
Bashford Manor Mall	3600 Bardstown Rd	Shopping
SHONTA WARE	4307 WOODGATE LN	Childcare
HOLY FAMILY CHILD CARE	3934 POPLAR LEVEL RD	Childcare
BEST WESTERN	1921 BISHOP LN	Grocery
INTERNATIONAL STAR SUPERMARKET	9715 TAYLORSVILLE ROAD	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
BEST WESTERN AIRPORT EAST/EXPO CENTER	1921 BISHOP LN	INN
Watterson City Office Park	1930 Bishop Ln.	Office
ST MARTHA	2825 KLONDIKE LN	Childcare
ST. MARTHA CHILD CARE	2825 KLONDIKE LN	Childcare
NEW BEGINNINGS FAMILY SERVICES	1949 GOLDSMITH LN	Childcare
SNOW WHITE PRE-SCHOOL	2814 PATTI LN	Childcare
ESL NEWCOMER ACADEMY	3741 PULLIAM DR	School
SCHUFF LANE GROUP HOME	1518 SCHUFF LN	Shelter
SCHUFF LANE GROUP HOME	1518 SCHUFF LN	Shelter
J-Town Shopping Center	9517 Taylorsville Rd.	Shopping
CVS #6217	9575 TAYLORSVILLE ROAD	Grocery
KINDER CARE LEARNING CENTER	2990 NEWBURG RD	Childcare
MOTEL 6	3200 KEMMONS DR	MOTEL
DOLLAR GENERAL STORE	9541 TAYLORSVILLE ROAD	Grocery
SAVE-A-LOT	9521 TAYLORSVILLE ROAD	Grocery
LOUISVILLE ADVENTIST ACADEMY	2988 NEWBURG RD	School
WALGREENS #3601	3800 POPLAR LEVEL ROAD	Grocery
ELAINE ROBINSON	2616 WILBUR LOOK LN	Childcare
PROVIDENCE CHILDCARE & PRESCHOOL	9513 TAYLORSVILLE RD	Childcare
FOURTH PRESBYTERIAN PRE-SCHOOL	3016 PRESTON HIGHWAY	Childcare
ECONOMY INN	3304 BARDSTOWN RD	INN
ACTIVE DAY OF LOUISVILLE AUDUBON PARK	3795 POPLAR LEVEL RD	Shelter
ALFRED BINET	3410 BON AIR AV	School
GOLDSMITH LANE ELEMENTARY	3520 GOLDSMITH LN	Childcare
TRAVELODGE LOUISVILLE AIRPORT	3315 BARDSTOWN RD.	INN
KINDER CARE LEARNING CENTER	3804 KLONDIKE LN	Childcare
GOLDSMITH ELEMENTARY	3520 GOLDSMITH LN	School
TRUCK 9	3511 FINCASTLE RD	Fire Dept
Klondike Manor Health Care Center	3802 Klondike Ln	Nursing Home
USPIRITUS BROOKLAWN	2125 GOLDSMITH LN	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
BROOKLAWN RESIDENTIAL TREATMENT PROGRAMS	2125 GOLDSMITH LN	Childcare
BROOKLAWN CHILD & FAMILY SERVICES	2125 GOLDSMITH LN	Childcare
BROOKLAWN CHILD & FAMILY SERVICES	2125 GOLDSMITH LN	Childcare
KLONDIKE ELEMENTARY SCHOOL	3807 KLONDIKE LN	Warning Sirens
Fetter Printing Co.	700 Locust Lane PO Box 33128	Manufacturing
KIDDIE KAMPUS DAY CARE	3685 POPLAR LEVEL RD	Childcare
SENECA HIGH	3510 GOLDSMITH LN	School
JEFFERSONTOWN FIRE DEPARTMENT #3	8630 BIGGIN HILL LANE	Fire Dept
KLONDIKE LANE ELEMENTARY	3807 KLONDIKE LN	Childcare
KLONDIKE ELEMENTARY CHILD	3807 KLONDIKE LN	Childcare
AUDUBON SCHOOL	1051 HESS LN	Warning Sirens
JOHN PAUL II ACADEMY	3525 GOLDSMITH LN	Childcare
ST. PIUS X PRE-KINDERGARTEN	3525 GOLDSMITH LN	Childcare
Meadows East Nursing Home	2529 Six Mile Ln	Nursing Home
AUDUBON TRADITIONAL ELEM	1051 HESS LN	School
QUMANE STORE	2909 PRESTON HIGHWAY	Grocery
COCHRANE ELEMENTARY	2511 TREGARON AV	Childcare
COCHRANE ELEMENTARY SCHOOL	2511 TREGARON AVE	Childcare
PINECREST COTTAGE AND GARDENS BED AND BREAKFAST	2806 NEWBURG RD	BED AND BREAKFAST
Jones Plastic & Engineering Corp.	2410 Plantside Dr	Manufacturing
ST. PIUS AFTER SCHOOL CARE	3521GOLDSMITH LN	Childcare
QUALITY INN & SUITES	3255 BARDSTOWN RD.	INN
ENGINE 8	2900 HIKES LN	Fire Dept
SOUTHSIDE CHRISTIAN CHILD CARE #LL	3620 KLONDIKE LN	Childcare
HOLIDAY INN SE RESTAURANT	3255 BARDSTOWN RD	Grocery
ST STEPHEN MARTYR	2931 PINDELL AV	School
CHRIST LUTHERAN KINDERGARTEN	9212 TAYLORSVILLE RD	Childcare
AL WATAN BAKERY	3711 KLONDIKE LANE	Grocery
Hillcreek Manor Rehabilitation	3116 Breckinridge Ln	Nursing Home
Beverly Healthcare Hillcreek	3116 Breckinridge Ln	Nursing Home
WALGREEN'S #3618	2360 STONEYBROOK DRIVE	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
LA PAZ TIENDA MEXICANA	3612 KLONDIKE LANE	Grocery
DIANA UNDERWOOD	4221 DOLPHIN RD	Childcare
LOTS OF TOTS DAY CARE	2901 PINDELL AVE	Childcare
BOYS & GIRLS HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOY'S HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOYS' HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOYS' HAVEN	2301 GOLDSMITH LN	Childcare
FATHER MALONEY'S BOYS' HAVEN	2301 GOLDSMITH LN	Childcare
CVS/PHARMACY #2337	3229 POPLAR LEVEL ROAD	Grocery
KIDDIE ACADEMY	3220 HUNSINGER	Childcare
CIRCLE K #3229	2703 PRESTON HWY	Grocery
CARTOON CAPERS/ST. BARNABAS	3044 HIKES LN	Childcare
SPEEDY MART	3130 POPLAR LEVEL ROAD	Grocery
CANDLEWOOD SUITES	11762 COMMONWEALTH DR.	HOTEL
KALEIDOSCOPE, INC.	10330 BUNSEN WAY	Shelter
CANDLEWOOD SUITES	11762 COMMONWEALTH DRIVE	Grocery
SULLIVAN COLLEGE	3101 Bardstown Rd	College
Hurstbourne Care Center of Stoneybrook & Nursing C	2200 Stoneybrook Dr	Nursing Home
LIFEWAY FOR YOUTH	2108 PLANTSIDE DR	Childcare
JENNIFER CECIL	2332 MT CLAIRE AVE	Childcare
WHITEHALL DAY CARE CENTER	2633 WHITEHALL TERRACE	Childcare
CAMPBELLSVILLE UNIVERSITY - LOUISVILLE	2300 Greene Way	College
HAYFIELD MONTESSORI SCHOOL	2000 TYLER LN	Childcare
HAYFIELD MONTESSORI SCHOOL	2000 TYLER LN	Childcare
ATHERTON HIGH	3000 DUNDEE RD	School
OUR MOTHER OF SORROWS	770 EASTERN PKWY	Childcare
COMFORT SUITES	1850 RESOURCE WAY	Grocery
SLEEP INN EAST	1850 PRIORITY WAY	INN
COMFORT SUITES	1850 RESOURCE WAY	INN
RITE AID #4633	3012 BARDSTOWN ROAD	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
Embassy Square Office Park	1400 Envoy Circle	Office
DOLLAR GENERAL STORE #7927	2817 DEL RIO PLACE	Grocery
PIC-PAC	786 MILLER AVE	Grocery
SHELBY STATION	2312 S PRESTON STREET	USPS
BON AIR REGIONAL LIBRARY		Library
SLEEP INN	1850 PRIORITY WAY	Grocery
BEST WESTERN ENVOY INN AND SUITES	9802 BUNSEN WAY	INN
FAMILY DOLLAR STORE #1351	790 EASTERN PARKWAY	Grocery
KRISPY KREME DOUGHNUT	3000 BARDSTOWN ROAD	Grocery
HIKES POINT	3050 HUNSINGER LANE	USPS
ST. RAPHAEL ACADEMIC & SOCIAL	2131 LANCASHIRE AVE	Childcare
NORTON AUDUBON HOSPITAL	1 Audubon Plaza Dr	Hospital
SMALL WORLD FAMILY DAY CARE	3107 WEDGEWOOD WAY	Childcare
ST RAPHAEL	2131 LANCASHIRE AV	School
DAY SPRING MEN'S HOME	3421 DAY SPRING CT	Shelter
EXTENDED STAYAMERICA	9801 BUNSEN WAY	EXTENDED STAY
WALGREENS	810 EASTERN PKWY	Grocery
DAY SPRING WOMEN'S HOME	3439 DAY SPRING CT	Shelter
SMALL WORLD CHILD DEVELOPMENT	2337 ALEXANDER AVE	Childcare
ST. RAPHAEL CHILD ENRICHMENT	2140 TYLER LN	Childcare
TARGET	4640 TAYLORSVILLE ROAD	Grocery
CHARIOT HOTEL	1902 EMBASSY SQUARE BLVD.	HOTEL
NORTHWOOD UNIVERSITY, KY CENTER	11492 Bluegrass Parkway	College
JENNY CRAIG #1602	1949 S. HURSTBOURNE PKWY	Grocery
MARRIOTT LOUISVILLE EAST	1903 EMBASSY SQUARE BLVD.	HOTEL
DOLLAR TREE STORE	1923 S. HURSTBOURNE PARKWAY	Grocery
SUBURBAN EXTENDED STAY LOUISVILLE EAST	4540 TAYLORSVILLE RD.	EXTENDED STAY
DAWN OLSON	4113 MARTHA AVE	Childcare
WAL-MART	1915 S. HURSTBOURNE LANE	Grocery
ASSUMPTION HIGH	2170 TYLER LN	School

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
RAMADA INN EAST LOUISVILLE	1902 EMBASSY SQUARE BLVD	Grocery
STRATHMOOR EDUCATION CENTER	2201 HAWTHORNE AVE	Childcare
BP OIL MART	3325 HIKES LANE	Grocery
HOMESTEAD STUDIO SUITES	1650 ALLIANT AVENUE	Grocery
McMahan Plaza	3000 Breckenridge Ln.	Shopping
Townfair Center	1970 Hurstbourne Parkway	Shopping
CARITAS PEACE ACADEMY	2020 NEWBURG RD	School
OUR LADY OF PEACE	2020 Newburg Rd	Hospital
JEFFERSONTOWN FIRE DEPARTMENT #2	4318 TAYLORSVILLE RD	Fire Dept
MERCY MONTESSORI SCHOOL	2181 TYLER LN	Childcare
MEREDITH DUNN SCHOOL	3023 MELBOURNE AV	School
HOLIDAY INN EXPRESS HOTEL/SUIT	1620 ALLIANT AVENUE	Grocery
HOMESTEAD STUDIO SUITES	1650 ALLLIANT AVE	HOTEL
SCHOOLHOUSE PRESCHOOL &	3017 HUNSINGER LN	Childcare
HAWTHORNE ELEMENTARY	2301 CLARENDON AV	Childcare
HAWTHORNE ELEMENTARY CHILD	2301 CLARENDON AVE	Childcare
PATEL BROTHERS INTERNATIONAL GROCERY	1830 S. HURSTBOURNE PARKWAY	Grocery
DOLLAR TREE #1898	4060 TAYLORSVILLE ROAD	Grocery
Blankenbaker Business Center	11405 Bluegrass Parkway	Office
LINDA BEIGHEY	12 HALLSDALE DR	Childcare
Hikes Point Plaza	4000 Taylorsville Rd.	Shopping
RITE AID #4635	4000 TAYLORSVILLE ROAD	Grocery
WALGREEN'S #5436	4025 TAYLORSVILLE ROAD	Grocery
KENNEDY METRO MIDDLE SCHOOL	4515 TAYLORSVILLE RD	Warning Sirens
Commonwealth Business Center	11003 Bluegrass Pkwy.	Office
ALEX KENNEDY ELEMENTARY	4515 TAYLORSVILLE RD	School
ST. PAUL'S PRE-SCHOOL &	4700 LOWE RD	Childcare
ST XAVIER HIGH	1609 POPLAR LEVEL RD	School
MERIDAY PRESCHOOL	3728 TAYLORSVILLE RD	Childcare
Lantech Inc.	11000 Bluegrass Parkway	Manufacturing

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
STUDIO LODGE	9700 BLUGRASS PARKWAY	HOTEL
BELLARMINE COLLEGE	2001 Newburg Rd	College
BRIGHT EXPECTATIONS	9303 HURSTBOURNE PARK BLVD	Childcare
Helois Pharmaceutical	9800 Bluegrass Parkway	Office
MANUAL STADIUM		Theatre/Stadium
RED CARPET INN	1640 S. HURSTBOURNE PARKWAY	Grocery
INDIANA WESLEYAN UNIVERSITY	1500 Alliant Ave.	College
ST AGNES	1800 NEWBURG RD	Childcare
ST. AGNES AFTER SCHOOL CARE	1800 NEWBURG RD	Childcare
Christopher East Health Care	4200 Browns Ln	Nursing Home
JAMESON INN LOUISVILLE EAST	1301 KENTUCKY MILLS DR	INN
MICROTEL INN	1221 KENTUCKY MILLS DR.	INN
RED CARPET INN	1640 S. HURSTBOURNE PKWY.	INN
COUNTRY INN AND SUITES LOUISVILLE EAST	1241 KENTUCKY MILLS DR	INN
IT'S A SMALL WORLD	2539 DOUP AVE	Childcare
ATA CAREER EDUCATION -LOUISVILLE	10180 Linn Station Rd	College
Centre Building	10100 Linn Station Rd	Office
UNIVERSITY OF PHOENIX-LOUISVILLE	10400 Linn Station Rd	College
KBHC METRO FOSTER CARE	10200 LINN STATION RD	Childcare
TRUCK 10	3401 DUTCHMANS LN	Fire Dept
ELF CHILD DEVELOPMENT CENTER	2930 BRECKENRIDGE LN	Childcare
Plainview Office Park	10172 Linn Station Rd.	Office
WALGREENS	2490 BARDSTOWN ROAD	Grocery
Home of the Innocents/Transit. Housing Program	1853 Rutherford Ave	Nursing Home
Plainview Triad East	10200 Linn Station Rd.	Office
Triad East	10200 Linn Station Rd.	Office
HOLIDAY INN HURSTBOURNE	1325 S. HURSTBOURNE PKWY.	INN
CHEROKEE	2240 TAYLORSVILLE ROAD	USPS

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
ST. MARK UNITED METHODIST PRE	4611 LOWE RD	Childcare
The King's Daughters & Sons Home	10001 Linn Station Rd	Nursing Home
ROBERTS HALL	1032 E BURNETT AVE	Shelter
HIGHLAND MIDDLE	1700 NORRIS PL	Childcare
HIGHLAND MIDDLE SCHOOL	1700 NORRIS PL	Childcare
AMSHOFF'S KIDCARE	1037 E BURNETT AVE	Childcare
SHELBY TRADITIONAL ACADEMY	735 ZIEGLER ST	School
CVS/PHARMACY #6208	2410 BARDSTOWN RD	Grocery
CALVARY CHILD DEVELOPMENT	2520 WALLACE AVE	Childcare
COURTYARD BY MARRIOTT	9608 BLAIRWOOD RD.	HOTEL
KENESETH ISRAEL PRESCHOOL	2531 TAYLORSVILLE RD	Childcare
Twinbrook Nursing Home & Rehabilitation Center	3526 Dutchmans Ln	Nursing Home
Plainview Village Center	9880 Linn Station Rd.	Shopping
ARDEN COURTS OF LOUISVILLE	10451 LINN STATION RD	Shelter
BAYMONT INN AND SUITES-LOUISVILLE EAST	9400 BLAIRWOOD RD	INN
DESSERTS BY HELEN	2210 BARDSTOWN ROAD	Grocery
SPEEDY MART	1735 NEWBURG ROAD	Grocery
DAYS INN HURSTBOURNE	9340 BLAIRWOOD RD	INN
PLAINVIEW	9858 LINN STATION ROAD	USPS
HIGHLANDS COMMUNITY MINISTRIES DAY CARE CENTER	2000 DOUGLASS BLVD	Childcare
HIGHLANDS COMM MINISTRIES ADULT DAY HLTH CTR	2000 DOUGLAS BLVD	Childcare
RED ROOF INN	9330 BLAIRWOOD RD.	INN
HURSTBOURNE BP	1335 S. HURSTBOURNE PARKWAY	Grocery
BRECKINRIDGE INN HOTEL	2800 BRECKENRIDGE LN.	INN
CIRCLE K #112	1330 S. HURSTBOURNE PKWY	Grocery
HURSTBOURNE/BP	1323 S. HURSTBOURNE PARKWAY	Grocery
JEWISH COMMUNITY CENTER	3600 DUTCHMANS LN	Childcare
DUNDEE CANDY SHOP	2112 BARDSDTOWN ROAD	Grocery
DRURY INN AND SUITES LOUISVILLE	9501 BLAIRWOOD RD	INN

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
GREATHOUSE/SHRYOCK TRAD ELEM	2700 BROWNS LN	Childcare
GREATHOUSE/SHYROCK ELEMENTARY	2700 BROWNS LN	Childcare
JEWISH FAMILY & VOCATIONAL SERVICE	3587 DUTCHMANS LN	Childcare
JEWISH DAY SCHOOL	3700 DUTCHMANS LN	School
MEDICAL ARTS GIFT SHOP	1169 EASTERN PARKWAY	Grocery
AUDREY LANIER	702 E BURNETT AVE	Childcare
Parkway Medical Center	1155 Eastern Pkwy	Nursing Home
ST FRANCIS OF ASSISI	1938 ALFRESCO PL	Childcare
ST. FRANCIS OF ASSISI	1938 ALFRESCO PL	Childcare
SHALOM TOWERS GROCERY	3650 DUTCHMANS LANE	Grocery
TUESDAY MORNING #171	9906 LINN STATION ROAD	Grocery
FREEDOM HOUSE/SHELBY MEN'S CENTER	1432 S SHELBY ST	Shelter
ADATH JESHURUN PRESCHOOL	2401 WOODBOURNE AVE	Childcare
Kaden Tower	6100 Dutchmans Lane	Office
MO'S FOOD MARKET	1036 GOSS AVENUE	Grocery
MATTINGLY CENTER, INC.	1520 BAXTER AVE	Shelter
HIGHLANDS EDUCATIONAL CENTER	1436 EASTERN PKWY	Childcare
HIGHLANDS EDUCATIONAL CENTER FOR KIDS	1436 EASTERN PKWY	Childcare
HIGHLANDS EDUCATIONAL CENTER FOR KIDS	1444 EASTERN PKWY	Childcare
EXTENDED STAY AMERICA	6101 DUTCHMANS LN.	EXTENDED STAY
HAUCK'S HANDY STORE	1000 GOSS AVE	Grocery
K'S FOOD MART & DELI	1779 BARDSTOWN RD	Grocery
Kentucky Nursing Home Association	1705 Stevens Ave	Nursing Home
ENGINE 20	1735 BARDSTOWN RD	Fire Dept
FALECIA COLLIER	2507 WOODMONT DR	Childcare
Springs Medical Office Center, The	6400 Dutchmans Parkway	Office
DE PAUL SCHOOL	1925 DUKER AV	School
5TH DIVISION LMPD	2301 DOUGLASS BLVD	LMPD
DIGNITARY PROTECTION LMPD	2301 DOUGLASS BLVD	LMPD
LMPD 5TH DISTRICT	2301 DOUGLASS BLVD	Warning Sirens
Paragon Centre	6040 Dutchmans Lane	Office
MARYHURST - REYNOLDS HOME	1619 BARDSTOWN RD	Childcare
MARYHURST - REYNOLDS HOME	1619 BARDSTOWN RD	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
MARYHURST - REYNOLDS HOME	1619 BARDSTOWN RD	Childcare
ADOPTION & HOME STUDY SPECIALISTS	10507 TIMBERWOOD CI	Childcare
FAMILIES THRU INTERNATIONAL ADOPTIONS	10507 TIMBERWOOD CI	Childcare
JEWISH HOSPITAL MEDICAL CENTER EAST	3920 Dutchmans Ln	Hospital
ITT TECHNICAL INSTITUTE	10509 Timberwood Cir	College
Four Courts Senior Center	2100 Millvale Rd	Nursing Home
OLD TOWN LIQUORS	1529 BARDSTOWN ROAD	Grocery
KINDER CARE LEARNING CENTER	1110 DUPONT CI	Childcare
LA PETITE ACADEMY	10501 TIMBERWOOD CI	Childcare
ST JAMES	1818 EDENSIDE AV	Childcare
MONSIGNOR HORRIGAN - ST. JAMES	1818 EDENSIDE AVE	Childcare
ASCENSION SCHOOL	4600 LYNNBROOK DR	Childcare
KIDS TIME	4600 LYNNBROOK DR	Childcare
Plainview Point	10503 Timberwood Cir.	Office
Trilogy Health Services	10602 Timberwood Cir	Nursing Home
Dupont Professional Towers	4010 Dupont Circle	Office
PLAINVIEW SCHOOL FOR EARLY	10320 TIMBERWOOD CI	Childcare
FLORINE DICKERSON	517 N WATTERSON TRAIL	Childcare
MARY HENDERSON	9206 SEATON SPRINGS PKWY	Childcare
NORTON WOMEN'S AND CHILDREN'S HOSPITAL	4001 Dutchmans Ln	Hospital
YMCA SACC BLOOM CHILDCARE ENRICHMENT PROGRAM	930 MARY ST	Childcare
CIRCLE K #3227	1351 BARDSTOWN RD	Grocery
MIDDLETOWN CHRISTIAN CHURCH	500 WATTERSON TRAIL	Childcare
THE BROOK/DUPONT	1405 BROWNS LN	School
THE BROOK HOSPITAL - DUPONT	1405 Browns Ln	Hospital
Springs Office Building	950 Breckenridge Lane	Office
HIGHLAND-SHELBY PARK LIBRARY		Library
HYATT PLANE LOUISVILLE EAST	701 S. HURSTBOURNE PKWY.	HOTEL
LITTLE LAMB'S ACADEMY	1403 BROWNS LN	Childcare
EXTENDED STAYAMERICA	1401 BROWNS LANE	EXTENDED STAY
Mid City Mall	1250 Bardstown Rd.	Shopping
FAMILY DOLLAR STORE #2424	1250 BARDSTOWN ROAD	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
BLOOM ELEMENTARY	1627 LUCIA AV	School
DOUGLAS HILL SWINM CENTER	501 GATEHOUSE LN	Warning Sirens
Executive Park	4800 Sherburn LN	Office
LOUISVILLE PRESBYTERIAN THEOLOGICAL SEM	1044 Alta Vista Rd	College
BAPTIST HEALTH LOUISVILLE	4000 Kresge Way	Hospital
BAPTIST HOSPITAL EAST CENTER	4000 KRESGE WAY	Childcare
THE WINE MARKET	1200 BARDSTOWN ROAD	Grocery
FRIENDS SCHOOL	901 BRECKENRIDGE LN	School
FRIENDS SCHOOL	901 BRECKENRIDGE LN	Childcare
ENGINE 11 / TRUCK 7	1025 RUBEL AV	Fire Dept
LOUISVILLE METRO FIRE DEPT ENGINE 11 TRUCK 7	1025 RUBEL AVE	Warning Sirens
CROSBY MIDDLE	303 GATEHOUSE LN	School
SPEEDWAY #9612	1101 BARDSTOWN ROAD	Grocery
LAWS LODGE CONFERENCE CENTER	1044 ALTA VISTA RD	LODGE
Williamsburg Office Park	420 S. Hurstbourne Pkwy.	Office
WALGREENS #6443	990 BAXTER AVENUE	Grocery
BELMONT VILLAGE	4600 BOWLING BLVD	Shelter
HITE ELEMENTARY SCHOOL CHILD	12408 OLD SHELBYVILLE RD	Childcare
JEFF CNTY TRADITIONAL MIDDLE	1418 MORTON AV	School
BAXTER	1527 HIGHLAND AVENUE	USPS
CHAPEL HOUSE GROCERY	945 SOUTH 5TH STREET	Grocery
CORRECTIONS DEPT-TRAINING	312 Whittington Pkwy Suite 111	CORRECTIONAL CENTER
Christian Health Center - - Independent Living	945 S. 5th St	Nursing Home
VICKIE DOYLE	1904 MIDDLETOWN DR	Childcare
HAWTHORN SUITES	751 CYPRESS STATION DR	EXTENDED STAY
LOUISVILLE COLLEGIATE SCHOOL	2427 GLENMARY AV	School
EASTERN HIGH	12400 OLD SHELBYVILLE RD	School
Parr's Rest Inc	969 Cherokee Rd	Nursing Home
HIGHLAND PRESBYTERIAN CHURCH	2114 HIGHLAND AVE	Childcare
HIGHLAND PRESBYTERIAN WEEKDAY	2114 HIGHLAND AVE	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
Moorman, Charles Home for Women	966 Cherokee Rd	Nursing Home
YMCA SACC COLLEGIATE SACC PROGRAM	2467 GLENMARY AVE	Childcare
YMCA/CHRISTIAN ACADEMY OF	3110 ROCK CREEK DR	Childcare
CHRISTIAN ACADEMY PRESCHOOL	3110 ROCK CREEK DR	Childcare
MIDDLETOWN UNITED METHODIST	11902 OLD SHELBYVILLE RD	Childcare
MIDDLETOWN UNITED METHODIST	11902 OLD SHELBYVILLE RD	Childcare
MIDDLETOWN LIBRARY		Library
CHRISTIAN ACADEMY ROCK CREEK	3100 ROCK CREEK DR	School
SUMMIT ACADEMY	11508 MAIN ST	School
Eastern Star Home in Kentucky	923 Eastern Star Court	Nursing Home
WEE CARE NURSERY I, II, & III	11616 MAIN ST	Childcare
MARYANITA NURSERY SCHOOL	2468 GRINSTEAD DR	Childcare
DOUGLAS HILLS BP	10600 SHELBYVILLE RD.	Grocery
LOWE ELEMENTARY SCHOOL	210 OXFORDSHIRE LN	Warning Sirens
HIGHLANDS COMMUNITY MINISTRIES - CHEROKEE	917 EASTERN STAR CT	Childcare
CVS PHARMACY #6205	10490 SHELBYVILLE ROAD	Grocery
TRINITY PRESBYTERIAN PRESCHOOL	10200 SHELBYVILLE RD	Childcare
PARTY OUTLET	10402 SHELBYVILLE ROAD	Grocery
OUR LADY OF LOURDES ELEM	510 BRECKINRIDGE LN	Childcare
OUR LADY OF LOURDES EXTENDED	510 BRECKINRIDGE LN	Childcare
HIGHLAND LATIN SCHOOL	10901 SHELBYVILLE RD	School
CONDONNIER FARMS	12405 SHELBYVILLE ROAD	Grocery
ANDERSON'S OLD FASHION CANDY & NUTS-BOOTH 23	12405 SHELBYVILLE RD	Grocery
LOWE ELEMENTARY	210 OXFORDSHIRE LN	Childcare
LOWE ELEMENTARY CHILD CARE	210 OXFORDSHIRE LN	Childcare
CAREY TYSON	210 MARKSFIELD CI	Childcare
KBHC PREGNANCY & ADOPTION	10801 SHELBYVILLE RD	Childcare
FIRST BAPTIST CHURCH OF MIDDLETOWN PARENT'S DAY OU	11721 MAIN ST	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
MIDDLETOWN	119 N EVERGREEN ROAD	USPS
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #2	10217 SHELBYVILLE RD	Fire Dept
ST MATTHEWS ELEMENTARY	601 BROWNS LN	Childcare
ST. MATTHEWS ELEMENTARY	601 BROWNS LN	Childcare
SPRING MEADOWS CHILDREN'S HOME	10901 SHELBYVILLE RD	Childcare
WALGREEN'S #7064	9409 SHELBYVILLE ROAD	Grocery
Z SALON & SPA	9407 SHELBYVILLE ROAD	Grocery
Hurstbourne Place	9300 Shelbyville Rd.	Office
Hurstbourne Park	9200 Shelbyville Rd.	Office
HURSTBOURNE BAPIST DAY SCHOOL	8800 SHELBYVILLE RD	Childcare
Paragon Place	9100 Shelbyville Rd.	Office
SPEEDY MART	2338 LEXINGTON ROAD	Grocery
TOTS LANDING PRESCHOOL & DAY	138 N EVERGREEN RD	Childcare
HIGHLAND FISH MARKET	12121 SHELBYVILLE ROAD	Grocery
DOLLAR TREE STORE #2213	11820 SHELBYVILLE ROAD	Grocery
Marriott's Forum at Brookside	200 Brookside Dr	Nursing Home
Forum at Brookside/Indepemndent & Convalenscent	200 Brookside Dr	Nursing Home
One Oxmoor Place	101 Bulitt Ln.	Office
8TH DIVISION LMPD	200 JUNEAU DR	LMPD
MIDDLETOWN HEALTH CENTER	200 JUNEAU DRIVE	LMPD
MIDDLETOWN LIBRARY		Library
OUR SAVIOR LUTHERAN SCHOOL	8307 NOTTINGHAM PW	School
SPEEDWAY #9643	12102 SHELBYVILLE RD	Grocery
ST. MATTHEWS BAPTIST	3515 GRANDVIEW AVE	Childcare
LUCKY DUCKY CHILD CARE	10211 WOODKNOLL RD	Childcare
WALGREEN'S	12101 SHELBYVILLE ROAD	Grocery
MIDDLETOWN ELEMENTARY	218 N MADISON AV	Childcare
MIDDLETOWN ELEMENTARY CEP	218 N MADISON AVE	Childcare
RESIDENCE INN BY MARRIOTT	120 N. HURSTBOURNE PKWY.	INN
KINDER CARE LEARNING CENTER	8016 SHELBYVILLE RD	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
SO BAPTIST SEMINARY - BOYCE COLLEGE	2825 LEXINGTON RD	Warning Sirens
SOUTHERN BAPTIST THEOLOGICAL SEMINARY	2825 Lexington Rd	College
LEGACY HOTEL AND CONFERENCE CENTER	2825 LEXINGTON RD	GRAND HOTEL
SPEEDY MART #52	8015 SHELBYVILLE ROAD	Grocery
Oxmoor Center	7900 Shelbyville Rd.	Shopping
GREAT AMERICAN COOKIE COMPANY	7900 SHELBYVILLE RD	Grocery
CATHERINES BELGIAN CHOCOLATES	7900 SHELBYVILLE ROAD	Grocery
SWEET FACTORY	7900 SHELBYVILLE ROAD	Grocery
HICKORY FARMS	7900 SHELBYVILLE ROAD	Grocery
ANNA LANE	415 DORSEY LN	Childcare
ST MATTHEWS	4600 SHELBYVILLE ROAD	USPS
ST. MATTHEWS PRE-SCHOOL	229 BRECKINRIDGE LN	Childcare
ST MATTHEWS CLASS CITY	3940 GRANDVIEW AVE	LMPD
ST. MATTHEWS/ELINE LIBRARY		Library
SUSANNA HOUSE CHRISTIAN CHILD	4210 CHURCH WAY	Childcare
HARVEY BROWNE PRESCHOOL	311 BROWNS LN	Childcare
St Matthews Manor	227 Browns Ln	Nursing Home
Beverly Healthcare St. Matthews	227 Browns Ln	Nursing Home
URSULINE MONTESSORI SCHOOL &	3105 LEXINGTON RD	Childcare
SACRED HEART MODEL	3107 LEXINGTON RD	School
BARRET TRADITIONAL MIDDLE	2561 GRINSTEAD DR	School
BRECKINRIDGE/FRANKLIN ELEM	1351 PAYNE ST	School
DISCOVERY PRE-SCHOOL & CHILD	111 FAIRMEADE RD	Childcare
Hurstbourne Forum Office Park	301 N. Hurstbourne Pkwy.	Office
SACRED HEART ACADEMY	3175 LEXINGTON RD	School
BARBARA'S DAY CARE	3019 AUBERT AVE	Childcare
HOLY SPIRIT SCHOOL	322 CANNONS LN	School
HOMEWOOD SUITES BY HILTON LOUISVILLE EAST	9401 HURSTBOURNE TRACE	EXTENDED STAY
CORNERSTONE CHILD DEVELOPMENT CENTER, INC.	211 BROWNS LN	Childcare
Distillery Commons	200 Distillery Commons	Office
CIRCLE K #106	4300 SHELBYVILLE ROAD	Grocery
HOLY SPIRIT CHILD CARE	3308 RICHARD AVE	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
WALGREEN'S	4240 SHELBYVILLE ROAD	Grocery
SERVICE PLUS #5	4217 SHELBYVILLE ROAD	Grocery
DAYBREAK ADULT DAY CENTER	2120 PAYNE ST	Shelter
ST. MATTHEWS AREA MINISTRIES	201 BILTMORE RD	Community Ministries
LOUISVILLE DIVERSIFIED SERVICES-PALS	136 SACRED HEART LN	Shelter
BIG LOTS #226	4121 SHELBYVILLE RD	Grocery
CVS/PHARMACY #6211	3721 LEXINGTON RD	Grocery
FIELD ELEMENTARY	120 SACRED HEART LN	Childcare
FIELD ELEMENTARY CHILD CARE	120 SACRED HEART LN	Childcare
UNIVERSITY OF LOUISVILLE SHELBY CAMPUS	9001 Shelbyville Rd	College
KRCFL (KY COMPUTER FORENSICS) LMPD	310 N WHITTINGTON	LMPD
SPEEDY MART	316 WALLACE AVE	Grocery
MARYHURST - ROSEHAVEN	2252 PAYNE ST	Childcare
MARYHURST - ROSEHAVEN	2252 PAYNE ST	Childcare
MARYHURST - ROSEHAVEN	2252 PAYNE ST	Childcare
HOLY ANGELS ACADEMY	12201 OLD HENRY RD	School
Sacred Heart Village	2120 Payne St	Nursing Home
TRINITY HIGH	4011 SHELBYVILLE RD	School
Masonic Homes of Kentucky	3701 Frankfort Ave	Nursing Home
HT FOOD MART	3420 FRANKFORT AVE	Grocery
WALGREENS #02924	2368 FRANKFORT AVENUE	Grocery
CRESCENT HILL BAPTIST CHURCH	2800 FRANKFORT AVE	Childcare
HIGHLAND LATIN SCHOOL	2800 FRANKFORT AVE	School
ENGINE 4	2620 FRANKFORT AV	Fire Dept
MARYHURST - CHABRAT HOME	109 KENNEDY AVE	Childcare
MARYHURST - CHABRAT HOME	109 KENNEDY AVE	Childcare
MARYHURST - CHABRAT HOME	109 KENNEDY AVE	Childcare
CRESCENT HILL LIBRARY		Library
THE WINE RACK	2716 FRANKFORT AVENUE	Grocery
BUSSMAN'S BAKERY	1906 FRANKFORT AVENUE	Grocery
Brownsboro Hills Nursing Home	2141 Sycamore Ave	Nursing Home

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
MASONIC HOME	290 MASONIC HOME DRIVE	USPS
UNITED CRESCENT HILL MINISTRIES	150 STATE ST	Community Ministries
CRESCENT HILL PRESBYTERIAN	142 CRESCENT AVE	Childcare
ST MATTHEWS FIRE DEPARTMENT #1	240 SEARS AVE	Fire Dept
Swift & Co.	1200 Story Ave	Manufacturing
ST JOSEPH CHILDREN'S HOME	2823 FRANKFORT AV	Childcare
ST. JOSEPH CHILD DEVELOPMENT	2823 FRANKFORT AVE	Childcare
ST. JOSEPH CHILDREN'S HOME	2823 FRANKFORT AVE	Childcare
ST. JOSEPH CHILDREN'S HOME	2823 FRANKFORT AVE	Childcare
American Printing House for the Blind Inc.	1839 Frankfort Ave PO Box 6085	Manufacturing
ST MATTHEWS	169 ST MATTHEWS AVE	Warning Sirens
NANCY HOOVER	12710 OLD HENRY RD	Childcare
B-LINE	1648 MELLWOOD AVENUE	Grocery
TINY TOT NURSERY-PRESCHOOL	908 ORMSBY LN	Childcare
KY SCHOOL FOR THE BLIND	1867 FRANKFORT AV	School
ST. JOSEPH EARLY CHILDHOOD	114 ADAMS ST	Childcare
AMERICAN PRINTING HOUSE FOR THE BLIND		Museum
PASRGAD GROCERY	2026 BROWNSBORO ROAD	Grocery
BABAN BAKEKRY	2018 BROWNSBORO ROAD	Grocery
FAMILY DOLLAR	1961 BROWNSBORO ROAD	Grocery
Beverly Healthcare-Mt Holly	446 Mount Holly Ave	Nursing Home
WALDEN SCHOOL	4238 WESTPORT RD	School
Bashford East Healthcare	446 Mt. Holly Ave	Nursing Home
ST. LUKE'S PRE-SCHOOL	1206 MAPLE LN	Childcare
VEHICLE IMPOUNDMENT LMPD	1487 FRANKFORT AVE	LMPD
KRIBS2KIDS, LLC	4244 WESTPORT RD	Childcare
SPRINGHILL SUITES BY MARRIOTT	10101 FOREST GREEN BLVD	HOTEL
WESTPORT ROAD BIBLE PRESCHOOL	4500 WESTPORT RD	Childcare

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
CHENOWETH ELEMENTARY	3622 BROWNSBORO RD	School
CHENOWETH ELEMENTARY CEP	3622 BROWNSBORO RD	Childcare
MELLWOOD ARTS CENTER		Theatre/Stadium
HOLY TRINITY SCHOOL	423 CHERRYWOOD RD	School
MARYHURST HIGH	1015 DORSEY LN	Childcare
MARYHURST - EUPHRASIA PROGRAM	1015 DORSEY LN	Childcare
MARYHURST - EUPHRASIA PROGRAM	1015 DORSEY LN	Childcare
MARYHURST - EUPHRASIA PROGRAM	1015 DORSEY LN	Childcare
ANCHORAGE CITY HALL	11506 PARK RD	Warning Sirens
EMBASSY SUITES LOUISVILLE EAST	9940 CORPORATE CAMPUS DR	HOTEL
ANCHORAGE CLASS CITY	11506 PARK RD	LMPD
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #4	1400 EVERGREEN RD	Fire Dept
CHENOWETH ELEMENTARY SCHOOL	3622 BROWNSBORO RD	Warning Sirens
NORTHEAST FAMILY YMCA CHILD	9400 MILL BROOK RD	Childcare
YMCA/ ST. LEONARD ELEM. AFTER	440 ZORN AVE	Childcare
ANCHORAGE	11400 RIDGE RD	School
ANCHORAGE	11501 PARK ROAD	USPS
Corporate Campus	9601 Ormsby Station Rd	Office
LESLIE CALBERT	12507 HIAWATHA AVE	Childcare
KIDS' PLACE MONTESSORI CENTER	13100 MAGISTERIAL DR	Childcare
CARRIAGE HOUSE PRESCHOOL	13100 MAGISTERIAL DR	Childcare
Beverly Healthcare Lyndon	1101 Lyndon Ln	Nursing Home
Lyndon Lane Nursing Center	1101 Lyndon Ln	Nursing Home
SECOND PRESBYTERIAN WEEKDAY	3701 OLD BROWNSBORO RD	Childcare
Hurstbourne Crossing	9721 Ormsby Station Rd.	Office
LOUISVILLE DAY TREATMENT CTR	8711 LA GRANGE RD	School
BELLEWOOD PRESBYTERIAN HOME FOR CH	11103 PARK RD	Childcare
BELLEWOOD PRESBYTERIAN HOME FOR CH	11103 PARK RD	Childcare
WISH'S DRUGS	9615 WHIPPS MILL ROAD	Grocery
CIRCLE K #117	9619 WHIPPS MILL RD	Grocery
NORTHEAST REGIONAL LIBRARY		Library

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
DESSERT GALLERY	9305 NEW LAGRANGE ROAD	Grocery
Camelot Shopping Center	1300 Lyndon Ln.	Shopping
USPIRITUS BELLEWOOD	11103 PARK RD	School
VETERAN'S HOSPITAL	800 ZORN AVE	Warning Sirens
BOWEN ELEMENTARY	1601 ROOSEVELT AV	School
BOWEN ELEMENTARY CHILD	1601 ROOSEVELT AVE	Childcare
KINDER CARE LEARNING CENTERS	730 ZORN AVE	Childcare
BOWEN SCHOOL	1601 ROOSEVELT AVE	Warning Sirens
BP MINI MART	7401 LAGRANGE RD	Grocery
CENTER FOR REHABILITATION & RECOVERY	10510 LAGRANGE RD	Shelter
JOANN HICKERSON	1723 PERSHING AVE	Childcare
CENTRAL STATE HOSPITAL	10510 La Grange Rd	Hospital
ST MATTHEWS FIRE DEPARTMENT #2	4400 BROWNSBORO RD	Fire Dept
BLUEGRASS PRESCHOOL & CHILD	9901 LAGRANGE RD	Childcare
ST ALBERT THE GREAT	1395 GIRARD DR	School
ROBLEY REX VA MEDICAL CENTER	800 Zorn Ave	Hospital
JEWISH HOSPITAL MEDICAL CENTER NORTHEAST	2401 Terra Crossing Blvd	Hospital
THE BROOK/KMI	8521 LA GRANGE RD	School
THE BROOK HOSPITAL - KMI	8521 La Grange Road	Hospital
SUBURBAN CHRISTIAN CHURCH	7515 WESTPORT RD	Childcare
PITT ACADEMY	7515 WESTPORT RD	School
ST. ALBERT'S PLAY CAFE	1301 TECHNY LN	Childcare
LITTLE SCHOOL HOUSE LEARNING	1705 W CREEKE WAY	Childcare
KAYFIELD ACADEMY II	2050 NELSON MILLER PKWY	Childcare
CHRIST CHURCH PRESCHOOL AND	4614 BROWNSBORO RD	Childcare
Jefferson Place	1705 Herr Ln	Nursing Home
WESTPORT MIDDLE SCHOOL	8100 WESTPORT RD	Warning Sirens
WESTPORT TRAD MIDDLE	8100 WESTPORT RD	School
WESTPORT LIBRARY		Library
BAPTIST HEALTH EASTPOINT	2400 Eastpoint Parkway	Hospital
RAQUEL HOWARD	2008 THE MEADOW RD	Childcare
B.P. OIL	1035 ZORN AVENUE	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
Jefferson Manor	1801 Lynn Way	Nursing Home
ST MATTHEWS FIRE DEPARTMENT #4	8414 WESTPORT RD	Fire Dept
GALEN COLLEGE OF NURSING	1031 Zorn Avenue	College
WEBSTER UNIVERSITY -- LOUISVILLE CAMPUS	1031 Zorn Ave.	College
RAMADA INN	1041 ZORN AVE.	INN
ISLAMIC SCHOOL OF LOUISVILLE	8215 OLD WESTPORT RD	School
WILDER ELEMENTARY SCHOOL	1913 HERR LN	Warning Sirens
WILDER ELEM. CHILDCARE	1913 HERR LN	Childcare
WILDER ELEMENTARY	1913 HERR LN	School
CARY HANNA	9204 TRENTHAM LN	Childcare
WESTPORT EARLY CHILDHOOD CENTER	8800 WESTPORT RD	Childcare
GEORGIA CHAFFEE TEENAGE PARENT	8800 WESTPORT RD	Childcare
SOUTHSIDE CHRISTIAN DAY CARE 8	8700 WESTPORT RD	Childcare
HOORAY'S WINE & SPIRITS	8730 WESTPORT ROAD	Grocery
KINDER CARE LEARNING CENTER	2013 HERR LN	Childcare
PORTLAND CHRISTIAN SCHOOL	8509 WESTPORT RD	Childcare
YMCA/MOTHER OF GOOD COUNSEL	8509 WESTPORT RD	Childcare
Holiday Manor	4900 Brownsboro Rd	Shopping
SERVICE PLUS #4	4900 BROWNSBORO RD	Grocery
COVENANT CLASSICAL ACADEMY	13902 FACTORY LN	School
EASTERN AREA COMMUNITY MINISTRIES	9104 WESTPORT RD	Community Ministries
Fenley Office Park	4967 US Hwy 42	Office
THOMAS JEFFERSON PRESCHOOL	4938 BROWNSBORO RD	Childcare
KAREN WHITE	8903 DUXBURY RD	Childcare
BALLARD HIGH	6000 BROWNSBORO RD	School
JENNY CRAIG WEIGHT LOSS CENTER	2213 HOLIDAY MANOR	Grocery
KAMMERER MIDDLE	7315 WESBORO RD	School
Northfield Center for Healthcare & Rehabilitation	6000 Hunting Rd	Nursing Home
DOLLAR TREE #2410	9206 WESTPORT ROAD	Grocery
DUNN ELEMENTARY	2010 RUDY LN	Childcare
DUNN ELEMENTARY CHILD CARE	2010 RUDY LN	Childcare
DUNN SCHOOL	2010 RUDY LN	Warning Sirens
Westport Plaza	9400 Westport Rd.	Shopping

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
CIRCLE K #131	9401 WESTPORT RD	Grocery
RITE AID #4646	9459 WESTPORT ROAD	Grocery
ST. THOMAS PRESCHOOL	9616 WESTPORT RD	Childcare
ZACHARY TAYLOR ELEMENTARY	9620 WESTPORT RD	Childcare
ZACHARY TAYLOR CHILDCARE	9620 WESTPORT RD	Childcare
MSD MUDDY FORK PUMP STATION	2120 INDIAN HILLS TRAIL	Warning Sirens
WALGREEN DRUG #3631	2420 LIME KILN LANE	Grocery
WATKINS MEMORIAL UNITED	9800 WESTPORT RD	Childcare
INDIAN HILLS CLASS CITY	3738 RIVER RD	LMPD
WALGREENS #4309	9702 WESTPORT ROAD	Grocery
WESTPORT ROAD BAPTIST MOTHERS	9705 WESTPORT RD	Childcare
WESTPORT ROAD BAPTIST CHILD	9705 WESTPORT RD	Childcare
Ford Motor Co.	3001 Chamberlain Ln	Manufacturing
Baptist Home East	3001 N. Hursbourne Pkwy	Nursing Home
TEMPLE EARLY CHILDHOOD	5101 U S HWY 42	Childcare
PARR'S REST HOME	3101 N HURSTBOURNE PKY	Shelter
Eden Care	901 Blankenbaker Rd	Nursing Home
SPRINGDALE PRESCHOOL	7812 BROWNSBORO RD	Childcare
EDEN TERRACE OF LOUISVILLE	901 BLANKENBAKER RD	Shelter
NORMA THOMAS	8207 PIPILO PL	Childcare
Barton House	6830 Overlook Dr	Nursing Home
Springhurst Towne Center	10508 Fischer Park Dr.	Shopping
MONTESSORI SCHOOL OF LSVL	10263 CHAMPION FARMS DR	School
CIRCLE K #3243	8001 BROWNSBORO ROAD	Grocery
COURTYARD BY MARRIOTT LOUISVILLE NORTHEAST	10200 CHAMPION FARMS DR	HOTEL
BARTON HOUSE OF LOUISVILLE #1	6830 OVERLOOK DR	Shelter
RESIDENCE INN BY MARRIOTT NORTHEAST	3500 SPRINGHURST PKY	EXTENDED STAY
NORTON ELEMENTARY	8101 BROWNSBORO RD	Childcare
NORTON ELEMENTARY CHILDCARE	8101 BROWNSBORO RD	Childcare
OPERATION OPEN ARMS	6410 LONGVIEW LN	Childcare
KWIK SHOP MARATHON	11401 WESTPORT ROAD	Grocery

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
HAMPTON INN EAST	4100 HAMPTON LAKE WAY	INN
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #7	8412 BROWNSBORO RD	Fire Dept
WORTHINGTON FPD #2	8412 BROWNSBORO RD	Warning Sirens
HAMPTON INN I-265	4100 HAMPTON LAKE WAY	Grocery
InTown Suites	11405 WESTPORT RD	EXTENDED STAY
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LN	INN
LOUISVILLE MART	4102 MURPHY LN	Grocery
CHICKEN LITTLE DAY CARE AND	3906 RIVEROAKS LN	Childcare
TANISHA FRYE	129 CHARTER OAKS DR	Childcare
NATHALIE CASWELL	4608 OAK FOREST RD	Childcare
PRECIOUS LAMBS CHRISTIAN CHILD	4140 ACCOMACK DR	Childcare
Lear Corp.	12510 Westport Rd	Manufacturing
WENETTA KING	4019 PACELLI PL	Childcare
SONIA MITCHELL	4712 WILLOW FOREST PL	Childcare
DIANNA BOARD	10408 SANDBOURNE WAY	Childcare
CHRISTIAN CHILD CARE	3800 NORTHUMBERLAND DR	Childcare
JO HOLLAND	4008 RIVER OAKS CI	Childcare
KENTUCKY COUNTRY DAY	4100 SPRINGDALE RD	Childcare
YMCA SACC KENTUCKY COUNTRY DAY SACC PROGRAM	4100 SPRINGDALE RD	Childcare
CHANCEY ELEMENTARY	4301 MURPHY LN	Childcare
YMCA SCHOOL AGE CHILD CARE MALCOLM B. CHANCEY, JR.	4301 MURPHY LN	Childcare
PATRICIA PARKER	4912 OAKBROOK DR	Childcare
MARILYN'S PRE-SCHOOL CHILD	3915 NORTHUMBERLAND DR	Childcare
GLENVIEW	4330 GLENVIEW AVENUE	USPS
B.P. FOOD MART #146	4740 CHAMBERLAIN LANE	Grocery
WORTHINGTON FPD #1	4700 MURPHY LN	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #9	4700 MURPHY LANE	Fire Dept

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE KARST		
NAME	**ADDRESS**	**FACILITY TYPE**
VIRGINIA CHANCE SCHOOL	4200 LIME KILN LN	Childcare
CHANCE SCHOOL (THE)	4200 LIME KILN LN	Childcare
NORTON CHILDREN'S MEDICAL CENTER - BROWNSBORO	4910 Chamberlain Ln	Hospital
NORTON BROWNSBORO HOSPITAL	4960 Norton Heathcare Blvd	Hospital
MS. HELEN'S DAY CARE	11503 FISHERMAN WAY	Childcare
FIRST KIDS EARLY CHILDHOOD	7700 US HWY 42	Childcare
ST. FRANCIS PRESCHOOL	6710 WOLF PEN BRANCH RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #8	9514 FEATHERBELL BLVD	Fire Dept
NORTON COMMONS ELEMENTARY	10941 KINGS CROWN DR	School
SAINT MARY ACADEMY	11311 SAINT MARY LN	School

CRITICAL FACILITIES AND INFRASTRUCTURE HIGHLY VULNERABLE LANDSLIDE		
NAME	**ADDRESS**	**FACILITY TYPE**
6310 OLD HEADY	6310 OLD HEADY RD	Warning Sirens
ST. PATRICK SCHOOL	1000 N BECKLEY STATION RD	Warning Sirens

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE DAM/LEVEE FAILURE		
NAME	**ADDRESS**	**FACILITY TYPE**
AL'S BAIT HOUSE	14216 DIXIE HWY	Grocery
HORSESHOE LAKE	14045 DIXIE HIGHWAY	Grocery
BOBBIE FRANKLIN	7302 NATHAN HALE WAY	Childcare
BIFF'S MOTEL	13305 DIXIE HWY	Hotel
DEAL MASTERS	6115 BLEVINS GAP ROAD	Grocery
VALLEY CHURCH OF THE NAZARENE	12519 DIXIE HWY	Warning Sirens
PLEASANT PLACE HOME FOR CARE	12800 Dixie Hwy	Nursing Home
DOLLAR GENERAL STORE #538	11909 DIXIE HIGHWAY	Grocery
BETHANY CHILD DEVELOPMENT & DAY CARE CENTER	6100 MOORMAN RD	Childcare
MEDORA ELEMENTARY SCHOOL	11801 DEERING RD	Warning Sirens
NEW SALEM CHILD CARE CENTER	6408 BETHANY LN	Childcare
PLEASURE RIDGE PARK FPD STA. #8	6501 BETHANY LN	Warning Sirens
MARY POWELL	6505 SUNNYVALE WAY	Childcare
PLEASURE RIDGE PARK FIRE DEPARTMENT #10	8201 GREENWOOD RD	Fire Dept
PRP FPD TRAINING CENTER	8201 GREENWOOD RD	Warning Sirens
LORETHIA BYRD	6709 HUNTERS CREEK BLVD	Childcare
SUZETTE COX	3230 ROSEWEDGE WAY	Childcare
PATRICIA DUNCAN	4420 TARA AVE	Childcare
MARY CLARK	4449 CHARLOTTE ANN DR	Childcare
MARIE TROWEL	3003 TEAKWOOD CI	Childcare
CANE RUN DAY CARE CENTER	4715 CANE RUN RD	Childcare
LENA'S KWIK SHOP	4000 LEES LANE	Grocery
LAKE DREAMLAND FIRE DEPARTMENT #1	4603 CANE RUN RD	Warning Sirens
HONEY BEE DAY CARE	4323 CHARLOTTE ANN DR	Childcare
PLEASURE RIDGE PARK FIRE DEPARTMENT #5	4603 CANE RUN RD	Fire Dept
HELEN'S DAY CARE CENTER INC.	4527 CANE RUN RD	Childcare
RESURRECTION LIFE CHURCH DAY	4415 OBOE DR	Childcare
FRIENDLY STOP FOOD MART	4502 CANE RUN ROAD	Grocery
Borden Chemical Inc.	6200 Camp Ground Rd	Manufacturing
SAVE-A-LOT	4443 CANE RUN ROAD	Grocery
DOLLAR GENERAL STORE	4443 CANE RUN ROAD	Grocery
MARY ZINN	4422 CANE RUN RD	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE DAM/LEVEE FAILURE		
NAME	**ADDRESS**	**FACILITY TYPE**
ENGLISH, SHATANYA	3430 RICHMONT RD	Childcare
RITE AID #4636	4315 CANE RUN ROAD	Grocery
Rohm and Haas Co	4300 Campground Rd	Manufacturing
P. J.'S DAY CARE CENTER	3809 BELQUIN CT	Childcare
EARLY HEAD START PROGRAM	3610 BOHNE AVE	Childcare
UJIMA NEIGHBORHOOD PLACE	3610 BOHNE AVENUE	Childcare
DUVALLE EDUCATION CENTER	3610 BOHNE AV	School
CAROLYN ROSS	1705 LANG CT	Childcare
TAMMIE BROWN	3718 STRATTON AVE	Childcare
LOUISVILLE METRO POLICE 4TH DISTRICT/KENNEDY SCHOOL	3807 YOUNG AVE	Warning Sirens
YVONNE WILLIAMSON	3518 CHAUNCEY AVE	Childcare
KENNEDY MONTESSORI ELEMENTARY	3800 GIBSON LN	School
KENNEDY ELEMENTARY CHILD CARE	3800 GIBSON LN	Childcare
FOSTER TRADITIONAL ACADEMY	1401 S 41ST ST	Childcare
YMCA SACC FOSTER CHILDCARE ENRICHMENT PROGRAM	1401 S 41ST ST	Childcare
LIL' KINGS & QUEENS I	3216 DUMESNIL ST	Childcare
WEST END SCHOOL	3628 VIRGINIA AVE	School
SANDRA BELL	4206 WINNROSE WAY	Childcare
E & R QUICK STOP	4501 GREENWOOD AVENUE	Grocery
TODDLER BEAR DAY CARE	819 S 39TH ST	Childcare
MARSHA RICHARDSON	830 SO 41ST ST	Childcare
CHRIST THE KING LEARNING CENTER	724 S 44TH ST	Childcare
ETA DAYCARE CENTER, LLC	724 S 44TH ST	Childcare
SHAWNEE LIBRARY	3912 W Broadway	Library
ETA DAYCARE CENTER	724 S 44TH ST	Childcare
VERNA JONES	671 S 40TH ST	Childcare
SHAWNEE PARK MAINTENANCE BLDG	4501 W BROADWAY	Warning Sirens
APRICOT HOUSE CHILD CARE II	400 S 41ST ST	Childcare
DORIS SHACKLETT	244 S 43RD ST	Childcare
NORTHWEST NEIGHBORHOOD PLACE	4018 WEST MARKET STREET	Clinic

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE DAM/LEVEE FAILURE		
NAME	**ADDRESS**	**FACILITY TYPE**
SHAWNEE HIGH SCHOOL	4018 W MARKET ST	Warning Sirens
JESSIE GREEN	109 N 38TH ST	Childcare
SHERYL'S KIDDIE KASTLE	205 N 38TH ST	Childcare
SHERICKA REED	218 N 39TH ST	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
HIGHVIEW FPD #3	10200 CEDAR CREEK RD	Warning Sirens
HIGHVIEW FIRE DEPARTMENT #3	10200 CEDAR CREEK RD	Fire Dept
Silver Heights Plaza	3811 Freedom Way	Shopping
ANGELS ARE US CHILD CARE	9218 BLUE LICK RD	Childcare
TONYA CALBERT	8500 LONG RIFLE CT	Childcare
BEST STOP FOOD MART	9200 BLUE LICK RD	Grocery
CIRCE K #109	9111 BLUE LICK ROAD	Grocery
Wesley Manor Retirement Community	5012 E. Manslick Rd	Nursing Home
Regency Health Care Center	1550 Raydale Dr	Nursing Home
LOUISVILLE BIBLE COLLEGE	8013 Damascus Rd	College
BLAKE ELEMENTARY	3801 BONAVENTURE BV	School
MINORS LANE ELEMENTARY	8510 MINOR LN	Childcare
MINORS LANE ELEMENTARY	8510 MINORS LN	Childcare
MINORS LANE ELEMENTARY SCHOOL	8510 MINOR LN	Warning Sirens
SOUTHERN HIGH	8620 PRESTON HY	School
PAM SNAWDER	8102 FLORIST RD	Childcare
ST RITA	8709 PRESTON HY	Childcare
ST. RITA AFTERCARE	8709 PRESTON HIGHWAY	Childcare
SOUTHERN HIGH SCHOOL	8620 PRESTON HWY	Warning Sirens
TODDLERS AND TOTS DAY CARE	8301 OLD SHEPHERDSVILLE RD	Childcare
HIGHVIEW FPD #2	8001 SMYRNA PKY	Warning Sirens
HIGHVIEW FIRE DEPARTMENT #2	8001 SMYRNA PKY	Fire Dept
VICTORIA WILDT	8100 APPLEGATE CT	Childcare
RITA BLACKWELL	7209 RAMBO WAY	Childcare
GENESIS HOUSE/HARMONY HOUSE/DAUGHTERS OR ZION	8311 PRESTON HWY	Shelter
ANGELS ARE US #3	8101 BLUE LICK RD	Childcare
SHORT STOP FOOD MART #18	8116 BLUE LICK RD	Grocery
A PIECE OF CAKE	8102 BLUELICK ROAD	Grocery
BLUE LICK B.P. #58	8200 PRESTON HWY	Grocery
SPEEDY MART #246	8003 OLD SHEPHERDSVILLE ROAD	Grocery
BRENTLINGER BP #57	7723 BARDSTOWN ROAD	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
ALESA BIRD	3703 CUTLER RD	Childcare
ANGELA ROBINSON	3614 BRIARCLIFF CT	Childcare
KIDS OF THE FUTURE	7803 LAUREL RIDGE RD	Childcare
BATES ELEM. SCHOOL	7601 BARDSTOWN RD	Warning Sirens
BATES ELEMENTARY	7601 BARDSTOWN RD	Childcare
BATES ELEMENTARY CHILDCARE	7601 BARDSTOWN RD	Childcare
SUMMIT HEIGHTS UNITED	7400 OUTER LOOP	Childcare
ROBBIENAI SMITH	6600 OUTER LOOP	Childcare
DOLLAR GENERAL STORE	7513 OUTER LOOP	Grocery
CHILDREN'S UNIVERSE #4	8019 BEULAH CHURCH RD	Childcare
JC'S CIGARETTE OUTLET #19	6720 OUTER LOOP	Grocery
DORIS OECHSLE FAMILY CHILD	10304 WINGFIELD RD	Childcare
7TH DIVISION LMPD	7201 OUTER LOOP	LMPD
LEARNING TREE (THE)	6701 OUTER LOOP	Childcare
SPEEDY MART	7920 FEGENBUSH LANE	Grocery
HICKORY FARMS	4800 OUTER LOOP	Grocery
GREAT AMERICAN COOKIE	4801 OUTER LOOP	Grocery
THE DOLLAR TREE STORE #861	4801 OUTER LOOP BLDG #861	Grocery
JOY-TI CHILD CARE	8600 BEULAH CHURCH RD	Childcare
WALGREEN'S	7914 FEGENBUSH LANE	Grocery
Festival on Jefferson Court, "	4501 Outer Loop	Shopping
SMYRNA ELEMENTARY	6401 OUTER LOOP	School
AIR (HELICOPTER) LMPD	7203 OUTER LOOP	LMPD
SPECIAL RESPONSE TEAM (SRT) LMPD	4711 OUTER LOOP	LMPD
CVS/PHARMACY #6209	4249 OUTER LOOP	Grocery
MOORE HIGH	6415 OUTER LOOP	School
WHITEFIELD ACADEMY	7711 FEGENBUSH LN	Childcare
YMCA/HIGHVIEW BAPTIST SCHOOL	7711 FEGENBUSH LN	Childcare
HIGHVIEW BAPTIST PRESCHOOL	7711 FEGENBUSH LN	Childcare
HIGHVIEW CHILDRENS ACADEMY	7406 FEGENBUSH LN	Childcare
PASTRY PLUS	7407-B FEGENBUSH LANE	Grocery
PLAYWORLD CHILD DEVELOPMENT	7200 PEPPERMILL LN	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
HIGHVIEW FIRE DEPARTMENT #1	7308 FEGENBUSH LN	Fire Dept
HIGHVIEW FPD #1	7308 FEGENBUSH LN	Warning Sirens
OKOLONA	7400 JEFFERSON BLVD	USPS
SOUTH CENTRAL REGIONAL LIBRARY	7300 Jefferson Blvd	Library
TANYA BARNETT	6817 MONTY LN	Childcare
VALARIE WILSON	6202 WHISPERING HILLS BLVD	Childcare
ST. ALBANS CHILD CARE	9004 BEULAH CHURCH	Childcare
FERN CREEK/HIGHVIEW UNITED MINISTRIES	9300 BEULAH CHURCH RD	Community Ministries
BEULAH PRE-SCHOOL	6704 BARDSTOWN RD	Childcare
FARMER ELEMENTARY	6405 GELLHAUS LN	School
CORNERSTONE ACADEMY	6300 BILLTOWN RD	School
A-Z,1-2-3 DAY CARE	6100 BILLTOWN RD	Childcare
TERESA BROWN	6300 SERENITY CT	Childcare
KIDZ WILL BE KIDZ	4306 SHADY VILLA DR	Childcare
MOORE'S DAY CARE CENTER, INC.	5057 POPLAR LEVEL RD	Childcare
BABYLAND DAY CARE	5057 POPLAR LEVEL RD	Childcare
BRIGHT BEGINNINGS II	5034 POPLAR LEVEL RD	Childcare
FREDDIE'S LIQUORS	5046 POPLAR LEVEL ROAD	Grocery
SMOKER'S OASIS	5044 POPLAR LEVEL ROAD	Grocery
BRIGHT BEGINNINGS CHILD	5051 POPLAR LEVEL RD	Childcare
WILLIE'S CHILD DEVELOPMENT	4305 NAOMI DRIVE	Grocery
LILLIE DYE	4112 MELDA LN	Childcare
LATINO-AMERICANO	5039 POPLAR LEVEL ROAD	Grocery
CHESS' LITTLE RAINBOWS	4118 PIXLEY WAY	Childcare
BUILDING A RAINBOW	5011 POPLAR LEVEL RD	Childcare
THOMAS JEFFERSON MIDDLE	1501 RANGELAND RD	Childcare
THOMAS JEFFERSON MIDDLE SCHOOL	4401 RANGELAND RD	Childcare
CHARLIE VETTINER PARK	5550 CHARLIE VETTINER PARK RD	Warning Sirens
FIRST NEIGHBORHOOD PLACE	1503 RANGELAND ROAD	Clinic

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
FAMILY DOLLAR STORE #957	4936 POPLAR LEVEL ROAD	Grocery
JIM DANDY FOOD MART	4902 POPLAR LEVEL RD	Grocery
GEORGE UNSELD EARLY CHILDHOOD CENTER	5216 ILEX AVE	School
NANCY BOWLDS	11606 CHINOOK CT	Childcare
ETTA SMITH	4202 E INDIAN TRAIL	Childcare
DOLLAR GENERAL STORE	4835 POPLAR LEVEL ROAD	Grocery
ANGELA EMBRY	5116 ALBA WAY	Childcare
ANEESHA MADDOX	4718 UNSELD BLVD	Childcare
AIRPORT AND EXPO LA QUINTA INN AND SUITES	4125 PRESTON HWY	INN
THE NEIGHBORS BP #1	1830 NEW BLANKENBAKER PARKWAY	Grocery
COMFORT SUITES	1850 RESOURCE WAY	Grocery
SLEEP INN EAST	1850 PRIORITY WAY	INN
COMFORT SUITES	1850 RESOURCE WAY	INN
SLEEP INN	1850 PRIORITY WAY	Grocery
HOMESTEAD STUDIO SUITES	1650 ALLIANT AVENUE	Grocery
HOLIDAY INN EXPRESS HOTEL/SUIT	1620 ALLIANT AVENUE	Grocery
HOMESTEAD STUDIO SUITES	1650 ALLLIANT AVE	HOTEL
WINGATE INN	12301 ALLIANT CT	INN
SUPER 8 MOTEL AND SUITES	1501 ALLIANT AVE	MOTEL
IT'S A SMALL WORLD	2539 DOUP AVE	Childcare
KENESETH ISRAEL PRESCHOOL	2531 TAYLORSVILLE RD	Childcare
WHITEFIELD ACADEMY EAST	15201 SHELBYVILLE RD	School
DOUGLAS HILL SWINM CENTER	501 GATEHOUSE LN	Warning Sirens
WALGREENS	13807 ENGLISH VILLA DRIVE	Grocery
CVS #5866	13900 SHELBYVILLE ROAD	Grocery
KIDS ACADEMY IV	13905 SHELBYVILLE RD	Childcare
CROSBY MIDDLE	303 GATEHOUSE LN	School
VICKIE DOYLE	1904 MIDDLETOWN DR	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
SUMMIT ACADEMY	11508 MAIN ST	School
WEE CARE NURSERY I, II, & III	11616 MAIN ST	Childcare
DOUGLAS HILLS BP	10600 SHELBYVILLE RD.	Grocery
CVS PHARMACY #6205	10490 SHELBYVILLE ROAD	Grocery
PARTY OUTLET	10402 SHELBYVILLE ROAD	Grocery
HIGHLAND LATIN SCHOOL	10901 SHELBYVILLE RD	School
KBHC PREGNANCY & ADOPTION	10801 SHELBYVILLE RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #2	10217 SHELBYVILLE RD	Fire Dept
SPRING MEADOWS CHILDREN'S HOME	10901 SHELBYVILLE RD	Childcare
HIGHLAND FISH MARKET	12121 SHELBYVILLE ROAD	Grocery
Marriott's Forum at Brookside	200 Brookside Dr	Nursing Home
Forum at Brookside/Indepemndent & Convalenscent	200 Brookside Dr	Nursing Home
8TH DIVISION LMPD	200 JUNEAU DR	LMPD
MIDDLETOWN HEALTH CENTER	200 JUNEAU DRIVE	LMPD
MIDDLETOWN LIBRARY	12556 Shelbyville Rd	Library
LUCKY DUCKY CHILD CARE	10211 WOODKNOLL RD	Childcare
SO BAPTIST SEMINARY - BOYCE COLLEGE	2825 LEXINGTON RD	Warning Sirens
SOUTHERN BAPTIST THEOLOGICAL SEMINARY	2825 Lexington Rd	College
LEGACY HOTEL AND CONFERENCE CENTER	2825 LEXINGTON RD	GRAND HOTEL
ANNA LANE	415 DORSEY LN	Childcare
URSULINE MONTESSORI SCHOOL &	3105 LEXINGTON RD	Childcare
SACRED HEART MODEL	3107 LEXINGTON RD	School
ST PATRICK	1000 N BECKLEY STATION RD	Childcare
YMCA/ST. PATRICK AFTER SCHOOL PROGRAM	1000 N BECKLEY STATION RD	Childcare
ST. PATRICK SCHOOL	1000 N BECKLEY STATION RD	Warning Sirens
SACRED HEART ACADEMY	3175 LEXINGTON RD	School
BARBARA'S DAY CARE	3019 AUBERT AVE	Childcare
JCPS BLANKENBAKER BUS COMPOUND	13075 MIDDLETOWN INDUSTRIAL BLVD	Warning Sirens

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
LOUISVILLE DIVERSIFIED SERVICES-PALS	136 SACRED HEART LN	Shelter
FIELD ELEMENTARY	120 SACRED HEART LN	Childcare
FIELD ELEMENTARY CHILD CARE	120 SACRED HEART LN	Childcare
HOLY ANGELS ACADEMY	12201 OLD HENRY RD	School
NANCY HOOVER	12710 OLD HENRY RD	Childcare
LOUISVILLE WATER CO CRESCENT HILL	100 RESERVOIR AVE	Warning Sirens
ST. LUKE'S PRE-SCHOOL	1206 MAPLE LN	Childcare
SPRINGHILL SUITES BY MARRIOTT	10101 FOREST GREEN BLVD	HOTEL
ANCHORAGE CITY HALL	11506 PARK RD	Warning Sirens
EMBASSY SUITES LOUISVILLE EAST	9940 CORPORATE CAMPUS DR	HOTEL
ANCHORAGE CLASS CITY	11506 PARK RD	LMPD
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #4	1400 EVERGREEN RD	Fire Dept
ANCHORAGE	11400 RIDGE RD	School
ANCHORAGE	11501 PARK ROAD	USPS
LESLIE CALBERT	12507 HIAWATHA AVE	Childcare
KIDS' PLACE MONTESSORI CENTER	13100 MAGISTERIAL DR	Childcare
CARRIAGE HOUSE PRESCHOOL	13100 MAGISTERIAL DR	Childcare
STOPHER ELEMENTARY	14417 AIKEN ROAD	School
Hurstbourne Crossing	9721 Ormsby Station Rd.	Office
BELLEWOOD PRESBYTERIAN HOME FOR CH	11103 PARK RD	Childcare
BELLEWOOD PRESBYTERIAN HOME FOR CH	11103 PARK RD	Childcare
NORTHEAST REGIONAL LIBRARY	15 Bellevoir Cir	Library
USPIRITUS BELLEWOOD	11103 PARK RD	School
Seniorcare	1700 Ups Dr.	Nursing Home
CENTRAL ST HOSP COFFEE SHOP	10510 LAGRANGE ROAD	Grocery
BP MINI MART	7401 LAGRANGE RD	Grocery
Meadowview Health & Rehabilitation Center	9701 Whipps Mill Rd	Nursing Home
CENTER FOR REHABILITATION & RECOVERY	10510 LAGRANGE RD	Shelter
CENTRAL STATE HOSPITAL	10510 La Grange Rd	Hospital
BLUEGRASS PRESCHOOL & CHILD	9901 LAGRANGE RD	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
JEWISH HOSPITAL MEDICAL CENTER NORTHEAST	2401 Terra Crossing Blvd	Hospital
KROGER WAREHOUSE	2000 NELSON MILLER PKWY	Warning Sirens
KAYFIELD ACADEMY II	2050 NELSON MILLER PKWY	Childcare
BAPTIST HEALTH EASTPOINT	2400 Eastpoint Parkway	Hospital
RAQUEL HOWARD	2008 THE MEADOW RD	Childcare
WESTPORT EARLY CHILDHOOD CENTER	8800 WESTPORT RD	Childcare
GEORGIA CHAFFEE TEENAGE PARENT	8800 WESTPORT RD	Childcare
COVENANT CLASSICAL ACADEMY	13902 FACTORY LN	School
EASTERN AREA COMMUNITY MINISTRIES	9104 WESTPORT RD	Community Ministries
DOLLAR TREE #2410	9206 WESTPORT ROAD	Grocery
ZACHARY TAYLOR ELEMENTARY SCHOOL	9620 WESTPORT RD	Warning Sirens
Westport Plaza	9400 Westport Rd.	Shopping
CIRCLE K #131	9401 WESTPORT RD	Grocery
RITE AID #4646	9459 WESTPORT ROAD	Grocery
ST. THOMAS PRESCHOOL	9616 WESTPORT RD	Childcare
ZACHARY TAYLOR ELEMENTARY	9620 WESTPORT RD	Childcare
ZACHARY TAYLOR CHILDCARE	9620 WESTPORT RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #3	13012 FACTORY LANE	Fire Dept
WATKINS MEMORIAL UNITED	9800 WESTPORT RD	Childcare
WALGREENS #4309	9702 WESTPORT ROAD	Grocery
WESTPORT ROAD BAPTIST MOTHERS	9705 WESTPORT RD	Childcare
WESTPORT ROAD BAPTIST CHILD	9705 WESTPORT RD	Childcare
Ford Motor Co.	3001 Chamberlain Ln	Manufacturing
Baptist Home East	3001 N. Hursbourne Pkwy	Nursing Home
PARR'S REST HOME	3101 N HURSTBOURNE PKY	Shelter
FORD ASSEMBLY PLANT	3520 CHAMBERLAIN LN	Warning Sirens
NORMA THOMAS	8207 PIPILO PL	Childcare
Springhurst Towne Center	10508 Fischer Park Dr.	Shopping

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
MONTESSORI SCHOOL OF LSVL	10263 CHAMPION FARMS DR	School
CIRCLE K #3243	8001 BROWNSBORO ROAD	Grocery
COURTYARD BY MARRIOTT LOUISVILLE NORTHEAST	10200 CHAMPION FARMS DR	HOTEL
RESIDENCE INN BY MARRIOTT NORTHEAST	3500 SPRINGHURST PKY	EXTENDED STAY
NORTON ELEMENTARY	8101 BROWNSBORO RD	Childcare
NORTON ELEMENTARY CHILDCARE	8101 BROWNSBORO RD	Childcare
KWIK SHOP MARATHON	11401 WESTPORT ROAD	Grocery
HAMPTON INN EAST	4100 HAMPTON LAKE WAY	INN
CONAGRA FOODS	12650 WESTPORT RD	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #7	8412 BROWNSBORO RD	Fire Dept
WORTHINGTON FPD #2	8412 BROWNSBORO RD	Warning Sirens
HAMPTON INN I-265	4100 HAMPTON LAKE WAY	Grocery
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LANE	Grocery
InTown Suites	11405 WESTPORT RD	EXTENDED STAY
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LN	INN
DOLLARS AND CENTS	11304 MAPLE BROOK DRIVE	Grocery
INDIA BAZAAR	11324 MAPLE BROOK DRIVE	Grocery
LOUISVILLE MART	4102 MURPHY LN	Grocery
CHICKEN LITTLE DAY CARE AND	3906 RIVEROAKS LN	Childcare
TANISHA FRYE	129 CHARTER OAKS DR	Childcare
NATHALIE CASWELL	4608 OAK FOREST RD	Childcare
PRECIOUS LAMBS CHRISTIAN CHILD	4140 ACCOMACK DR	Childcare
Lear Corp.	12510 Westport Rd	Manufacturing
WENETTA KING	4019 PACELLI PL	Childcare
SONIA MITCHELL	4712 WILLOW FOREST PL	Childcare
DIANNA BOARD	10408 SANDBOURNE WAY	Childcare
CHRISTIAN CHILD CARE	3800 NORTHUMBERLAND DR	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
JO HOLLAND	4008 RIVER OAKS CI	Childcare
KENTUCKY COUNTRY DAY	4100 SPRINGDALE RD	Childcare
YMCA SACC KENTUCKY COUNTRY DAY SACC PROGRAM	4100 SPRINGDALE RD	Childcare
CHANCEY ELEMENTARY	4301 MURPHY LN	Childcare
YMCA SCHOOL AGE CHILD CARE MALCOLM B. CHANCEY, JR.	4301 MURPHY LN	Childcare
PATRICIA PARKER	4912 OAKBROOK DR	Childcare
MARILYN'S PRE-SCHOOL CHILD	3915 NORTHUMBERLAND DR	Childcare
NORTHEAST CHRISTIAN CHURCH	9900 BROWNSBORO RD	Warning Sirens
B.P. FOOD MART #146	4740 CHAMBERLAIN LANE	Grocery
WORTHINGTON FPD #1	4700 MURPHY LN	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #9	4700 MURPHY LANE	Fire Dept
WALGREEN'S #7643	9801 BROWNSBORO ROAD	Grocery
NORTON CHILDREN'S MEDICAL CENTER - BROWNSBORO	4910 Chamberlain Ln	Hospital
NORTON BROWNSBORO HOSPITAL	4960 Norton Heathcare Blvd	Hospital
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #8	9514 FEATHERBELL BLVD	Fire Dept

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
HIGHVIEW FPD #3	10200 CEDAR CREEK RD	Warning Sirens
HIGHVIEW FIRE DEPARTMENT #3	10200 CEDAR CREEK RD	Fire Dept
Silver Heights Plaza	3811 Freedom Way	Shopping
ANGELS ARE US CHILD CARE	9218 BLUE LICK RD	Childcare
TONYA CALBERT	8500 LONG RIFLE CT	Childcare
BEST STOP FOOD MART	9200 BLUE LICK RD	Grocery
CIRCE K #109	9111 BLUE LICK ROAD	Grocery
Wesley Manor Retirement Community	5012 E. Manslick Rd	Nursing Home
Regency Health Care Center	1550 Raydale Dr	Nursing Home
LOUISVILLE BIBLE COLLEGE	8013 Damascus Rd	College
BLAKE ELEMENTARY	3801 BONAVENTURE BV	School
MINORS LANE ELEMENTARY	8510 MINOR LN	Childcare
MINORS LANE ELEMENTARY	8510 MINORS LN	Childcare
MINORS LANE ELEMENTARY SCHOOL	8510 MINOR LN	Warning Sirens
SOUTHERN HIGH	8620 PRESTON HY	School
PAM SNAWDER	8102 FLORIST RD	Childcare
ST RITA	8709 PRESTON HY	Childcare
ST. RITA AFTERCARE	8709 PRESTON HIGHWAY	Childcare
SOUTHERN HIGH SCHOOL	8620 PRESTON HWY	Warning Sirens
TODDLERS AND TOTS DAY CARE	8301 OLD SHEPHERDSVILLE RD	Childcare
HIGHVIEW FPD #2	8001 SMYRNA PKY	Warning Sirens
HIGHVIEW FIRE DEPARTMENT #2	8001 SMYRNA PKY	Fire Dept
VICTORIA WILDT	8100 APPLEGATE CT	Childcare
RITA BLACKWELL	7209 RAMBO WAY	Childcare
GENESIS HOUSE/HARMONY HOUSE/DAUGHTERS OR ZION	8311 PRESTON HWY	Shelter
ANGELS ARE US #3	8101 BLUE LICK RD	Childcare
SHORT STOP FOOD MART #18	8116 BLUE LICK RD	Grocery
A PIECE OF CAKE	8102 BLUELICK ROAD	Grocery
BLUE LICK B.P. #58	8200 PRESTON HWY	Grocery
SPEEDY MART #246	8003 OLD SHEPHERDSVILLE ROAD	Grocery
BRENTLINGER BP #57	7723 BARDSTOWN ROAD	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
ALESA BIRD	3703 CUTLER RD	Childcare
ANGELA ROBINSON	3614 BRIARCLIFF CT	Childcare
KIDS OF THE FUTURE	7803 LAUREL RIDGE RD	Childcare
BATES ELEM. SCHOOL	7601 BARDSTOWN RD	Warning Sirens
BATES ELEMENTARY	7601 BARDSTOWN RD	Childcare
BATES ELEMENTARY CHILDCARE	7601 BARDSTOWN RD	Childcare
SUMMIT HEIGHTS UNITED	7400 OUTER LOOP	Childcare
ROBBIENAI SMITH	6600 OUTER LOOP	Childcare
DOLLAR GENERAL STORE	7513 OUTER LOOP	Grocery
CHILDREN'S UNIVERSE #4	8019 BEULAH CHURCH RD	Childcare
JC'S CIGARETTE OUTLET #19	6720 OUTER LOOP	Grocery
DORIS OECHSLE FAMILY CHILD	10304 WINGFIELD RD	Childcare
7TH DIVISION LMPD	7201 OUTER LOOP	LMPD
LEARNING TREE (THE)	6701 OUTER LOOP	Childcare
SPEEDY MART	7920 FEGENBUSH LANE	Grocery
HICKORY FARMS	4800 OUTER LOOP	Grocery
GREAT AMERICAN COOKIE	4801 OUTER LOOP	Grocery
THE DOLLAR TREE STORE #861	4801 OUTER LOOP BLDG #861	Grocery
JOY-TI CHILD CARE	8600 BEULAH CHURCH RD	Childcare
WALGREEN'S	7914 FEGENBUSH LANE	Grocery
Festival on Jefferson Court, "	4501 Outer Loop	Shopping
SMYRNA ELEMENTARY	6401 OUTER LOOP	School
AIR (HELICOPTER) LMPD	7203 OUTER LOOP	LMPD
SPECIAL RESPONSE TEAM (SRT) LMPD	4711 OUTER LOOP	LMPD
CVS/PHARMACY #6209	4249 OUTER LOOP	Grocery
MOORE HIGH	6415 OUTER LOOP	School
WHITEFIELD ACADEMY	7711 FEGENBUSH LN	Childcare
YMCA/HIGHVIEW BAPTIST SCHOOL	7711 FEGENBUSH LN	Childcare
HIGHVIEW BAPTIST PRESCHOOL	7711 FEGENBUSH LN	Childcare
HIGHVIEW CHILDRENS ACADEMY	7406 FEGENBUSH LN	Childcare
PASTRY PLUS	7407-B FEGENBUSH LANE	Grocery
PLAYWORLD CHILD DEVELOPMENT	7200 PEPPERMILL LN	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
HIGHVIEW FIRE DEPARTMENT #1	7308 FEGENBUSH LN	Fire Dept
HIGHVIEW FPD #1	7308 FEGENBUSH LN	Warning Sirens
OKOLONA	7400 JEFFERSON BLVD	USPS
SOUTH CENTRAL REGIONAL LIBRARY	7300 Jefferson Blvd	Library
TANYA BARNETT	6817 MONTY LN	Childcare
VALARIE WILSON	6202 WHISPERING HILLS BLVD	Childcare
ST. ALBANS CHILD CARE	9004 BEULAH CHURCH	Childcare
FERN CREEK/HIGHVIEW UNITED MINISTRIES	9300 BEULAH CHURCH RD	Community Ministries
BEULAH PRE-SCHOOL	6704 BARDSTOWN RD	Childcare
FARMER ELEMENTARY	6405 GELLHAUS LN	School
CORNERSTONE ACADEMY	6300 BILLTOWN RD	School
A-Z,1-2-3 DAY CARE	6100 BILLTOWN RD	Childcare
TERESA BROWN	6300 SERENITY CT	Childcare
KIDZ WILL BE KIDZ	4306 SHADY VILLA DR	Childcare
MOORE'S DAY CARE CENTER, INC.	5057 POPLAR LEVEL RD	Childcare
BABYLAND DAY CARE	5057 POPLAR LEVEL RD	Childcare
BRIGHT BEGINNINGS II	5034 POPLAR LEVEL RD	Childcare
FREDDIE'S LIQUORS	5046 POPLAR LEVEL ROAD	Grocery
SMOKER'S OASIS	5044 POPLAR LEVEL ROAD	Grocery
BRIGHT BEGINNINGS CHILD	5051 POPLAR LEVEL RD	Childcare
WILLIE'S CHILD DEVELOPMENT	4305 NAOMI DRIVE	Grocery
LILLIE DYE	4112 MELDA LN	Childcare
LATINO-AMERICANO	5039 POPLAR LEVEL ROAD	Grocery
CHESS' LITTLE RAINBOWS	4118 PIXLEY WAY	Childcare
BUILDING A RAINBOW	5011 POPLAR LEVEL RD	Childcare
THOMAS JEFFERSON MIDDLE	1501 RANGELAND RD	Childcare
THOMAS JEFFERSON MIDDLE SCHOOL	4401 RANGELAND RD	Childcare
CHARLIE VETTINER PARK	5550 CHARLIE VETTINER PARK RD	Warning Sirens
FIRST NEIGHBORHOOD PLACE	1503 RANGELAND ROAD	Clinic

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
FAMILY DOLLAR STORE #957	4936 POPLAR LEVEL ROAD	Grocery
JIM DANDY FOOD MART	4902 POPLAR LEVEL RD	Grocery
GEORGE UNSELD EARLY CHILDHOOD CENTER	5216 ILEX AVE	School
NANCY BOWLDS	11606 CHINOOK CT	Childcare
ETTA SMITH	4202 E INDIAN TRAIL	Childcare
DOLLAR GENERAL STORE	4835 POPLAR LEVEL ROAD	Grocery
ANGELA EMBRY	5116 ALBA WAY	Childcare
ANEESHA MADDOX	4718 UNSELD BLVD	Childcare
AIRPORT AND EXPO LA QUINTA INN AND SUITES	4125 PRESTON HWY	INN
THE NEIGHBORS BP #1	1830 NEW BLANKENBAKER PARKWAY	Grocery
COMFORT SUITES	1850 RESOURCE WAY	Grocery
SLEEP INN EAST	1850 PRIORITY WAY	INN
COMFORT SUITES	1850 RESOURCE WAY	INN
SLEEP INN	1850 PRIORITY WAY	Grocery
HOMESTEAD STUDIO SUITES	1650 ALLIANT AVENUE	Grocery
HOLIDAY INN EXPRESS HOTEL/SUIT	1620 ALLIANT AVENUE	Grocery
HOMESTEAD STUDIO SUITES	1650 ALLLIANT AVE	HOTEL
WINGATE INN	12301 ALLIANT CT	INN
SUPER 8 MOTEL AND SUITES	1501 ALLIANT AVE	MOTEL
IT'S A SMALL WORLD	2539 DOUP AVE	Childcare
KENESETH ISRAEL PRESCHOOL	2531 TAYLORSVILLE RD	Childcare
WHITEFIELD ACADEMY EAST	15201 SHELBYVILLE RD	School
DOUGLAS HILL SWINM CENTER	501 GATEHOUSE LN	Warning Sirens
WALGREENS	13807 ENGLISH VILLA DRIVE	Grocery
CVS #5866	13900 SHELBYVILLE ROAD	Grocery
KIDS ACADEMY IV	13905 SHELBYVILLE RD	Childcare
CROSBY MIDDLE	303 GATEHOUSE LN	School
VICKIE DOYLE	1904 MIDDLETOWN DR	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
SUMMIT ACADEMY	11508 MAIN ST	School
WEE CARE NURSERY I, II, & III	11616 MAIN ST	Childcare
DOUGLAS HILLS BP	10600 SHELBYVILLE RD.	Grocery
CVS PHARMACY #6205	10490 SHELBYVILLE ROAD	Grocery
PARTY OUTLET	10402 SHELBYVILLE ROAD	Grocery
HIGHLAND LATIN SCHOOL	10901 SHELBYVILLE RD	School
KBHC PREGNANCY & ADOPTION	10801 SHELBYVILLE RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #2	10217 SHELBYVILLE RD	Fire Dept
SPRING MEADOWS CHILDREN'S HOME	10901 SHELBYVILLE RD	Childcare
HIGHLAND FISH MARKET	12121 SHELBYVILLE ROAD	Grocery
Marriott's Forum at Brookside	200 Brookside Dr	Nursing Home
Forum at Brookside/Indepemndent & Convalenscent	200 Brookside Dr	Nursing Home
8TH DIVISION LMPD	200 JUNEAU DR	LMPD
MIDDLETOWN HEALTH CENTER	200 JUNEAU DRIVE	LMPD
MIDDLETOWN LIBRARY	12556 Shelbyville Rd	Library
LUCKY DUCKY CHILD CARE	10211 WOODKNOLL RD	Childcare
SO BAPTIST SEMINARY - BOYCE COLLEGE	2825 LEXINGTON RD	Warning Sirens
SOUTHERN BAPTIST THEOLOGICAL SEMINARY	2825 Lexington Rd	College
LEGACY HOTEL AND CONFERENCE CENTER	2825 LEXINGTON RD	GRAND HOTEL
ANNA LANE	415 DORSEY LN	Childcare
URSULINE MONTESSORI SCHOOL &	3105 LEXINGTON RD	Childcare
SACRED HEART MODEL	3107 LEXINGTON RD	School
ST PATRICK	1000 N BECKLEY STATION RD	Childcare
YMCA/ST. PATRICK AFTER SCHOOL PROGRAM	1000 N BECKLEY STATION RD	Childcare
ST. PATRICK SCHOOL	1000 N BECKLEY STATION RD	Warning Sirens
SACRED HEART ACADEMY	3175 LEXINGTON RD	School
BARBARA'S DAY CARE	3019 AUBERT AVE	Childcare
JCPS BLANKENBAKER BUS COMPOUND	13075 MIDDLETOWN INDUSTRIAL BLVD	Warning Sirens

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
LOUISVILLE DIVERSIFIED SERVICES-PALS	136 SACRED HEART LN	Shelter
FIELD ELEMENTARY	120 SACRED HEART LN	Childcare
FIELD ELEMENTARY CHILD CARE	120 SACRED HEART LN	Childcare
HOLY ANGELS ACADEMY	12201 OLD HENRY RD	School
NANCY HOOVER	12710 OLD HENRY RD	Childcare
LOUISVILLE WATER CO CRESCENT HILL	100 RESERVOIR AVE	Warning Sirens
ST. LUKE'S PRE-SCHOOL	1206 MAPLE LN	Childcare
SPRINGHILL SUITES BY MARRIOTT	10101 FOREST GREEN BLVD	HOTEL
ANCHORAGE CITY HALL	11506 PARK RD	Warning Sirens
EMBASSY SUITES LOUISVILLE EAST	9940 CORPORATE CAMPUS DR	HOTEL
ANCHORAGE CLASS CITY	11506 PARK RD	LMPD
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #4	1400 EVERGREEN RD	Fire Dept
ANCHORAGE	11400 RIDGE RD	School
ANCHORAGE	11501 PARK ROAD	USPS
LESLIE CALBERT	12507 HIAWATHA AVE	Childcare
KIDS' PLACE MONTESSORI CENTER	13100 MAGISTERIAL DR	Childcare
CARRIAGE HOUSE PRESCHOOL	13100 MAGISTERIAL DR	Childcare
STOPHER ELEMENTARY	14417 AIKEN ROAD	School
Hurstbourne Crossing	9721 Ormsby Station Rd.	Office
BELLEWOOD PRESBYTERIAN HOME FOR CH	11103 PARK RD	Childcare
BELLEWOOD PRESBYTERIAN HOME FOR CH	11103 PARK RD	Childcare
NORTHEAST REGIONAL LIBRARY	15 Bellevoir Cir	Library
USPIRITUS BELLEWOOD	11103 PARK RD	School
Seniorcare	1700 Ups Dr.	Nursing Home
CENTRAL ST HOSP COFFEE SHOP	10510 LAGRANGE ROAD	Grocery
BP MINI MART	7401 LAGRANGE RD	Grocery
Meadowview Health & Rehabilitation Center	9701 Whipps Mill Rd	Nursing Home
CENTER FOR REHABILITATION & RECOVERY	10510 LAGRANGE RD	Shelter
CENTRAL STATE HOSPITAL	10510 La Grange Rd	Hospital
BLUEGRASS PRESCHOOL & CHILD	9901 LAGRANGE RD	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
JEWISH HOSPITAL MEDICAL CENTER NORTHEAST	2401 Terra Crossing Blvd	Hospital
KROGER WAREHOUSE	2000 NELSON MILLER PKWY	Warning Sirens
KAYFIELD ACADEMY II	2050 NELSON MILLER PKWY	Childcare
BAPTIST HEALTH EASTPOINT	2400 Eastpoint Parkway	Hospital
RAQUEL HOWARD	2008 THE MEADOW RD	Childcare
WESTPORT EARLY CHILDHOOD CENTER	8800 WESTPORT RD	Childcare
GEORGIA CHAFFEE TEENAGE PARENT	8800 WESTPORT RD	Childcare
COVENANT CLASSICAL ACADEMY	13902 FACTORY LN	School
EASTERN AREA COMMUNITY MINISTRIES	9104 WESTPORT RD	Community Ministries
DOLLAR TREE #2410	9206 WESTPORT ROAD	Grocery
ZACHARY TAYLOR ELEMENTARY SCHOOL	9620 WESTPORT RD	Warning Sirens
Westport Plaza	9400 Westport Rd.	Shopping
CIRCLE K #131	9401 WESTPORT RD	Grocery
RITE AID #4646	9459 WESTPORT ROAD	Grocery
ST. THOMAS PRESCHOOL	9616 WESTPORT RD	Childcare
ZACHARY TAYLOR ELEMENTARY	9620 WESTPORT RD	Childcare
ZACHARY TAYLOR CHILDCARE	9620 WESTPORT RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #3	13012 FACTORY LANE	Fire Dept
WATKINS MEMORIAL UNITED	9800 WESTPORT RD	Childcare
WALGREENS #4309	9702 WESTPORT ROAD	Grocery
WESTPORT ROAD BAPTIST MOTHERS	9705 WESTPORT RD	Childcare
WESTPORT ROAD BAPTIST CHILD	9705 WESTPORT RD	Childcare
Ford Motor Co.	3001 Chamberlain Ln	Manufacturing
Baptist Home East	3001 N. Hursbourne Pkwy	Nursing Home
PARR'S REST HOME	3101 N HURSTBOURNE PKY	Shelter
FORD ASSEMBLY PLANT	3520 CHAMBERLAIN LN	Warning Sirens
NORMA THOMAS	8207 PIPILO PL	Childcare
Springhurst Towne Center	10508 Fischer Park Dr.	Shopping

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
MONTESSORI SCHOOL OF LSVL	10263 CHAMPION FARMS DR	School
CIRCLE K #3243	8001 BROWNSBORO ROAD	Grocery
COURTYARD BY MARRIOTT LOUISVILLE NORTHEAST	10200 CHAMPION FARMS DR	HOTEL
RESIDENCE INN BY MARRIOTT NORTHEAST	3500 SPRINGHURST PKY	EXTENDED STAY
NORTON ELEMENTARY	8101 BROWNSBORO RD	Childcare
NORTON ELEMENTARY CHILDCARE	8101 BROWNSBORO RD	Childcare
KWIK SHOP MARATHON	11401 WESTPORT ROAD	Grocery
HAMPTON INN EAST	4100 HAMPTON LAKE WAY	INN
CONAGRA FOODS	12650 WESTPORT RD	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #7	8412 BROWNSBORO RD	Fire Dept
WORTHINGTON FPD #2	8412 BROWNSBORO RD	Warning Sirens
HAMPTON INN I-265	4100 HAMPTON LAKE WAY	Grocery
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LANE	Grocery
InTown Suites	11405 WESTPORT RD	EXTENDED STAY
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LN	INN
DOLLARS AND CENTS	11304 MAPLE BROOK DRIVE	Grocery
INDIA BAZAAR	11324 MAPLE BROOK DRIVE	Grocery
LOUISVILLE MART	4102 MURPHY LN	Grocery
CHICKEN LITTLE DAY CARE AND	3906 RIVEROAKS LN	Childcare
TANISHA FRYE	129 CHARTER OAKS DR	Childcare
NATHALIE CASWELL	4608 OAK FOREST RD	Childcare
PRECIOUS LAMBS CHRISTIAN CHILD	4140 ACCOMACK DR	Childcare
Lear Corp.	12510 Westport Rd	Manufacturing
WENETTA KING	4019 PACELLI PL	Childcare
SONIA MITCHELL	4712 WILLOW FOREST PL	Childcare
DIANNA BOARD	10408 SANDBOURNE WAY	Childcare
CHRISTIAN CHILD CARE	3800 NORTHUMBERLAND DR	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE SEVERE WINTER WEATHER		
NAME	**ADDRESS**	**FACILITY TYPE**
JO HOLLAND	4008 RIVER OAKS CI	Childcare
KENTUCKY COUNTRY DAY	4100 SPRINGDALE RD	Childcare
YMCA SACC KENTUCKY COUNTRY DAY SACC PROGRAM	4100 SPRINGDALE RD	Childcare
CHANCEY ELEMENTARY	4301 MURPHY LN	Childcare
YMCA SCHOOL AGE CHILD CARE MALCOLM B. CHANCEY, JR.	4301 MURPHY LN	Childcare
PATRICIA PARKER	4912 OAKBROOK DR	Childcare
MARILYN'S PRE-SCHOOL CHILD	3915 NORTHUMBERLAND DR	Childcare
NORTHEAST CHRISTIAN CHURCH	9900 BROWNSBORO RD	Warning Sirens
B.P. FOOD MART #146	4740 CHAMBERLAIN LANE	Grocery
WORTHINGTON FPD #1	4700 MURPHY LN	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #9	4700 MURPHY LANE	Fire Dept
WALGREEN'S #7643	9801 BROWNSBORO ROAD	Grocery
NORTON CHILDREN'S MEDICAL CENTER - BROWNSBORO	4910 Chamberlain Ln	Hospital
NORTON BROWNSBORO HOSPITAL	4960 Norton Heathcare Blvd	Hospital
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #8	9514 FEATHERBELL BLVD	Fire Dept

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE TORNADO		
NAME	**ADDRESS**	**FACILITY TYPE**
CORAL RIDGE ELEMENTARY	10608 NATIONAL TP	School
CORAL RIDGE ELEMENTARY SCHOOL	10608 NATIONAL TURNPIKE	Warning Sirens
DONNA'S DAY CARE	10014 NATIONAL TPKE	Childcare
PLEASURE RIDGE PARK FIRE DEPARTMENT #3	8508 TERRY RD	Fire Dept
SAVE-A-LOT #75	8521 TERRY ROAD	Grocery
DOLLAR GENERAL STORE #3302	8519 TERRY ROAD	Grocery
RITE AID #4627	8517 TERRY RD	Grocery
LIL KINGS & QUEENS INFANTS & TODDLERS PALACE	8505 TERRY RD	Childcare
SOUTHWEST COMMUNITY MINISTRIES	8504 TERRY RD	Community Ministries
FELICIA RUDOLPH	5809 JERRY LN	Childcare
LIL' KINGS & QUEENS CHILDCARE	8409 TERRY RD	Childcare
SANDERS ELEMENTARY	8408 TERRY RD	School
SANDERS ELEMENTARY SCHOOL	8408 TERRY RD	Warning Sirens
DOLLAR GENERAL STORE #8553	7005 GLOBAL DRIVE	Grocery
PHOENIX HOUSE	5323 NEW CUT RD	Childcare
PHOENIX HOUSE	5323 NEW CUT RD	Childcare
PHOENIX HOUSE	5323 NEW CUT RD	Childcare
G-N-K'S FAMILY MART	1937 LOWER HUNTERS TR	Grocery
FAMILY DOLLAR #4110	6621 SOUTHSIDE DRIVE	Grocery
ENGINE 23	706 KENWOOD DR	Fire Dept
ST FRANCIS DESALES HIGH	425 W KENWOOD DR	School
HOLY CROSS HIGH SCHOOL	5144 DIXIE HY	School
BARBARA LEWIS	6017 UPPER HUNTERS TRACE	Childcare
KERRICK ELEMENTARY	2210 UPPER HUNTERS TC	School
ELEGANT AWARDS	5138 DIXIE HIGHWAY	Grocery
BOOTH #27	5138 DIXIE HIGHWAY	Grocery
DONUT BOOTH	5138 DIXIIE HWY, BOOTH 212	Grocery
BOOTH 281	5138 DIXIE HIGHWAY	Grocery
NANCY'S CERAMICS	5138 DIXIE HIGHWAY	Grocery

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE TORNADO		
NAME	**ADDRESS**	**FACILITY TYPE**
KERRICK ELEMENTARY SCHOOL	2212 UPPER HUNTERS TRACE	Warning Sirens
CENTER AT RIVERPORT	7401 RIVERPORT DR	Childcare
CENTER AT RIVERPORT	7401 RIVERPORT DR	Childcare
SEARS ESSENTIALS	4915 DIXIE HWY	Grocery
K-Mart Plaza	4915 Dixie Hwy.	Shopping
Georgetown Manor Nursing & Rehabilitation	900 Gagel Ave	Nursing Home
VANESSA ROACH	4705 WALNUT GROVE AVE	Childcare
EL RINCON LEONES LATIN GROCERY AND BOUTIQUE	4761 DIXIE HIGHWAY	Grocery
SAVELLA DICKERSON	4918 ROCKAWAY CI	Childcare
RESIDENCE INN BY MARRIOT LOUISVILLE AIRPORT	700 PHILLIPS LN	Hotel
ASHTON BEST WESTERN	653 PHILLIPS LANE	Grocery
SPRINGHILL SUITES BY MARRIOT LOUISVILLE AIRPORT	820 PHILLIPS LN	Hotel
HAMPTON INN	800 PHILLIPS LN.	Hotel
HOWARD JOHNSON	709 PHILLIPS LANE	Grocery
HAMPTON INN	800 PHILLIPS LANE	Grocery
SEMPLE ELEMENTARY	724 DENMARK ST	School
DENMARK GROCERY	901 DENMARK AVE	Grocery
EDIE CLAYTON	1010 DRESDEN AVE	Childcare
AUDUBON SCHOOL	1051 HESS LN	Warning Sirens
LOUISVILLE PRESBYTERIAN THEOLOGICAL SEM	1044 Alta Vista Rd	College
LAWS LODGE CONFERENCE CENTER	1044 ALTA VISTA RD	Hotel
URSULINE MONTESSORI SCHOOL &	3105 LEXINGTON RD	Childcare
SACRED HEART MODEL	3107 LEXINGTON RD	School
ST. PATRICK SCHOOL	1000 N BECKLEY STATION RD	Warning Sirens
BARBARA'S DAY CARE	3019 AUBERT AVE	Childcare
JCPS BLANKENBAKER BUS COMPOUND	13075 MIDDLETOWN INDUSTRIAL BLVD	Warning Sirens
LOUISVILLE DIVERSIFIED SERVICES-PALS	136 SACRED HEART LN	Shelter
FIELD ELEMENTARY	120 SACRED HEART LN	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE TORNADO		
NAME	**ADDRESS**	**FACILITY TYPE**
FIELD ELEMENTARY CHILD CARE	120 SACRED HEART LN	Childcare
KIDS' PLACE MONTESSORI CENTER	13100 MAGISTERIAL DR	Childcare
CARRIAGE HOUSE PRESCHOOL	13100 MAGISTERIAL DR	Childcare
STOPHER ELEMENTARY	14417 AIKEN ROAD	School
JEWISH HOSPITAL MEDICAL CENTER NORTHEAST	2401 Terra Crossing Blvd	Hospital
KAYFIELD ACADEMY II	2050 NELSON MILLER PKWY	Childcare
BAPTIST HEALTH EASTPOINT	2400 Eastpoint Parkway	Hospital
WESTPORT EARLY CHILDHOOD CENTER	8800 WESTPORT RD	Childcare
GEORGIA CHAFFEE TEENAGE PARENT	8800 WESTPORT RD	Childcare
COVENANT CLASSICAL ACADEMY	13902 FACTORY LN	School
EASTERN AREA COMMUNITY MINISTRIES	9104 WESTPORT RD	Community Ministries
KAREN WHITE	8903 DUXBURY RD	Childcare
DOLLAR TREE #2410	9206 WESTPORT ROAD	Grocery
ZACHARY TAYLOR ELEMENTARY SCHOOL	9620 WESTPORT RD	Warning Sirens
Westport Plaza	9400 Westport Rd.	Shopping
CIRCLE K #131	9401 WESTPORT RD	Grocery
RITE AID #4646	9459 WESTPORT ROAD	Grocery
ST. THOMAS PRESCHOOL	9616 WESTPORT RD	Childcare
ZACHARY TAYLOR ELEMENTARY	9620 WESTPORT RD	Childcare
ZACHARY TAYLOR CHILDCARE	9620 WESTPORT RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #3	13012 FACTORY LANE	Fire Dept
WATKINS MEMORIAL UNITED	9800 WESTPORT RD	Childcare
WALGREENS #4309	9702 WESTPORT ROAD	Grocery
WESTPORT ROAD BAPTIST MOTHERS	9705 WESTPORT RD	Childcare
WESTPORT ROAD BAPTIST CHILD	9705 WESTPORT RD	Childcare
Ford Motor Co.	3001 Chamberlain Ln	Manufacturing
Baptist Home East	3001 N. Hursbourne Pkwy	Nursing Home
TEMPLE EARLY CHILDHOOD	5101 U S HWY 42	Childcare
PARR'S REST HOME	3101 N HURSTBOURNE PKY	Shelter
Eden Care	901 Blankenbaker Rd	Nursing Home

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE TORNADO		
NAME	**ADDRESS**	**FACILITY TYPE**
EDEN TERRACE OF LOUISVILLE	901 BLANKENBAKER RD	Shelter
FORD ASSEMBLY PLANT	3520 CHAMBERLAIN LN	Warning Sirens
NORMA THOMAS	8207 PIPILO PL	Childcare
Springhurst Towne Center	10508 Fischer Park Dr.	Shopping
MONTESSORI SCHOOL OF LSVL	10263 CHAMPION FARMS DR	School
CIRCLE K #3243	8001 BROWNSBORO ROAD	Grocery
COURTYARD BY MARRIOTT LOUISVILLE NORTHEAST	10200 CHAMPION FARMS DR	Hotel
RESIDENCE INN BY MARRIOTT NORTHEAST	3500 SPRINGHURST PKY	Hotel
NORTON ELEMENTARY	8101 BROWNSBORO RD	Childcare
NORTON ELEMENTARY CHILDCARE	8101 BROWNSBORO RD	Childcare
KWIK SHOP MARATHON	11401 WESTPORT ROAD	Grocery
HAMPTON INN EAST	4100 HAMPTON LAKE WAY	Hotel
CONAGRA FOODS	12650 WESTPORT RD	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #7	8412 BROWNSBORO RD	Fire Dept
WORTHINGTON FPD #2	8412 BROWNSBORO RD	Warning Sirens
HAMPTON INN I-265	4100 HAMPTON LAKE WAY	Grocery
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LANE	Grocery
InTown Suites	11405 WESTPORT RD	Hotel
HOLIDAY INN EXPRESS	3711 CHAMBERLAIN LN	Hotel
DOLLARS AND CENTS	11304 MAPLE BROOK DRIVE	Grocery
INDIA BAZAAR	11324 MAPLE BROOK DRIVE	Grocery
LOUISVILLE MART	4102 MURPHY LN	Grocery
CHICKEN LITTLE DAY CARE AND	3906 RIVEROAKS LN	Childcare
TANISHA FRYE	129 CHARTER OAKS DR	Childcare
NATHALIE CASWELL	4608 OAK FOREST RD	Childcare
PRECIOUS LAMBS CHRISTIAN CHILD	4140 ACCOMACK DR	Childcare
Lear Corp.	12510 Westport Rd	Manufacturing
WENETTA KING	4019 PACELLI PL	Childcare

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE TORNADO		
NAME	**ADDRESS**	**FACILITY TYPE**
SONIA MITCHELL	4712 WILLOW FOREST PL	Childcare
DIANNA BOARD	10408 SANDBOURNE WAY	Childcare
CHRISTIAN CHILD CARE	3800 NORTHUMBERLAND DR	Childcare
JO HOLLAND	4008 RIVER OAKS CI	Childcare
KENTUCKY COUNTRY DAY	4100 SPRINGDALE RD	Childcare
YMCA SACC KENTUCKY COUNTRY DAY SACC PROGRAM	4100 SPRINGDALE RD	Childcare
CHANCEY ELEMENTARY	4301 MURPHY LN	Childcare
YMCA SCHOOL AGE CHILD CARE MALCOLM B. CHANCEY, JR.	4301 MURPHY LN	Childcare
PATRICIA PARKER	4912 OAKBROOK DR	Childcare
MARILYN'S PRE-SCHOOL CHILD	3915 NORTHUMBERLAND DR	Childcare
NORTHEAST CHRISTIAN CHURCH	9900 BROWNSBORO RD	Warning Sirens
B.P. FOOD MART #146	4740 CHAMBERLAIN LANE	Grocery
WORTHINGTON FPD #1	4700 MURPHY LN	Warning Sirens
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #9	4700 MURPHY LANE	Fire Dept
WALGREEN'S #7643	9801 BROWNSBORO ROAD	Grocery
NORTON CHILDREN'S MEDICAL CENTER - BROWNSBORO	4910 Chamberlain Ln	Hospital
NORTON BROWNSBORO HOSPITAL	4960 Norton Heathcare Blvd	Hospital
MS. HELEN'S DAY CARE	11503 FISHERMAN WAY	Childcare
FIRST KIDS EARLY CHILDHOOD	7700 US HWY 42	Childcare
ST. FRANCIS PRESCHOOL	6710 WOLF PEN BRANCH RD	Childcare
ANCHORAGE MIDDLETOWN FIRE DEPARTMENT #8	9514 FEATHERBELL BLVD	Fire Dept
BRIGHT FUTURES II CHILD CARE CENTER	6331 RIVER RD	Childcare
NORTON COMMONS ELEMENTARY	10941 KINGS CROWN DR	School
SAINT MARY ACADEMY	11311 SAINT MARY LN	School

HIGHLY VULNERABLE CRITICAL FACILITIES AND INFRASTRUCTURE WILDFINRES		
NAME	**ADDRESS**	**FACILITY TYPE**
4607 BLEVINS GAP RD	4607 BLEVINS GAP RD	Warning Sirens

APPENDIX F

MITIGATION STRATEGY SCORING SHEETS

1.1	**Strategy:** Prepare for special needs at-risk groups during disaster.	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	y
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	y
	Implemented with currently available technologies?	y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

1.2	**Strategy:** Develop Health Impact Assessment "Tool" to assist in developing mitigation projects	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

1.3	**Strategy:** Community Health Education clearinghouse	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

1.4	**Strategy:** Increase training for WebEOC. Continue to promote and utilize state WebEOC platform for managing local incidents	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

1.5	**Strategy:** Continue to install emergency generators in public schools	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

1.6	**Strategy:** Continue to procure emergency supply kits for public schools:	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

1.7	**Strategy:** Community Hazard Assessment and Mitigation Planning System (CHAMPS) implementation and training for Louisville Metro emergency management staff:	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	11

1.8	**Strategy:** Continue public education & standard public statements for all hazards	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	17
	Priority Low (0-6) Medium (7-12) High (13-18)	17

1.9	**Strategy:** Increase registration for Mobile Alert technology:	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

1.1	**Strategy:** Utilize JCPS weather stations	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	 11

1.11	**Strategy: Re-establish bi-annual hazard mitigation meetings**	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	 11

1.12	**Strategy:** Update and develop new research publications related to climate change and its impact on hazards	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

1.13	**Strategy:** Review JCPS MetroSafe access	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	
	Total	12
	Priority Low (0-6) Medium (7-12) High (13-18)	 12

1.14	**Strategy:** Continue exercise program and expand to include discussions on mitigation strategies	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	12
	Priority Low (0-6) Medium (7-12) High (13-18)	12

1.15	**Strategy:** Conduct early-warning siren tests at schools	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

1.16	**Strategy:** Explore partnerships to increase weather monitoring	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	
	Total	6
	Priority Low (0-6) Medium (7-12) High (13-18)	6

1.17	**Strategy:** Institute a formal emergency generator management/maintenance program	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

4.1	**Strategy: Find location and build tornado shelters/safe rooms for Minors Lane neighborhood**	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	Y
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

4.2	**Strategy:** Promote safe rooms/tornado shelter for new construction	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	Y
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	17
	Priority Low (0-6) Medium (7-12) High (13-18)	17

4.3	**Strategy:** Promote & Distribute Weather Radios	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

4.4	**Strategy:** Continue public outreach on related to retrofitting, mitigation, education and wind-driven building techniques	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

4.5	**Strategy:** Expand existing snow route mapping outreach	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

4.6	**Strategy:** Continue Extreme Heat mitigation public outreach and education	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

4.7	**Strategy:** Continue Extreme Heat public outreach and education to promote NWS' Pediatric Vehicular Heatstroke campaign	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

4.8	**Strategy:** Continue Extreme Heat public outreach and education related to Animals	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

4.9	**Strategy:** Implement an Extreme Heat Mitigation Program focused on albedo levels	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

4.1	**Strategy:** Extreme Heat Mitigation though Tree Canopy Programs	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	 14

4.11	**Strategy:** Develop Extreme Heat and Extreme Cold Plans	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	15

4.12	**Strategy:** Update and develop new research publications related to climate change and its impact on hazards	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	16
	Priority Low (0-6) Medium (7-12) High (13-18)	16

5.1	**Strategy: Continue to develop public outreach strategy related to specific geologic hazard areas**	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	11

5.2	**Strategy:** Develop an Earthquake Risk Assessment with best available building data	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	12
	Priority Low (0-6) Medium (7-12) High (13-18)	12

5.3	**Strategy:** Continue delivering earthquake education and outreach to schools	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	12
	Priority Low (0-6) Medium (7-12) High (13-18)	12

5.4	**Strategy:** Expand Karst/sinkhole Risk Assessments to include Louisville Metro areas	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	11

5.5	**Strategy:** Collection of sinkhole data	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	 11

5.6	**Strategy:** Continue Karst/Sinkhole public outreach, education and warning	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	11

5.7	**Strategy:** Initiate a Landslide Risk Assessment: project to collect information on potential landslide events	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

5.8	**Strategy:** Incorporate landslide mitigation into building codes	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.1	**Strategy:** Promote public education for HazMat response activities to include sheltering in place	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.2	**Strategy:** Develop HazMat public education/ awareness/training for business community	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.3	**Strategy:** Conduct HazMat outreach to individuals and small businesses	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	11

6.4	**Strategy: Update HazMat Risk Assessments**	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.5	**Strategy:** Develop innovative methods for collecting drought data:	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	10
	Priority Low (0-6) Medium (7-12) High (13-18)	

6.6	**Strategy:** Wildfire public outreach and education	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	11
	Priority Low (0-6) Medium (7-12) High (13-18)	11

6.7	**Strategy: Continue to develop strategies for wildfire suppression**	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	7
	Priority Low (0-6) Medium (7-12) High (13-18)	7

6.8	**Strategy:** Continue to coordinate wildfire outreach activities	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	7
	Priority Low (0-6) Medium (7-12) High (13-18)	7

6.9	**Strategy:** Update Multi-model transportation plan	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	6
	Priority Low (0-6) Medium (7-12) High (13-18)	6

6.1O	**Strategy:** Incorporate hazard mitigation into Neighborhood Development Plans	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	8
	Priority Low (0-6) Medium (7-12) High (13-18)	8

6.11	**Strategy:** Promote public outreach related to natural hazards in neighborhoods	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	8
	Priority Low (0-6) Medium (7-12) High (13-18)	8

6.12	**Strategy:** Establish an Emergency Housing Plan	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.13	**Strategy:** Promote hazard mitigation within Economic Development outreach	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	9
	Priority Low (0-6) Medium (7-12) High (13-18)	9

6.14	**Strategy:** Promote sustainability initiatives at educational institutions	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	9
	Priority Low (0-6) Medium (7-12) High (13-18)	9

6.15	**Strategy:** Refine and update Louisville Metro's homeless sheltering strategy	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.16	**Strategy:** Continue to support the development of the Disease Outbreak Support Plan (DOSP)	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	Y
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

6.17	**Strategy:** Refine Mass vaccination plan	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.18	**Strategy:** Continue to fund Housing Authority security measures	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.19	**Strategy:** Improve Housing Authority Fire Control Systems	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.2	**Strategy:** Extend external security agreements	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.21	**Strategy:** Extend security agreements with Louisville Metro Police Department	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	12
	Priority Low (0-6) Medium (7-12) High (13-18)	12

6.22	**Strategy:** Secure IT data center from natural hazards	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.23	**Strategy:** Secure IT data center from cyber-attacks:	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.24	**Strategy:** Transition to cloud-based servers	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.25	**Strategy:** Establish Emergency Reassessment protocols	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	
	Address multiple hazards?	Y
	In general, benefits equal or exceed costs?	
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.26	**Strategy:** Continue air quality alert day program and announcements	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

6.27	**Strategy:** APCD continue to support HazMat activities:	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

6.28	**Strategy:** Continue to manage and fund the Strategic Toxic Air Reduction Program	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	15
	Priority Low (0-6) Medium (7-12) High (13-18)	15

6.29	**Strategy:** Secure additional HazMat response equipment	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	13
	Priority Low (0-6) Medium (7-12) High (13-18)	13

6.3	**Strategy:** Maintain zoning regulations associated with HazMat separation requirements	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	Y
	Provide benefit to underserved communities as defined by CDC's SVI?	Y
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14

6.31 D	**Strategy:** Develop new regulations related to Tree Canopy removal	
	Question	**Answer**
	Does the Strategy:	
	Solve an existing or future problem?	Y
	Reduce the exposure or vulnerability to a targeted hazard?	Y
	Address multiple hazards?	
	In general, benefits equal or exceed costs?	Y
	Implement a goal, policy, or project identified in the Previous Hazard Mitigation Plan, General Plan or Capital Improvement Plan?	Y
	Can the Strategy be:	
	Implemented with existing funds?	Y
	Implemented by existing state or federal grant programs?	
	Completed within the 5-year life cycle of the hazard Mitigation Plan?	Y
	Implemented with currently available technologies?	Y
	Will the Strategy:	
	Be accepted by the Louisville Metro community?	Y
	Be supported by community leaders?	Y
	Provide benefit to vulnerable populations?	
	Provide benefit to underserved communities as defined by CDC's SVI?	
	Comply with local ordinances or zoning laws?	Y
	Create an overall positive or neutral impact on the environment?	Y
	Comply with existing local, state and federal environmental laws and regulations?	Y
	Is there:	
	Sufficient expertise in the Louisville Metro Area to undertake the project?	Y
	Do Agencies have the existing authority to undertake the project?	Y
	Total	14
	Priority Low (0-6) Medium (7-12) High (13-18)	14